Roots of Creativity and Innovation in Developing Societies

by Anil K. Gupta

There is an old Sufi tale.

Rabia al-Adawiyya heard that Salih of Quawsin used to teach his children almost everyday beginning the phrase: ‘Knock at the door and it will be opened to you.’

Rabia said: ‘How long will you persist in saying this O' Salih, when the door has never been shut?’

Realizing that the door is open!

Perhaps for those who believe that colonial period had extinguished the fire of creativity in Indian society, the message is, “Sorry, you were looking at the wrong door!”

The door to people’s creativity was actually never closed. A large mass of poor people had no choice but to be inventive in order just to survive. It is appropriate that we ask ourselves, ‘Why didn’t the pervasive potential for creativity and innovations by farmers, artisans, tribal, pastoralists, fishermen and women and forest dwellers never became the building block for nation building at any level so long?’ And it is not just in India that it did not happen. Even in other countries, the policy makers have been equally indifferent towards this potential. However, after the recent economic crisis in most countries that is forcing them to fold back the state (to the extent possible), a serious rethinking has started. National and international institutions realize that without active participation of the civil society, the scourge of hunger and deprivation can not be overcome. But which elements of the civil society should one focus on most? The focus of this conference is to draw attention towards the potential of such civil society actors who do not just articulate problems but also generate the solutions.

Why did it not happen?

It is not that there never was a concern for building upon local knowledge and institutions. It is just that in our drive to develop through borrowed concepts and instruments we created such a super structure of the state that it lost its ability to scout, much less spawn experimentation and innovations at grassroots. If it were only an absence of sensitivity, the problem would have been less serious. But this statist structure also developed antibodies which ensured that if some innovative farmer or artisan succeeded in breaking out of the mold of mediocrity, the myopic mandarins in this system
will ensure quick rejection of such hopes. That explains partly why there is so much of cynicism and hopelessness in the society.

Elite sees hope in the burgeoning consumerism. It is not in the realm of new discoveries, inventions and innovations (with the exception of few sectors such as information sciences), that we expect global leadership to be ever ours.

Deprived of sufficient access to natural resources and economic means of livelihood, many disadvantaged communities have no choice but to innovate in order just to survive. Many of such creative communities and individuals have only knowledge resources (in which they are relatively rich) left with them. If they are deprived of even this resource without adequate reward not only would they lose incentives for production and reproduction of this knowledge, the society would also lose access to vibrant laboratory for developing low external input sustainable technologies and institutions. It is true that much of this knowledge has grown through social interactions and without economic incentives in past, but given increasing fragmentation of society, immeserization of poor and other stresses, it is unlikely that these processes of knowledge production and reproduction would be able to sustain these in future. The knowledge networks have to be reconstituted by the people and their partners in development.

Knowledge Centre approach underlying Honey Bee philosophy assumes that future transformation of developmental alternatives of alleviating poverty and hunger will emerge by networking large number of decentralized nodes around the world for generating practical solutions to the problem of hunger. Since these nodes are distributed across different institutional settings and regional & cultural contexts guided by various philosophical and ethical values, building bridges across these nodes will require respect for pluralism inherent in civil society. This respect will perhaps emanate when we will take into account the existing differences and accesses, assurances and abilities available to different communities as well as formal institutions across north and south. It is the network of this kind that we hope forge and invent through ICCIG.

Gospel of the Dirty Hand

Years ago, K.M. Munshi, Cabinet Minister of Food and Agriculture in his lecture on the Gospel of the Dirty Hand (1953) bemoaned that even his daughter did not want to soil her hands and he himself dirtied it often with only the fountain pen ink. Most researchers, did not realize what the gospel taught: "For the soiled hand of the worker on the land is the magic touch which starts the unbroken chain of action and reaction from the soil to the spirit, transforming the organism of the life."
Learning to unlearn is more difficult that just learning

Many of us have been guilty of behaving no different from the other actors in society who have exploited people at grassroots in different resource markets. So much so that we even celebrate extraction through disciplines like ethobotany. Several years ago, the ethical dilemma and moral conflicts started emerging in my mind about the relationship between bringing peoples’ knowledge in public domain and private rewards. I was not sure that all the recognition and compensation I was receiving was entirely due to my own brilliance. I reviewed literature and wrote a paper on ethical dilemma and value conflicts in management research. This review helped me understand the dilemma that other researchers had faced while dealing with knowledge of disadvantaged people. I realized that ethical and accountable research had always posed the dilemma I was facing about what do poor gain through our research. How do we address our accountability toward providers of knowledge?

These issues posed some new questions that had not been adequately addressed before. After all, much of what I had written was in English and most poor people did not read that language (and some of them, for that matter, any language). How do they critique our understanding of their problems and the solutions?

A larger research programme on the sustainable development of high risk environment initiated around this time tried to build linkages between articulation at district, state and central level in political arena as well as linkage between farmers’ knowledge and that of the scientists. This programme was supported for three years by Swiss Development Cooperation (SDC) and helped considerably in consolidating the work in drylands. Whatever remaining hesitance there was in the mind was dissolved. The search for alternative paradigm for ethically accountable and responsible research framework became intense. Thus, was born the germ of the Honey Bee network.

A silent revolution has been going on, unnoticed and uncelebrated. This has never been seen in past as a source of healing the sick soils, souls and spirits. Can the technological and institutional innovations by small farmers in disadvantaged regions provide spur for such a revolution? We believe that these can, and our faith stems from thousands of innovations that we have already documented in Honey Bee network. But will these innovations be able to rescue the spirit of non-
sustainably used resource on their own? Perhaps not, and hence our argument for blending the two knowledge systems, the formal and organized one with the informal and unorganized one.

**Genesis of Honey Bee Network**

The fundamental assumption behind most developmental approaches aimed at poverty alleviation is that poor people are too poor to be able to think and plan on their own. The result is that most interventions are designed externally either by the civil servants, technocrats or, in some cases, NGOs. Despite so much discussion on participation, poor people have seldom been given the opportunity to articulate their own agenda and vision in which outsiders could participate at the terms that people determine. The entire participatory paradigm has served to emphasize participation of people in plans or programmes that we, the outsiders design. Not only is the space for articulation limited, but even when people solved their problems through their own ingenuity, there was seldom an institutional window available to recognize, respect and reward the creativity and innovation underlying the solution by the people.

In high risk environments such as drought prone areas, flood prone regions, hill areas and forest regions, both the market forces as well as public systems are quite weak. The markets are weak because people have limited purchasing power. And the state support system is weak because population density is low, number of votes are fewer and the political and economic patronage the constituents can provide cannot counter balance the support provided from well endowed, irrigated regions or urban areas. Given such a situation, poor people have to be very inventive to survive. Their coping strategies have not always been successful in tiding over the crisis. If that were not the case, they would not have been so disadvantaged in meeting their basic needs, educating their children and generating sustainable employment opportunities. After all, it is in the drought prone regions and other disadvantaged regions mentioned above where literacy is the lowest and male emigration the highest. Consequently, the proportion of women headed or a managed household is also high. The weak public systems and markets find it all the more difficult to deal with such households compounding the socio-economic stress. It is in this context that regions of high biodiversity are found to be the regions of high poverty too.

a. The biodiversity is high in these areas, primarily due to diversity in soil, climate and other physical and social structures.

b. The poverty is high because markets are often unable to generate demand for diverse colours, tastes, shapes and qualities of natural products. Products of mass consumption, particularly when
processed by machines, have low variability because quality of the throughput by machines has
to be uniform.

c. The regions of high diversity also have very poor public infrastructure (just in tandem with weak
private market forces) because the people have limited surplus to attract public servants, and they
are less articulate and organized to create political pressure (except through insurgent movements
as is becoming evident from different parts of the world).

d. The low demand for ecological and technological skills of these communities characterizes them
as ‘unskilled’ labor fit for being a part of the urban slums, squatters or other similar work force.
Once the knowledge system is devalued, the cultural and social decline follows. The tenuous
relationship with the nature is ruptured. The ecological degradation spurred by various external
resource extractors is aided and abetted by many poor as well as not so poor people for whom
survival in short term seems possible only through eco-degrading strategies.

Despite such a constraining environment, there are signs of hope. And these signs indicate
tremendous potential that exists for turning around the economy and ecological balance in these
regions by building upon what people already know.

About a decade ago, questions of these kind arose in our mind and led to the emergence of the
Honey Bee network, which by now has acquired global presence in about 75 countries. The basic
thrust of our work is to build upon what people know and do well. In other words, instead of
identifying only the problem that people have, we make solutions developed by the people as the
point of departure. This thrust has two positive consequences for our own selves. It generates (i)
humility because these solutions have been generated without any contributions from us or other
outsiders, and (ii) respect for the experimental and inventive ethic of the people, who with so little
could achieve so much; what would be their potential in solving problems if the existing constraints
could be relaxed!

Honey Bee is a metaphor indicating ethical as well as professional values which most of us seldom
profess or practice. A honey bee does two things which we, the intellectuals, often don’t do. (i) It
collects pollen from the flowers and flowers do not complain, and (ii) it connects flower to flower
through pollination, apart from making honey, of course. When we collect knowledge of farmers or
indigenous people, I am not sure whether they do not complain. Similarly, by communicating only in
English or French, or a similar global language, there is no way we can enable people to people
communication. In the Honey Bee network, we have decided to correct both the biases. We make it a
matter of principle to always credit whatever knowledge we collect from them and to share, fairly
and reasonably, any benefit arising out of the knowledge or value addition in the same. Similarly, we also have insisted that this knowledge be shared in vernacular languages so that people to people communication can take place.

Honey Bee, in that sense, is like a knowledge centre/ network which pools the solutions developed by people across the world in different sectors and links, not just the people, but also the formal and informal science. It is obvious that people cannot find solutions for all problems. At the same time, the solutions they find need not always be optimal. So, there remains a scope for value addition and improvement in efficiency and effectiveness. But it is definite that a strategy of development which does not build upon on what people know and do well cannot be ethically very sound and professionally very accountable or efficient.

IIMA and Innovations

There has been a long tradition of research at IIMA on blending excellence in formal and informal sector. Prof. Ravi Mathai, the first full-time director of the IIMA, had initiated a pioneering experiment in Jawaja (a drought-prone district of Rajasthan) to organize weavers and leather workers. He also linked them to the top national institutes of design and leather research to develop self-sustaining development options.

Later, action research experiments were pursued in Dharampur, Surendranagar, Banaskanta, Jhabua, Panchmahals, Ahmednagar, Chitradurga, Shimoga and many other districts. A proposal was developed on "Developmental Entrepreneurship" to evolve educational alternatives for creative individuals in the organized sector. A concept of Rural Universitu was developed to enlarge the scope of excellence beyond the formal boundaries of institutions. Honey Bee experiment, in that context, is just a step ahead.

Alternatives to Development: From Grassroots to Global

IIMA and SRISTI (a development voluntary organisation set up few years ago), along with many others, provide organizational support to the Honey Bee network around the world. It is important to stress that our database on local innovations has been developed through methods and approaches that people can use around the world without much difficulty. We neither use nor approve of any of the so called Rapid Rural Appraisal (RRA) or Participatory Rural Appraisal (PRA) methods. These methods create a cast of mind which legitimizes short cut approach to learning and often leads to exploitative mode of relationship with people. We believe that learning has to be mutual, patient and in categories that people use for defining their worldview. What we have done, therefore, is very
simple. We take help of students during their summer vacation and ask them to look for odd balls in the villages. These odd balls are the farmers who try to experiment and do things differently. Many of them end up solving the problem in a very creative and innovative manner. But the unusual thing about these innovations is that they remain localized sometimes unknown to other farmers in the same village. Lack of diffusion cannot be considered a reflection on the validity of these innovations. What kind of innovations these are? We have come across technological, socio-cultural, institutional and educational innovations contributing to the conservation of local resources and generation of additional income or reduction or prevention of possible losses.

The International Conference on Creativity and Innovations at Grassroots (ICCIG) for sustainable natural resource management was organized by the Centre for Management in Agriculture, IIMA during Jan 11-14, 1997. The Conference brought participants from forty countries together for four days at IIMA. This Conference, in some sense, pooled insights from grassroots level creativity around the world. In some sense, it also helped in taking stock of the progress we have made in garnering global voice and visibility for creative urges from the grassroots. There were discussions on the various ways of respecting, recognising and rewarding creativity and at the same time removing asymmetry in the rights and responsibilities of knowledge providers and utilizers.

The Conference was sponsored by National Bank for Agriculture and Rural Development (NABARD) and co-sponsored by International Society for Ecological Economics (ISEE), International Association for study of Common Properties (IASCP), SRISTI, Oxford Centre for Ethics, Environment and Society, FAO/FTPP, Gujarat Agro Industries Corporation (GAIC), Indian Council for Agricultural Research (ICAR), Council for Scientific and Industrial Research (CSIR), International Research Development Centre (IDRC) and Pew Conservation Scholar Award.

Honey Bee has already collected more than two thousand innovative practices predominantly from dry regions to prove that disadvantaged people may lack financial and economic resources, but are very rich in knowledge resource. That is the reason we consider the term ‘resource poor farmer’ as one of the most inappropriate and demeaning contributions from the West. If knowledge is a resource and if some people are rich in this knowledge, why should they be called resource poor? At the same time, we realize that the market may not be pricing peoples’ knowledge properly today. It should be remembered that out of 114 plant derived drugs, more than 70 per cent are used for the same purpose for which the native people discovered their use (Farnsworth, 1988). This proves that basic research linking cause and effect had been done successfully by the people in majority of the cases. Modern science and technology could supplement the efforts of the people, improve the efficiency of the extraction of the active ingredient or synthesize analog of the same, thereby improving effectiveness.
The scope for linking scientific search by the scientists and the farmers is enormous. We are beginning to realize that peoples’ knowledge system need not always be considered informal just because the rules of the formal system fail to explain innovations in another system. The soil classification system developed by the people is far more complex and comprehensive than the USDA classification systems. Likewise, the hazards of pesticides residues and associated adverse effects on the human as well as entire ecological system are well known. In the second issue of Honey Bee, out of ninety four practices thirty four dealt with indigenous low external input ways of plant protection. Some of these practices could extend the frontiers of science. For instance, some farmers cut thirty to forty days old sorghum plants or *Calotropis* and put these in the irrigation channel so as to control or minimize termite attack in light dry soils. Perhaps hydrocyanide present in sorghum and similar other toxic elements in *Calotropis spp.* contributed towards this effect. There are a large number of other plants of pesticidal importance found in arid and semi arid regions, hill areas and flood prone regions which can provide sustainable alternatives to highly toxic chemical pesticides.

It is possible that private corporations may not have much interest in the development and diffusion of such alternatives which pass control of knowledge into the hands of people. However, an informed, educated and experimenting client always spurs better market innovations as is evident from the experience of computer industry. Therefore, we do not see that there is a basic contradiction between the knowledge systems of people and the evolution of market rules to strengthen and build upon it. However, such a model of market would be highly decentralized, competitive, open and participative.

Honey Bee, in that sense, is an effort to mould markets of ideas and innovations but in favor of sustainable development of high risk environments. The key objectives of SRISTI, thus, are to strengthen the capacity of grassroots level innovators and inventors engaged in conserving biodiversity to (a) protect their intellectual property rights, (b) experiment to add value to their knowledge, (c) evolve entrepreneurial ability to generate returns from this knowledge, and (d) enrich their cultural and institutional basis of dealing with nature.

Of course no long-term change in the field of sustainable natural resource management can be achieved if the local children do not develop values and a worldview which is in line with the sustainable life style. Thus education programs and activities are essential to perpetuating reform.

A. Combining Sacred and secular streams of consciousness
Rehmatbhai is a Muslim livestock healer and is respected so much by the Hindu pastoralists and the livestock keepers in the dry region of Gujarat, that they call him Gopal Bapa. This is the name given to Lord Krishna - a Hindu God who was known for taking care of cattle. It is this blending of sacred consciousness with secular beliefs that is reflective of survival strategies in many parts of the world.

B. Conserving fresh water in saline soil and saline ground water conditions

In Kutch there is a large grassland called as Banni, comprising saline flat soils. No cultivation is done in this area which incidentally is Asia’s largest pasture. People have developed a very ingenious way of conserving fresh water in the sub-soil system called virda. What farmers do is to take the branches of Prosopis spp. and make a square frame of the same. After the rains when the salts have leached down, they dig a well of 20-25 feet deep and line it with wooden frames having a layer of grass in between. These frames prevent soil from caving in and the grass lining filters the water, which moves into the well from the surrounding soil. These wells are filled up with the soil during rainy season, but when water is required, the soil is taken out and the water oozes in from side ways. Since the specific gravity of fresh water is less than the saline water, it floats on the saline ground water. For at least two-three months after opening the virda, water remains drinkable. Later, it becomes saline. This is a technique which has provided answer to the problem of drinking water for human and livestock use for centuries in this area. Perhaps, this technique is of use in other arid environments as well. Incidentally, there is not any technology developed by modern science with comparable efficiency and low cost. There is also no mechanism available today for people to people transfer of such technologies and ideas.

C. Sowing Box, Tilting Bullock cart and SRISTI venture capital support fund for small innovations

Amrutbhai Agrawat is an artisan, making farm implements, based in village Pikhor of district Junagadh, Gujarat. He has developed several innovative farm implements such as wheat sowing box and groundnut digger. Most sowing equipment have the lowest portion through which the seeds fall on the ground in the shape of a pipe. The metering devices are located in the seed box. In the dry regions with strong winds, lodging can be a problem in irrigated fields. Amrutbhai devised a box which is now used for many crops to spread the seeds in a strip. While the seed rate remains constant, the distance between the seeds is increased so that they do not fall one over another. With better root growth there is a more efficient nutrient uptake and also the crop does not lodge. In addition, if there is a water stress in between, the crop is able to better withstand because of stronger root network. Similarly, the groundnut digger was designed with the help of a blade hoe having the
flexibility to change the distance between the two rows as well as modify the depth to which hoe enters into the soil to uproot the groundnut pods.

Amrutbhai had an idea about solving another problem that has remained unsolved for centuries. In most tropical plain lands, farmers have to carry the farm yard manure with a cart to a point in the field. After pouring the manure out in the field, farmers have to scatter the same with the help of baskets manually. It consumes lot of labour and time. He thought if a modification could be made in the design of the bullock cart, farmer could easily tilt the cart and distribute the manure slowly and slowly, single handedly in the entire field. He discussed the idea with us and articulated the risks. This was a fit idea worthy of support by a Venture Capital Fund (VCF). But as is well known, there is no VCF for a small and scattered innovations. We have banks but no VCF. SRISTI realized the gap and with the support of an IDRC grant and Pew Conservation Scholar Award decided to experiment with the idea of VCF. A proposal was prepared and reviewed with two of the acknowledged peers. And eventually the cart has been developed through a small risk taking venture of Amrutbhai and SRISTI. Large number of other ideas and inventions remain undeveloped or inadequately developed for want of a VCF support.

D. Converting Crisis into opportunity: Plant protection innovations and south to north technology transfer

In the Honey Bee database, we have a large number of examples of use of local materials to solve plant protection problems. Farmers have found new uses of existing plant biodiversity to control the pest and disease problems in the crops. For instance, ‘naffatia’ (Ipomoea fistulosa) is a plant often used for fencing purposes. Animals don’t eat it and there are not many uses known of this plant. It is toxic in nature and, in some places, the branches have been dried and used for making baskets for storing seeds or grains. During 1973, when there was a steep oil price hike, many farmers started looking for substitutes for chemical pesticides. And thus new inventions took place in the field of non-chemical pest control. Later, when many pests became resistant to pesticide and a tread mill effect started being felt, the farmers’ search for alternatives became widespread. In one such area where farmers were tired of using chemical pesticides, a school teacher namely Gamel Singh thought of using the extract of naffatia as a herbal pesticide. There are many tales of about how the idea of using this plant for controlling this pest originated. According to one view, in a farm, some farm workers were taking tea. For some reason, one of the farm workers had to go out for a short while. His wife covered his tea with the leaf of naffatia. When the worker came back and took the tea, he developed toxic symptoms. He had to be taken to the doctor and survived with great difficulty. An idea was born that if the leaves were so toxic that by merely covering the cup of tea with it, it became toxic, then why couldn’t it be used as a herbal pesticide.
Subsequently, we have done research on it and found it quite effective against not only some of the pests but also against certain microbial and fungal cultures. In another case, a tribal, Bhogilal Rajwadia in Bharuch district devised a unique method of pest control. What he did was to take help of 8-10 farmers or laborers who stood in a line. They took the leaves of a creeper *Combretum ovalifolium* and put these in a shoulder bag. The people moved in the windward direction after catching blister beetle from the air and crushing it with the leaves already collected. The combined effect of insect and leaf extract seemed to produce some signals which repelled the insects. Such a heuristic of combining plant and insect extract doesn’t exist in modern science. Similarly, there are a large number of other plant extracts (other than neem) which have been developed by the farmers and which could help in making crop cultivation in marginal regions more profitable. Most countries do not have a fast track approach for developing or registering herbal pesticide. If there can be a special fund for supporting formal research on farmers innovations in public or private sector labs, a whole range of sustainable technologies which are cost effective could be developed. These technologies may help transform agriculture not only in developing countries but also in economically developed but biodiversity wise poor European and North American countries. These innovations may help in transferring technologies from south to south and south to north.

**E. When Weakness is source of strength: indigenous veterinary knowledge**

Relatively speaking there is much higher preponderance of the traditional knowledge in livestock sector compared to the contemporary innovations. The livestock health system is much weaker than human health system and, therefore, people had to evolve their own coping strategies. One of the common problems is yoke gall in new bullocks when trained for the first time to carry the yoke on their shoulders. Apart from the pain it causes to the bullock, there is a considerable economic loss because of lost draught power. Rahmatbhai alias Gopal Bapa found a local plant called as *Zipta* (*Cordia* spp.) whose extract mixed with saliva of bullocks seem to provide relief from yoke gall within a week or ten days.

In another case, some times the calf dies within the womb of the cow and if not taken out could endanger the life of cow itself. There are local veterinary surgeons who can do a surgery and take calf out without hurting the womb.

This knowledge base has tremendous opportunity for generating cross cultural and regional linkages. For instance, pastoralists in Mongolia used a home made lick out of onion leaves with wheat germ, sodium bicarbonate and dried milk for the animals. It was found that this lick was very rich in selenium. The deficiency of this element could cause the young calves to die prematurely apart from
causing other problems. While discussing the idea of the Honey Bee network with Akwasasne people in Canada, it was discovered that they were facing a problem in the livestock which was traced to the deficiency of selenium. This is what the potential of Honey Bee network is. A practice in Mongolia documented by a professor in Scotland, published in Honey Bee becomes available to indigenous peoples in Canada and generates a possibility of solving local problems.

Neither market nor existing national or international channels will be able to connect the knowledge nodes around the world in order to empower the local communities and individuals who generate local solutions for applications in different parts of the world.

F. A Three wheel tractor: Reward or Reprimand

It is not surprising that most innovators seem to prefer to maintain their own counsel and not go out of their way either to popularize innovation or to share with others. If they did it, they could meet the fate of Bhanjibhai of Junagadh district. Bhanjibhai realized that medium class farmers needed a smaller tractor which use less energy and had greater maneuverability. He designed a three-wheel tractor. However, the reward he got for this innovation was in the form of reprimand from the Regional Transport Officer who asked him to sign a stamped document stating that he would never bring the tractor on the road. A society reflects its values through its actions. Not one policy maker at local or higher level has felt bothered by such treatment to the innovators. And this of course is not the isolated case.

G. Do innovators fragment or integrate their life spaces and follow only holistic perspective?

A recent study by Pastakia (1996) on heuristics of innovations based on case studies of innovative farmers scouted through Honey Bee database made several interesting discoveries. He found that the innovators whose heuristics had a higher potential for sustainable outcomes generally used normative or ethical criteria for searching and evaluating options. Further, most innovators had a moderate ideological orientation with average scores lying in between the extremes of idealism and pragmatism. Similarly, the score on analytical orientation demonstrated that innovators again lay in between the two extremes of reductionism and holism. Further, most innovators fragmented their life spaces as mentioned earlier and it did not seem to matter so far as search for technology with moderate to high sustainable outcomes is concerned. The eco-pruners found the policy environment extremely constraining and tried to find ways of going around it rather than campaign for its reform. In any case, some of them found the system highly insensitive to the needs of grassroots innovators/eco-pruners.
H. Can farmers’ innovation extend the frontiers of science?

There are many other studies that we have pursued in the last few years which demonstrate time and again, the inability of formal system to fully appreciate the potential of so call informal innovations. For instance, I once asked a gathering of plan physiologists and chemists about three experiences I had. My purpose was to enquire whether the formal science could identify the conceptual linkage between three observations that seemed somehow related. In Andhra Pradesh when farmers transplant tobacco seedlings, they put their hands in a pot of milk every now and then. Their assumption was that such a practice prevented diffusion of tobacco mosaic virus. In Gujarat, when cattle were affected by foot and mouth disease, farmers poured milk on their hoofs. When I was a kid, once I had a pain in my ear. The land lady put her breast milk in my ear and it relieved my pain. Nobody could think of any connection immediately. But, a doctoral student, viz., Duttananda from Centre for Cellular and Molecular Biology (CCMB), Hyderabad came to me during tea time and offered an hypothesis. He mentioned that work of Dr. Das had shown a possible reason for Parse women to have high breast cancer. It was lower content of Rnase enzyme in their milk. Apparently the vector virus which transferred or induced the cancer was a type II RNA virus. Both Tobacco Mosaic Virus (TMV) and Foot and Mouth Disease (FMD) were type II viruses. Perhaps, the Rnase enzyme in the milk inactivated the virus after the protein coat was cut somehow. Such a hypothesis did not exist in virology. If proved, it would extend the frontiers of science.

The study by Pastakia had demonstrated several new heuristics which did not exist in the literature before.

I. Clapping With One Hand: The Crucible of Creativity

Process and purpose: How pervasive is the creative urge in society and why dominant developmental paradigms have not taken note of this potential. To some extent this indifference of policy makers, educationists and even NGOs can be traced to the deep seated belief in the assumption that if people were poor, they were somehow responsible for it. Or they were not creative enough. What was missed was the possibility that at least in some cases the reason for poverty was superior ethical spirit of the innovators.

How did we scout innovators?

We have been following several approaches to scout local innovations as well as traditional knowledge. We have taken help of students of various Gandhian rural institutions/ Vidyapiths during summer vacations. They go from one village to another to look for ‘odd balls’. Some of these odd
balls have helped us in surveying others of their kind. This approach has been particularly successful in locating innovative artisans who are far more scattered than any other occupational group. Stalls have been set up in farmers’ fairs as well as religious fairs to disseminate local knowledge and also seek the same. Computerized databases in local language have been made available to farmers to access knowledge base and feel encouraged to share their experiences with others. Competitions have been organized among grassroots functionaries of state government in Gujarat as well as Rajasthan to scout innovators. Similar competitions have also been organized among students before summer vacation. In addition biodiversity contests have been organized to scout for ‘little genius’ among children going to school or otherwise. The last approach has been extremely rewarding from the point of view of the potential that we could see for transforming the young minds.

**Scouting and sustaining the ‘little genius’**

The biodiversity contests were organized among school children and, in some cases, drop outs and adults as well. The idea was to know whether some children had an inborn aptitude for nature and if so, can it inspire others to develop similar perspective. Children were asked few days in advance to bring as many samples of plants as they knew about along with their uses. They were also asked to bring a list of plants they knew but could not find out for one or the other reason. In addition, the nature related songs and sayings were also collected in a few cases.

The first contest was organized in Madurai by Sustainable – agriculture and Environment Voluntary Action (SEVA), at our suggestion. Similar contests were organized in Kerala, UP, Gujarat in India and in Vietnam and Bhutan also. What was most remarkable about these contests was the fact that young children coming from very disadvantaged backgrounds showed an extraordinary capability to inventorize biodiversity. Mahadev K Sodha of Tadav village in Banaskantha district could make a list of as many as 305 plants at an age less than twelve years. Ankita Patel of Valawada village of Valsad district could identify 165 plants with their uses. Several lessons were learnt from these competitions but one needs to be specially highlighted.

In one of the villages in Virampur taluka, we invited a local herbalist who knew most about biodiversity to give away the prizes. Karimbhai, a potter by profession agreed to grace the occasion. After the function we offered him some utensils as a token gift and also as a mark of our respect. To our surprise, he refused to accept the gift. It took us a while to understand that he would accept payment for the pots if we bought them. But in his role as a biodiversity expert, he could not accept any payment because he had never charged for his healing services. He is an extremely poor person who had withdrawn his elder son from the school because of poverty. Such is the stuff of which some knowledge rich, economically poor biodiversity experts are made up of.
design for rewarding creativity, we will have to ensure that such an ethics becomes stronger and not weaker because of the recognition and reward by the society.

**Lessons of biodiversity contests**

These lessons are based on several studies pursued by Ravi J Matthai Centre for Educational Innovation (RJMCEI) at IIMA as well as by SRISTI and Honey Bee network members in India and abroad (Shukla, Chand and Gupta, 1995, SRISTI, 1996, Gupta and Ura, 1995).

a. The ecological ethics of some of the poorest people was far stronger than one would assume. However, one could not keep people poor to conserve diversity or the ecological ethics. It should be possible to maintain ethics without deprivation.

b. The sacred dimension of one’s belief system was compatible with the secular goals of the innovators. Karimbhai was revered by everybody just as Rehmatbhai alias Gopal Bapa was. It is this blended culture which has to guide the spirit of enquiry of young minds.

c. Little children have shown sometimes far greater spirit of participation than we, the adults, can ever show. For instance, when a little handicapped girl who did not even come to the school brought a single leaf as an entry into the competition it became obvious that winning a race certainly was not the upper most in the mind of a child. The participation was. How do we sustain this spirit when the children grow up?

d. The boys and girls did not seem to have any difference in their knowledge about local biodiversity upto class fifth. However, in class sixth and seven, the boys seem to know much more than the girls. Apparently, the additional responsibility of girls in performing household chores restricting them from pursuing similar awareness but biodiversity.

e. The children from scheduled caste and tribes seem to know significantly more plants compared to the children from forward caste. Obviously there was certain area of knowledge in which the backward children were actually forward. Obviously the children from so called lower castes had to spend far more time with the nature either in grazing animals or collecting forest produce or otherwise.

f. In one of the such contests organized among children as well as adults, a child of less than twelve year old age had acquired half of the knowledge of biodiversity compared to the maximum knowledge of the community. Subsequently, we have come across students who knew as many as
300 plants at the same age as mentioned above. The great tragedy is the formal education system ensures that such children get no opportunity for further mobility in their life as naturalists. Unless they learn ‘A for apple, B for Boy, C for Cat’, there is very little future for these children.

g. The most ironic aspect of these processes is that the regions where we find such children having extra ordinary knowledge of biodiversity are also the regions with high drop out rate in primary education. In addition, these regions have some other characteristics equally important for generating policy recommendations. The poverty levels are high, the proportion of women headed or managed households and male emigration area also high. If we generate incentives which accrue only for those who either are educated, or are male or do not migrate, then the poor may be left out.

h. In one of the contests in Kottayam in Kerala, children brought not just the list of plants but also the seedlings. The school administration decided to give some of the seedlings as prizes and other as living mementos to the participants. The result was that a great degree of churning took place shuffling the local biodiversity around. This is an experiment which offers enormous opportunities for further refinement or modification to promote people to people exchange of knowledge as well as diversity.

i. We also tried to study the correlation between excellence in academic world vis-a-vis the excellence in ecological realm. There was no correlation between the two and exact sign varied from school to school. However, one can safely infer that not being good in academics does not confer any disadvantage in achieving excellence in the biodiversity based knowledge.

j. One of the modifications we did in recent round of biodiversity contest was to scout indicators. More than sixty indicators of various kinds (rain and other climatic parameters, disease and pests, fertility of soil, animal performance, crop performance, etc.) were scouted through these contests. Many of these indicators would need to be validated through systematic observation, cross cultural testing and through scientific appraisal wherever possible. What is important is to recognize that many of these indicators embody tremendous wisdom coded in the form of easy to interpret signals. It is obvious that this knowledge can blend very well with scientific knowledge for mutual advantage.

Learning from women innovators: Does gender make a difference to the nature of indigenous knowledge?
I was visiting homesteads of certain poor women farmers in Tangail district of Bangladesh along with some young agricultural scientists. We observed something unusual while talking to a woman farmer. She had very little land where she had grown nursery of sweet potato. Her hope was that if she got some land on lease, she would transplant the sweet potato on that land or else continue to grow nursery as a crop so that during the months she couldn’t afford to feed rice to her family, she could feed sweet potato as a staple food. She was cutting sweet potato vines, kept it ready for transplantation in anticipation of land on lease. While cutting the vines, she was also de-rooting the vines at the nodes leaving only one or two roots. We asked her the reason for this practice. She explained that by doing so she was ensuring that there would only be one or two tubers at each node. These will be round and have thicker skin. The roundness was preferred by the consumer and fetched better price. The thickness of the skin helped in storing the tuber for longer period of time. These criteria were not incorporated in the selection criteria of sweet potato at either national or international research institute. Obviously, the practice made lot of sense and helped overcome some very specific constraints.
During the study of women and homestead utilization, Ms. Dilruba an oilseed breeder made a case study of women farmers in northern Bangladesh. She found a very interesting practice for providing moisture to arecanut trees during winter when there was hardly any rain and due to sandy soils, the condition became droughty. She planted a banana plant in between four arecanut. The sucker of banana absorbed moisture during the rainy season and released it to the roots of arecanut during winter season. Obviously this is a very sustainable practice.

(c) Entrepreneurial development through self-help technologies

Gangaben became a widow at an early age. She pursued her education thanks to the very enlightened policy of women education followed by the King of Gondal state. She collected more than 2000 self-help recipes for making dyes, ink, pesticide, seed storage, etc., and published them in a book for helping rural youth to gain self-employment. And this was done more than 100 years ago in 1893. Thousand copies of this book were said to have been sold in three days. We are still to come across another effort of this kind in recent times notwithstanding the policy pronouncements favouring self-employment and entrepreneurship.

Do Most Communities Bother About Their Traditional Wisdom?

Much is said about the so-called communitarian spirit of the knowledge system in any village. It is also suggested that commoditisation of knowledge is contrary to the communitarian spirit of the people. It is argued that knowledge is to be treated as a common property and everybody should have unhindered access to it. Most of the local knowledge experts we met bemoaned a common problem which is the lack of interest among younger people to acquire the expert knowledge of the elders. As if this was not enough in many communities these local experts are not able to meet their basic needs also. Since many of them do not charge for their services, the society on its own does not recognize its responsibility to provide much incentive to these experts except respect. Since young people do not see a rewarding career in this enterprise of knowledge building, they do not pursue apprenticeship under these experts.

Any knowledge system of this kind drawing upon local biodiversity requires access to the ecological resources for sustained production and reproduction of the knowledge. The same communities which benefits from the knowledge of local experts do not enable these experts to gain access do any piece of common property land or be allotted land for private use so that the experts can have their own herbal gardens.
Given such a context, any framework that makes the same communities as custodians of this knowledge and the benefit accruing from value addition does not appear very fair to us.

**Rewarding Creativity, Conserving Diversity and Overcoming Mediocrity**

The issue thus is: how do we go about compensating or rewarding indigenous or local communities for their valuable knowledge and conservation contribution. For the first time that the communities and individuals who conserved biodiversity despite remaining poor have a chance of overcoming their poverty by being compensated for their traditional as well as contemporary creativity. Even more promising possibility is that this can happen without any need for patronizing protection from the state (which kept them poor and illiterate for so long). That is not the only promise. We could even hope that the polity of this country for once could get out of the hands of self seeking rent extracting class of non-competitive, non-creative and non-inventive industrial, trading, professional and farming elite. The game thus is very clear. Those who have faith in the inventive capabilities of the economically poor but intellectually rich communities and individuals would like to exploit the opportunity offered by General Agreement on Tariffs and Trade (GATT) and Rio agreement. On the other hand, there are those who still live under the illusion that a patronizing and protective regime is what poor are looking forward to.

Those who are opposing the protection of intellectual property rights are doing so perhaps because they have no confidence left whatsoever in the native genius. Their argument seems to be very simple, “since we have never won in past in any global struggle, what is the guarantee that we will in future when odds are against us”. A mentality of failure, cynicism and defeatism is unlikely to generate any hope even with best of the circumstances and all odds favouring us.

**A Plea for Global Registration of innovations, traditional knowledge and practices:**

SRISTI has been pleading for a global registration system akin to the Honey Bee network of grassroots innovators for last several years but particularly since 1989 when the Honey Bee network was started and reinforced later several times (Honey Bee, 1990-1996; Gupta, 1991, 1995; SRISTI, 1993). Subsequently, the Third World Network also endorsed this idea as apart of their proposal on community Intellectual property rights but they had restricted the scope of such a registry only to the collective knowledge. We have argued from the beginning that innovations are produced not only by collective groups but also by individuals and not just in long past but also in the contemporary times.

It will be possible to achieve the following results from such a registry:
(i) Acknowledgement of individual and collective creativity.

(ii) Grant entitlements to grassroots innovators for receiving a share of any returns that may arise from commercial applications of their knowledge, innovations or practices with or without value addition secondary entitlements.

(iii) Linking the golden triangle of entrepreneurship by linking Investments, enterprise and innovations. Small-scale investors in North and South cannot afford to go to various countries, scan diversity of knowledge and resources, negotiate contracts and invest up front huge amounts for value addition. If they do not participate, then the field will remain dominated by only large corporations. This register will help small-scale investors seek opportunities of communication with communities and individual innovators and explore opportunities of investment. Large number of potential negotiations will take place increasing the opportunities for innovative communities and individuals. The competition among the investors tempered by competition among potential suppliers of a various kinds of knowledge as well as diversity will moderate expectations on both the sides.

(iv) An autonomous authority of which local community representatives will be the majority members could be entrusted with the responsibilities of having access to all the contracts. A copy of the contracts may have to be deposited with this authority so as to avoid short changing of the communities. These contracts will also be scrutinized to see whether management plans for sustainable extraction of diversity have been drawn up in scientifically appropriate manner or not. Penalties may have to be imposed for non-sustainable extraction of herbs by domestic as well as external extractors.

(v) Each entry in the Register will be coded according to a universal system like International Standard Book Number (ISBN). The postal pin code of the habitat of the community or individuals registering innovations will be incorporated in the indexation system so that geo-referencing of innovations can be done. In due course the contextual information of innovations can also be incorporated in the system so that Geographic Information System (GIS) of innovations can help cross connect the communities having similar ecological situations or facing similar constraints or challenges.

(vi) The entry in the register will in the first stage be mere acknowledgement of creativity and innovation at grassroots level. But later some of the innovations will be considered appropriate for award of inventor’s certificate or a kind of petty patent which is a limited purpose and limited duration protection. Essential purpose of this innovation also is to enable the
potential investors (a cooperative of consumers, producers, an entrepreneur, or a large firm in private or public sector).

(vii) The award of certificate will also increase entitlement of innovator/s for access to concessional credit and risk cover so that transition from collector, or producer of herbs to developer and marketeer of value added products can take place in cases where innovators deem that fit.

(viii) The registration system will also be part of Knowledge Network linking problem solving people across the world at grassroots level. This will promote people to people learning and serve as a multilanguage, multilevel, multimedia (oral, textual, electronic) clearinghouse for local and indigenous communities. Wherever necessary and possible, formal scientific institutions will be linked up in the network.

Apart from the registration system a large number of specific incentives would need to be developed for different categories of knowledge, innovations and practices. Similarly the incentives for preservation of sustainable lifestyles of indigenous communities would also be different. In the following four sections we provide a shopping list of incentives under different categories.

We should recognize four fold scheme of compensation (Gupta, 1990):

a. Material-Specific
b. Material-Non Specific
c. Non Material-Specific
d. Non Material-Non specific

(a) Material-Specific: In cases in which specific individuals have contributed to conservation of land races or wild plants with specific economic and inventive uses, their rights to receive licensing fee or royalty must be recognized.

In case of (b) i.e. material-non specific, i.e., community or a larger group, the compensation would flow to a group through trust funds, risk fund or insurance funds to encourage inventive communities to take more experimentation and perhaps progress on the path of entrepreneurship. Insurance funds should also ensure that communities or farmers growing land races get price advantage compared to the high yielding varieties.
There are several ways in which revenue can be generated for providing various incentives to individuals or collectives:

(i) A cess or tax on the sale of seeds using the given germplasm conserved or contributed by the specific individual or community,

(ii) Share in the turnover from commercializable plant derived product such as herbal pesticides, veterinary medicines, vegetative dyes, anti-oxidant compounds, nutritional supplements etc.

(iii) A tax on the market arrivals in grain markets in green revolution regions or high yielding varieties of different crops (including various cash crops) to be used for conserving diversity and providing incentives to communities and individuals conserving diversity.

(iv) License fee to be collected from public as well as private sector companies for using germplasm still conserved by communities in backward regions even if available in national or international gene banks.

(v) License fee could be supplemented by larger investments in infrastructural development in these regions particularly in education and other minimum needs.

There are several other ways in which the revenue can be generated. The important point to be understood is that people would not conserve biodiversity while remaining poor for too long.

It has also to be remembered that while farm leaders are opposing the IPR regime for farmers’ and the scientists, they have no locus standii on the matter. The biodiversity is least in green revolution regions from which most of leaders come. The regions, in which diversity is highest, would not get another chance for being compensated for their ongoing contribution to maintenance of diversity and associated knowledge system.

One can innovate in many ways to identify the precise areas and communities that are conserving rare germplasm. The primary school children and teachers can be involved in country wide documentation of the bio-diverse regions, races, wild plants of economic importance etc., in the form of a campaign led by some committed Non Government Organizations (NGOs) and professionals apart from community leaders. State department of agriculture and revenue staff can also be involved in urgent inventorization of knowledge, materials and claimant communities and individuals.
Farmers growing local varieties particularly under threat will need to be compensated for not shifting to high yielding varieties in selected areas. Mechanisms can be worked out for in situ conservation through the involvement of state agricultural universities and other conservation bodies.

(c) The non material-specific rewards deal with honor and recognition of individuals and specific groups of people who have contributed most in conserving biodiversity.

(d) The non material and non specific instruments deal with changes in policies, curriculum at different levels, institutional norms for providing credit and other support systems. Banks would not consider financing a herd of local well-bred Gir cows, or bio-diverse farm at the same scale at which they would finance input intensive farm. Students are not taught any thing inspiring about the contribution of communities which conserve biodiversity. On the other hand they are shown as backward.

A scheme needs to be developed for supporting all those panchayats which will undertake systematic cultivation of local land races in every season in large enough areas for enabling some seed exchange. Villages which have conserved local varieties like Jackrana variety of pearl millet or Khirchia of salt tolerant wheat need to be provided some funds for local development linked to the contribution these land races are making in breeding on an ongoing basis. This will give a signal to other communities as well. Funds under this scheme also may be allocated by an autonomous body rather than bureaucracy.

The Patent act must provide for recognition of indigenous innovations. Data base like that of SRISTI can provide a valuable beginning point. Scope can exist for defensive patents in which certain innovations valid for larger social use can be patented not to prevent their diffusion but to prevent their being patented by some third party.

Linkages with Desert Convention (ICCD) (Gupta, 1995)

In this context, operationalization of various articles of International Convention to Combat Desertification, particularly Article 16(b), Article 18, Article 19 and 20(c & d), Article 25-3(a), Article 26, etc., in order to network existing information channels so as to make innovative solutions accessible to people in a manner that they can use these and share feedback/feed forward.

The Article 16 of Convention deals with information collection, analysis and exchange so as to accomplish (a) early warning, and advance planning for adverse climatic periods and (b) practical
applications to deal with these variations by the people. It suggests that information needs of the local communities and decision makers are addressed through various ways of information networks integrating physical, biological, social and economic indicators. Article 16(d) suggests use of expertise of governmental and non-governmental organizations for dissemination of information. Article 16(g) provides for exchange of information on local and traditional knowledge, “ensuring adequate protection for it and providing appropriate return from the benefit derived from it, on an equitable basis and on mutually agreed terms, to the local population concerned”.

The important caution which needs to be exercised in this regard is about “mutually agreed terms”. People providing their knowledge whether traditional or contemporary may not always be able to fully assess the terms at which they should agree to share it. Many times, because of their superior ethical values, they may share it without asking for any reciprocity. Under such circumstances, the values of the receiver would determine whether or not he/she would provide any share in the benefits to the source/s of the knowledge. To avoid such an asymmetry in the exchange of information, I have argued that developed countries should enact a protocol or country specific legislations which should require every company/individual in private or public sector to declare that the product or process being protected is based on knowledge collected ‘lawfully’ and ‘rightfully’.

Thus, even if a developing country does not have a law or institutions to implement a law regarding adequate protection for local and/or traditional knowledge, it will be the responsibility of the user in developed country to declare how the knowledge was collected fulfilling not just the legal requirement but also the moral requirement. Otherwise, it may be legal to take the knowledge of the community or an individual innovator in a country where law to the contrary does not exist. But could it be called ‘rightful’?

The provisions of Article 16(g) of ICDD can be combined with Article 8(j) and 15.5 of the Convention on Biological Diversity (CBD). In addition to the sharing of benefits, the concept of prior informed consent will also need to be operationalized.

Large number of plants from which vegetative dyes can be made for clothes or leather may be found in dry regions. These dyes may be in great demand because of pollution hazards and human allergy caused by synthetic dyes. How will the knowledge and resource be exchanged in a manner that providers as well as receiver see it in their mutual interest that resources are conserved?

Article 20(d) draws attention to the role of foundations, NGOs and other private entities to bring about debt swaps as well as other innovative means of reducing external debt burden of affected developing countries, particularly in Africa. To operationalize this provision, Knowledge Centre/
Network would have to mobilize and network financial nodes for this purpose. Knowledge Centre can create pressure on the global institutions by periodically sharing information on how the trade, environment, technology and resources have been made available for the purpose.

**Rethinking Education, Environment, Excellence and Ethics**

Vijaya Sherry Chand (1996) looked into the educational innovations needed to situate the local knowledge in the context of Gandhian institutions. He observed that the choices made by the *gram vidyapith* network to cater to rural and socio-economically marginalized sections of society are evident in the composition of the student intake. About half of the students belong to low-income groups. Almost 70 percent are from agricultural backgrounds, and about 10 percent are from labour backgrounds. About 75 percent of the students have completed their schooling in Basic schools, that is, most of these students have spent their secondary or higher secondary schooling years in Basic schools. Many of the students are first-generation college-goers and have made their own higher education decisions on the basis of information provided by their schools. More than 80 percent have confined their options to *gram vidyapiths*, primarily on account of lower perceived private costs than in mainstream education; familiarity with the Basic philosophy of education; or lack of self-confidence.

Most students understand *vidyapith* education as an attempt to combine value education and technical education. Given the above conclusions, two experimental initiatives were examined. The first, reorientation of the project work course of the third year dairy science students of Mahila Gram Vidyapith, Nardipur, was motivated by two sets of factors, both of which relate to the larger issue of dealing with marginalities within a marginal education system: incorporating concerns about sustainable and alternative development in formal curricula and dealing with the issue of gender in *vidyapith* education. The main conclusion from the perspective of the *vidyapiths*, is that recognition of women’s knowledge in areas not usually associated with them will help in the transcending of the current stereotypical association of women with home science and domestic skills. Paradoxically, in the transcending of the current stereotypical association of women with home science and domestic skills, Paradoxically, women’s functions (feeding, housing, calf management etc.) are emphasized in the present curriculum in contrast to areas where males are primarily involved (price fixation, partnerships in animal ownership, indigenous animal cure expertise etc.). The format of project work - which can also be applied to other curricular streams like agriculture, forestry and extension - is particularly useful in this respect since it allows for flexibility in the selection of areas for study and for a greater degree of autonomy to the student in the conduct of the study. However, the study of areas of women’s knowledge by itself can have only a limited impact if it is not accompanied by a wider debate on the re-interpretation of the *vidyapith* model’s current ambivalence regarding gender:
a blend of radical and conservative elements in the approach to female education which allows a corrective emphasis on equal opportunities to coincide with a disregard of ideological roots of gender stereotyping which retains women in stereotypical roles.

**Incorporating indigenous knowledge in under-graduate curriculum of women studies**

To overcome a major weakness of our database on indigenous knowledge of women and also to generate interests among younger students in this field, we decided to experiment on educational innovation. Women students of undergraduate degree in rural studies were encouraged at Mahila Gram Vidyapeeth, Nardipur to take up a topic for a small thesis documenting women’s’ ecological, technological and institutional knowledge. About 80 such theses have been written up during last three years providing a very rich base of technological knowledge.

The experiment has shown that there is a tremendous diversity of knowledge among women on the same subject in different regions. In the absence of knowledge network, the knowledge has not diffused as widely as it should.

Why don’t formal scientific systems recognize and build upon and reward informal innovations?

Jabbarbhai, formerly a truck driver and now a rickshaw puller has developed a fascinating innovation by adding four gears to an ordinary rickshaw to reduce the effort required to pull it over steep slopes as well as with heavy weights. The problem of a rickshaw, or a pulley for drawing water from the well of many such day-to-day activities including sickle for harvesting crops should have received attention long time ago but it did not.

What are the barriers which prevent elite technological institutions from addressing the problems common people face and adding value to their innovations to improvise them and make them even more efficient?

Several studies and encounters with the scientists over last 10-15 years reveal following factors that perhaps explain partly the reason for indifference of the scientists:

If we couldn’t succeed with so many resources, how could common farmers achieve breakthroughs with much lesser education, knowledge and other resources.

Assuming for a minute that there is some consensus on what constitutes success, the logic of above statement fails to recognize that ability to generate creative solutions need not be a function of
formal training alone. Otherwise the rickshaw, the pulley for drawing water or bullock cart or sickle would have been modified several times over by now. The peer group of the scientists sometimes includes primarily the professionals in economically developed societies. If certain problems are important in those societies and, therefore, are published in their journals, then these problems automatically become important for the counterpart scientists in the developing countries.

The success may elude the scientists because of the culture of conformity and compliance pervading in scientific organizations. J. B. S. Haldane once said that the reason for lack of scientific breakthrough are two fold, one, the Indians are very polite and second, they don’t want to break their rules particularly the scientific rules. It is futile to blame the colonial past for the bureaucratic culture in the organization. The reason essentially is the absence of adherence to what K.M. Munshi called the Gospel of the Dirty Hand.

Even in cases where scientists have had success in past, their anxiety and tendency to repeatedly use the same framework may become the reason for their failure. Green revolution technologies are one example. These were very effective in basic production and productivity, but the path weren't sustainable. The laggards of pre-revolution strategy have become the pioneers of biodiversity conservation. Putting far too much of faith in one strategy obviously isn’t very prudent in a changing environment.

If exposure at an early age has a bearing on motivation in later life, then one can understand why scientists are not very responsive to grassroots innovation. I remember during my own college days (and it doesn’t seem that the trend has changed very much) there was never any session or topic in the class which would generate pride in the knowledge of and innovations by farmers, pastoralists, artisans, fisherwomen and men, etc. It took me almost a decade after graduation to discover the first two post-graduate theses in indigenous knowledge guided by Dr. Y.P. Singh way back in 1967. Even today there are not many research programmes which have been built upon farmers’ innovations although farmers knowledge and practices have certainly been reviewed in many studies in the last two decades.

In the age of modernity working on a local knowledge embodied in a simple solution does not generate a great degree of awe or respect among the peers. For instance, after an article was published in Loksarvani about the use of buttermilk, several farmers wrote to us inquiring about it. One farmer did an experiment and sent his results of buttermilk spray on different crops to boost productivity. For all that we know this might become a popular technology just as spray of coconut water has become in some parts of Gujarat. Of course this would happen in spite of and not because of scientists.
In many cases, scientists don’t respond to unconventional ideas because of excessively narrow specialization and professional values coming in the way of experimentation on allied issues. A plant physiologist may not ordinarily appreciate if an entomologist uses a growth promoting substance to compensate the damage by the pest. This is a totally different way of thinking that if pest do cause some damage why not increase the growth so that pest also get their foods and farmers also get their productive returns without any negative externality.

Lot of good research is done as a part of postgraduate degree programme. The problems for research that students select or are assigned by the guides are generally oriented towards career prospects. In the post-liberalization phase job opportunities are available primarily in private sector. These concerns do not incorporate ideas emerging from the grassroots even if some of these can be developed into commercializable products.

**Social structures and grooming of creative mind:**

Right from the childhood one message which is often drilled in to the mind of child, ‘don’t ask too many questions, do as you are told, it is not a good manner to speak too much before elders’.

Conformity and compliance characterized good behavior and ‘cultured upbringing’. Deviance is shunned no matter in which direction.

There is a heavy pressure among all communities for girls to confirm to a particular life pattern and opportunity matrix. This itself may be a very significant reason for lack of social dynamism in Indian society. There are several levels at which creativity in Indian society could be discerned and nurtured. The first and the most important assumption that I am making here is that large number of creative people, groups and communities exist and are continuing with their efforts notwithstanding the pervasive cynicism in society.

**Alternative sciences: Can text and context be separated?**

Ashish Nandy (1995) in the second edition of his famous book (Alternative Sciences: Creativity and Authenticity in two Indian scientists) observes in the preface: ‘Over the years I have given up this two fold division (of science into its text and context) and come to believe that there is no Orwellian thought - police guarding the border between the contents and context of the modern science. The main function of the dichotomy has been to deflect all criticism of science away from the scientists, towards the forces that control the externalities of modern science - some well known candidates
being the military-industrial complex, American hegemony, Stalinism, Oriental despotism and religious bigotry...'

According to this principle (of split legitimation), only the good that sciences does need to be owned by the scientists, never the evil. He continues to say that this division has in some sense been responsible for creating ambivalence towards modern science. Ashish Nandy criticize himself for not pursuing systematically the alternative frames of knowledge used by Ramanujam and Jagdish Chandra Bose - the two scientists whose life he analyzed in the book. He confesses in the section on Srinivas Ramanujam, there is no discussion of the indigenous schools of mathematics which had survived in vestigial form in south India especially in Kerala, which shaped his mathematical worldview. Even in the case of Jagdish Chandra Bose, there is insufficient effort to set Bose’s vitalistic biophysics within the tradition of Indian science.

The contradiction of balancing the sea saw of indigenous vision and modern science or modern vision and indigenous science are portrayed very poignantly as:

In such peoples (creative scientists), science becomes the battleground where the community’s ambitions confront its backlogs, and the scientist becomes a microcosm where the community’s adaptive capabilities challenge the creative power of the individual. In the process, science may some time be distorted and some scientists may become hollow dehumanized men. The society also may pay a heavy price, swinging between the extremes of total acceptance of exogenous models of science in society and a doomed search for a fully home-brewed science.

However, broken glasses can sometimes act as prisms. The deviant cultures of science in such societies too can, through a process of refraction, give an altogether different analytic perspective to world science as an identifiable psychosocial process.

Ashish then departs from this analogy to reflect on 19th century India and the indigenous scientific tradition available then. However, I plan to take the analogy of broken glass further. To me it appears that the broken fragments of glass act as a prism not just to refract the light emanating from deviant cultures of science but also from the culture of deviant science in the farms, farms and homesteads. Multiple heuristic used by experimenting farmers, artisans and other communities refract through these broken glass pieces a variety of perspectives on the process of innovation. Let me catalogue certain specific ways in which the creativity manifest in Indian society at different levels. I am not suggesting that these manifestations are visible to everybody but I do assert that like a child who cherishes an assortment of pebbles or feathers or used match sticks that she collects to play with, I and many of my colleagues in SRISTI and Honey Bee Network have indeed gathered these pebbles with child like curiosity. If we did not have a complete theory to explain most of the innovations we managed with propositions or conjectures and if even conjunctures appeared difficult to postulate,
we managed with episodes and in some cases with mere graphic events. I recall a paper by Amartya Sen (1980) on Description as a Choice. Sen first of all regrets that description as a scholarly activity has always been ridiculed or downgraded compared to analysis. He proceeds then to suggest that descriptions can be used for prescription or prediction.

The descriptions of innovation that I have offered provide sufficient indication of certain prescriptions and a few predictions. Predictions first, There is no doubt if Knowledge Networks of creative people in different parts of the country and eventually in the world become strong people will find a way of dominating science and not be dominated by the superstructure of modern science. There is no inevitability in knowledge systems for one vision to dominate another. It is just a matter of relative emphasis in one’s own mind on the specific criteria of validation and value addition in knowledge. If 50,000 farmers experiment different variations of a simple idea a very complex and tremendously profound set of heuristics may emerge opening up multiple trajectories of developing various ideas. Some of these paths may parallel very closely the path the modern scientists may take which is of a very reductionist approach to solving problems. And yet there will be other paths which will combine reductionist and holistic visions in varying proportions.

It is this ability to combine visions to produce multiple ways of advancing an idea that gives me greatest confidence for predicting a very hopeful future of our society building upon these innovations.

But I also have some prescriptions. Following from the descriptions. The first prescription is that indigenous visions should not become an alibi for isolation and fragmentation of knowledge system. To argue that a farmer in a village of Gujarat cannot communicate and deal with an idea produced and processed in a village of Latin America is to pass a value judgment about how knowledge systems are constructed and facilitated by the gatekeepers of resources and institutions. It has nothing to with the idea itself. Obviously many of us who travelled around the world and see a great scope of learning from each other considered this discourse across the continental cultures as a necessary building block of our vision. How is it that something which is inevitable and indispensable for the growth of modern mind becomes dispensable and avoidable for the growth of mind of millions of creative farmers and artisans in the villages?

I also contend that creative urge in human mind is natural and logical way to grow in any part of the world. It is this schooling and institutionalization of ones place in the world which is the source of the problem. Howard Gardner (Creating Minds, 1993) puts it well when he calls Albert Einstein as the perennial child. To argue that abstraction of that order doesn’t happen every day, my only
response is that large number of problems that affect men, women, and children in most marginal environments of our society remain unsolved day after day.

**If problems can persist, why shouldn’t solutions exist?**

All of us have seen a bullock cart and have also seen various tasks that it performs. Likewise we have seen various other transport vehicles in urban areas which have greater facility to perform transportation, traction and other functions. The problem of taking farmyard manure to the field and dumping it in one part for later distribution through the baskets in different parts of the field has been known to any student of farming systems. And yet the thought of making a bullock cart in which the trolley could be tilted by using gears in such a manner that manure can be poured into the furrows by moving the cart around the field did not occur to anyone for 100s of years that the cart has been around. It required imagination of Amrutbhai of Pikhore village of Junagadh district to solve this problem with little support from SRISTI. There may be many other Amrutbhais who have similar ideas but no support or provocation.

We have all seen the sickle with which crops are harvested or grasses cut. Improvement in the efficiency of sickle could have been a subject of national technology mission. It would never be and perhaps for that reason individual labourers will continue to invent new ways of designing sickles.

Large numbers of land races of crops and breeds of animals have been conserved by the communities all around the world. Why is it that only some villages evolve institutions for systematic upgradation of genetic diversity and not others. Institutional innovations provide as much diversity as technological innovations. The only difference is that institutional innovations are more difficult to observe since institutions like rules exist in the minds of the people. Technological artifacts can be observed. Institutional process has either to be experienced or narrated.

I have argued that technologies are like words and institutions like grammar. Grammar has rules by subscribing to which it would be difficult to innovate. Every institution is an instrument of coercion and compliance. It is true that institutional innovations do take place and to that extent collective capability to resolve dilemma and bring change also increases. However, there is obviously a tension between the goal of institutional conformity and vision of technological and institutional innovations. One would notice that farmers who innovated are often on the margin of the society. They neither seek approval from their peers nor necessarily allow their enthusiasms to be tampered when collective disapproval is imposed upon them. There are some who impressed the society with their excellence so much that they are adored but seldom are their values adopted. Therefore, Bhaskarbhai Save is revered by farmers in Maharashtra but has no follower in his own village
(Pastakia, 1996). He has a dish antenna on roof of his house and enjoys different channels on televisions and at the same time advocates and justifiably so a natural and organic approach to farming. His own standard of simplicity need not come in the way of his children’s yearning for affluence/luxury so long as basic values of natural ecological balance are maintained.

And when we move a few steps further, we notice a variety of ethical and institutional positions that different innovators take in their personal professional and institutional life. In a meeting organized to feedback the findings of research with each of innovator whose experience were documented and whose heuristics were analyzed by a doctoral student (Astad Pastakia, 1996), I asked a question as to what would they do when they themselves fall sick or their animals fall sick or their crops are sick or affected by pests or diseases. For many of the innovators degree to which rules were enforced in different life spaces varied a great deal. For instance, when they would fall sick themselves most of them would wait for a while or try for some local medicines and then not hesitate in going to a allopathic doctor. They wouldn’t necessarily look for an ayurvedic doctor. Similarly when animals falls sick they would try various local medicines, or consult local expert if available and then call a doctor - a modern veterinary doctor if nothing else worked. But when their crops were affected by pests or diseases, most of them would adhere to non-chemical path. In a few cases, it was ideological, or religious or just a pragmatic approach born out of past experience or their exposure.

In our analytical approach, we would expect personality of a innovator to be consistent in the core components of sustainable approach. This is obviously a problem of the analytical framework and not that of phenomenon itself. Most studies on creativity highlight that a creative personality is not necessarily a consistent personality.

The institutional contexts of a traditional animal healer or an indigenous human healer are even more paradoxical as mentioned earlier. The same people who benefit from a particular recipe or a practice of indigenous healer would never, even for a moment, think of the possibility of their son or daughter becoming an apprentice to that healer. We want to benefit from the fruits of creativity but we neither want to sow the seed nor nurture it when it sprouts. Perhaps many of us have reconciled that only way the progress can be achieved is through domination of a non-sustainable worldview, technology and institutional arrangements because that is the way progress have taken place in the world so far. Even when attention is drawn to the rethinking going on in the western society itself, the argument is that we should first grow and achieve the same kind of accumulation as witnessed in the west. Only later would we care for the nature and other life support systems.

The roots of creativity of Indian society grow in a soil that is full of pebbles and subject to extreme erosion. The erosion takes place through revivalist tendencies. Erosion also takes place through
excessive aping of exotic culture and technologies without building upon local knowledge. Even if soil is conserved in some places it is under threat of erosion because the future users of the resource don’t have patience with the traditional ethics or institutions. But like a good artisan who does not blame his tools, we have to plough the same soil and generate creative solutions with all the limitations of the soil and the plough. The emerging global, legal and institutional regime makes it possible for creativity across cultures and continents to be inter-connected.

Rethinking future India

How do I expect renaissance to take place in Indian society. To be more precise, the challenge really is to speed up the rate of churning already taking place. How do we do it?

1. Catch Them Young: Nursery for little genius

We recognize that the primary education is the first time a child comes across the institution of schooling and sometimes de-schooling. And inspired teacher produces optimistic inspired students. These teachers need not exist only in the school. Every village community has local experts in various kinds of knowledge system ranging from climbing a tree to deciphering the foot prints of animals or taxonomy of soils suitable for making pots or growing plants or plastering the walls of the hut or grain bins. This knowledge which has potential for being joyful, competitive, specialized and at the same time medium of learning three R’s (reading, writing, and arithmetic) has to be the basis for the scouting little genius in our society. Once specific area of expertise/ tendencies is discovered, mentors identified from among the formal and informal teachers should become accessible to these children. This process will never become part of the national education policy because it would not require consultants from World Bank or retired education officers as the new breed of facilitators (exceptions apart). However, our studies on innovations in primary education (Vijaya Sherry Chand and Shukla, 1995; UPE, 1994; SRISTI, 1996) have shown a tremendous potential that exists for teachers to act as transformers of social change. The federations of primary school teachers in different states can help in scouting such outstanding self-motivated teachers. The only incentive these teachers may need is freedom to experiment and extend their roles beyond the call of duty. In other words, liberating them from unfair comparisons and the shackles of inspectors and others who may drain their energy. These teachers could be given responsibility for different clutches to generate learning processes that bring informal teachers within the formal boundaries of schools and vice-versa.

2. Stemming erosion of knowledge
The erosion of knowledge was never as fast as it has been in the current generation. Surely any knowledge system will have debilitating as well as empowering dimensions. Thus some elements of traditional knowledge may in fact need re-interpretation rather than just being forgotten. In a society which has had high degree of illiteracy, the assumption would be that knowledge erosion is caused by it. The empirical evidence is otherwise. It is the advent of modern education which has contributed to the erosion of community interactions and the knowledge produced in the process. The erosion has also taken place of the knowledge produced by individual innovators in recent past as well as by individual experts which may be known to the community but is not produced by it. To stem this erosion, we obviously need to restore some of the linkages described in point one above. In addition, we should remember that different kinds of knowledge trees grow in different kinds of soils. Similarly, different kinds of creepers of expertise grow on different trees. Therefore, one cannot expect same process or institutional arrangement to help in stemming the erosion of knowledge of different kinds. The concept of knowledge network described earlier in the paper may help in generating pluralistic choices.

3. Transition of ideas into innovations: Establishing a venture capital fund for small innovations

The preponderance of market penetration in rural as well urban societies is a matter of the fact. However, the existing market structures and processes enable only certain kind of ideas to be scaled up and diffused through commercial or non-commercial channels. Large number of individual innovators may not like to become entrepreneurs themselves. They may also have no interest in converting their innovation into a commercializable product. Therefore, a linkage between innovation, investment and entrepreneurship is vital.

4. Inter-generational transfer of knowledge

Singh and Varma (1969) had asked a question about the continued relevance of the indigenous knowledge in a specific context of animal husbandry. That question could still be asked because the mainstream educational and public policy system still does not give due attention to the peoples knowledge system. One implication of this is the downgrading of the knowledge system in the eyes of young people of the same community. Once esteem goes down the incentives for young people to acquire that knowledge and experiment and rejuvenate the same also go down. This leads to serious discontinuities in the inter-generational flow of knowledge. Once the “local experts” of the older generation are gone there are no substitutes and the knowledge held by those individuals in trust for future generations is lost forever.
The Real India, as Yash Pal Committee looking into the subject of Technical Education for Real India has suggested will not stand a separation between informal and formal knowledge systems. The challenge is to blend the creativity and excellence in formal system with the ones in informal system. But that will require us to recognize that the door to grassroots creativity is already open. Or else we will keep knocking.

5. Creating Knowledge Network of Knowledge Rich economically poor people around the Country and the world

The SRISTI model of empowerment and sustainable technology development implies a possibility of improving income and livelihoods of knowledge rich economically poor communities and individuals through documentation, value addition and experimentation and local innovations.

The concept of a Knowledge Centre /Network being promoted by SRISTI and Honey Bee network could be one vehicle through which these goals could be pursued and operationalised as given below:

a. To trigger a multi-channel, multi-node and multi-level network of individuals, institutions and social movements engaged in generating solutions to the problem of hunger and poverty,

b. To operationalize various articles of International Convention to Combat Desertification, particularly Article 16(b), Article 18, Article 19 and 20(c & d), Article 25-3(a), Article 26, etc., in order to network existing information channels so as to make innovative solutions accessible to people in a manner that they can use these and share feedback/feed forward.

c. To generate reciprocity amongst providers and receivers of information so that incentives for problem solvers to network with knowledge centre continue to grow.

d. To develop and operationalise an international fund for recognizing, respecting and rewarding creativity and innovation at grassroots level and ensuring sustainable use of natural resources, protection of basic human rights, gender equality, and ethical discourse and conduct of business.

 e. To network with existing efforts all over the globe with similar goals such as International Foundation for Science, Sweden (IFS), Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI), Honey Bee network for indigenous innovations, Tranet, ISEE, IASCP, Center for Indigenous Knowledge for Agriculture and Rural Development (CIKARD), etc.
f. To mobilize volunteers from the private and public sectors, the third sector and even religious organizations to generate and support local trust funds to be managed by communities trying to augment innovative solutions developed by them or others.

g. To set up a venture capital fund for small innovations which may support innovators directly or may underwrite risk or provide bank guarantees for similar funds to be set up in different parts of the world for augmenting peoples capacity to solve their own problems.

h. To fulfill an ethical obligation towards poor people by ensuring, (i) all the information concerning any programme or project is made available in local language to the peoples representatives at local level before designing and implementing the same, (ii) sharing of information during the course of project implementation and respecting the right of people to information and, (iii) protecting the intellectual property and cultural heritage rights of local communities.

If we have to generate sustainable technologies and institutional solutions for preventing land degradation, conservation of biodiversity and generation of income employment opportunities then we will have to recognize that discourse on development must take place in re-defined categories with enhanced role for civil society actors. The poor people should never be considered resource poor because then it would imply that they are poor even in the knowledge resource. We should recognize that language of discourse does generate a habit of thought and a way of looking at the problems or opportunities. Knowledge of people is an important resource and a framework which denies that is neither legitimate nor ethically sound.

Similarly, a framework of development which treats people as victims and helpless clients of official delivery systems would never be able to generate preparedness amongst professionals to participate in the plans of local communities and innovative individuals. Time has come when we the outsiders should learn how to participate in people’s plans and not vice versa. Finally, technology development is a process which requires re-thinking in the formal institutions dominated by chemical intensive approaches and high powered machines. For most of the marginal communities living in fragile environments, standardized solutions as developed for green revolution regions will not work. The organisational arrangements which generate incentive for scientists to work with the people to develop technologies with limited potential for diffusion generally don’t exist. There is a great deal of restructuring required in the international and national research organisations if technology development and diffusion process has to become relevant and meaningful for marginal environments and disadvantaged communities. Honey Bee network with its limited resources and experiences has demonstrated that such a transformation is indeed feasible.
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Summary of Plenary Sessions
Summary of Plenary Sessions

Prof. Anil K. Gupta, in his introductory speech, defined the purpose of the conference as bridging the gap between the knowledge system at the grassroots level and the policies made by activists, scholars, and the voluntary sector. He stated two major gaps in our academic accountability. First, research does not benefit those from whom data or information is collected. This is because what is learnt from people at the grassroots level in their language is seldom shared with them. Moreover, the contributors of knowledge are not able to validate or question the inference drawn from the knowledge provided. Secondly, resources generated from the information provided do not reach them. “This conference is a bold attempt to correct this anomaly in the academic world,” he said. He concluded by mentioning that the conference marked a departure in our thinking, from problem solving to solution augmentation.

The conference focussed on institutional innovations, educational innovations for conservation and resource management, technological innovations, socio-cultural aspects of knowledge systems and innovations, rewarding peoples’ creativity, and market-based mechanisms for commercialization of sustainable technologies, products and services.

The then Director of IIMA, Dr. P. M. Shingi extended a personal welcome to all the delegates. He spoke about the activities of the Institute. He explained how history, technology, and ecology influence the heterogeneous nature of our society. He elucidated the wide scope of creativity and innovations as that emanating from the varied problems of development that arise as there are people living in coastal areas, hilly regions, plains, flood-prone areas, drought-stricken areas, and cyclone-affected areas. “The biggest challenge for us is how do we prepare ourselves to manage and build on this creativity and innovations at grassroots”, concluded Prof. Shingi.

Shri Amrutbhai Agrawat, a grassroots innovator, inaugurated the conference. Shri Agrawat has developed a tilting bullock cart besides other innovative implements. In his inaugural address, he vehemently claimed that one did not have the right to food and existence if one did not take care of the natural resources. He urged that the resources should be managed with a sense of accountability.
to nature. He drove home the point by narrating an interesting story from the *Shrimad Bhagwat Gita*. “If one works hard, is creative, thoughtful and persists with one’s efforts, one will be able to use natural resources in a sustainable manner and create space for grassroots innovations in the society”, he remarked.

The then Union Minister of State for Science and Technology, Dr. Y. K. Alagh, in his keynote address, emphasized the need for government policies to encourage local initiatives in the decentralized framework. The goal of the government should be to help those who help themselves. It should also structure an organization/ institution and infrastructure framework in which individuals and social and community groups can unleash the power of their creativity for social good and individual profit.

Dr. Alagh argued that this approach would imply a number of concrete initiatives including:

First, development of markets and communication infrastructure in backward areas; in particular, the implementation of proposals of the Department of Electronics on the National Information Highway with priority on education, small-scale industry, farmers, and NGOs.

Secondly, the incentives given to government research institutions to link with private producers like the incentive incremental rupee scheme or the Technology Development Board needed to be extended to other knowledge generating or networking institutions.

Thirdly, policy needed a blend of strategic intervention and market-based development. For example, decentralized agriculture development including subsidies to those groups, which successfully organize land and water development efforts or more sustainable cropping, or tree development, also needed a market. This would ensure that the price of inputs likes water-saving devices, soil amendments, newer seeds, information and credit inputs go down and the price of outputs produced accruing to the innovating producer go up.
Finally, he felt that objectives for the nation should be set up nationally; there must be greater freedom at the local level for creativity to flourish. He called this the concept of cooperative federalism that would be a part of the planning process.

Dr. Alagh highlighted the interface between environment and community in the Indian context and raised the issue of whether creativity can be created and stressed the need to distinguish individual initiative, community initiatives, and societal responses. He said that societal creativity could be unleashed by abolishing quantitative restrictions, allowing the flow of currency, reducing tariffs, and doing away with explicit objectives of trying to structure economics to help out backwardness or employment.

He felt that the problem of creativity was very complex since it dealt with the problem of defining social objectives. He recalled a research based on the success stories of NGOs, implying that success was achieved in cases where the community tried to resolve their problems of land and water themselves. Though they were making losses in financial terms and needed help from outside NGOs, they had still created islands of excellence.

This raised the question of whether rules for replication of these successes could be defined. This called for intermeshing community initiatives at a local level with the market form of organizations, involving social support and leadership. What is required is a mixture of community effort in a targeted sense, allowing individual initiatives, and developing organizations and rules that support those who support themselves rather than dictating out the agenda from New Delhi.

Having a science system that will unleash creativity on a social scale is more effective than a just well developed science system. This requires institutions that will interact with the communities in a larger manner.

Prof. Anil K. Gupta differed from Dr. Alagh in tracing the roots of poverty of villages. He submitted that the backwardness of the village was not because the villagers could not deal with the market on their terms. Rather, the market does not have the ability to price their knowledge. Transforming the
lives of the ‘knowledge rich but economically poor’ people without having them to beg for it would be quite a matter to ponder.

Dr. Kamla Chowdhury, Chairperson, Society for Promotion of Wasteland Development, remarked that scientific methodology was dominating our knowledge base was being mechanistic and reductionist in its approach. A new world image that is slowly emerging now after more than a century of modern science and technology is not only an ecological and holistic view but also an ethical, spiritual, and pro female view.

She perceived that at the heart of the matter is the need to make moral choices and to move towards the technology with a human face and a non-violent economics that will co-operate with nature and people rather than exploiting them mindlessly. This can be achieved only with a non-violent way of life and so we turn towards Gandhi, the messiah of non-violence for his sacred truths.

“This Conference on Creativity and Innovation at Grassroots is in the Gandhian tradition. It focuses on local people, on local conditions, and on local sacred truths. It takes the religious, spiritual, and sacred into account in solving problems. This is the direction in which we must move - the sangam of traditional and scientific knowledge,” urged Dr. Chowdhury.

Dr. Anil K. Gupta quoted Dr. K.M. Munshi's words from a 1953 lecture on the Gospel of Dirty Hand to the Governing Board of Indian Council of Agricultural Research. "Unless and until we are able to establish the spirit of working dirtying our hands, we will take our administrative system far removed from people and their knowledge system."

Ms. Elaben Bhatt, Chairperson of Self-Employed Women's Association, highlighted the popular perception that art, only the rich and the educated can afford creativity, modernity, innovation, and technology. The idea is to relate them to the common people. The answer, she remarked, lies in an expanding market within the reach of the common man, without them having to go through middlemen for selling their goods.
This raised the pivotal question of who would help in establishing a Management Information System for the common man, there being no management schools for them. “Our world is still small because we are small. We may remain small but we are to be ready and prepared to combat larger forces. We are building our capacity to access and stand firmly in the competitive world,” she stressed.

She remarked that the constraints the common person faces are illiteracy and not having a formal education. This makes them ignorant of the written word, laws, rules, regulations, procedures, etc.; thus getting things done became difficult.

Her concluding remarks were on investing in people because people made our nation a nation. Wherever given support, the people’s initiatives have shown the way to change; since creativity and innovation are within us and around us.

Dr. I. G. Patel, former Director of London School of Economics and Chairperson of IIMA Board, called for recognizing that the ‘helpless’ people can be the basis of their own upliftment by their own sense of self-respect and self-dignity. They may be poor and deprived of resources, but they have tremendous resources in terms of creativity, innovativeness, wisdom, and knowledge, which far surpasses what the ‘privileged’ people, think they have.

He pointed out that we have an obligation to link the poor people with the academicians, scientists, government, and the rest of the society. This would provide channels of assistance to them and bring the creativity of the so-called least advantaged people to the rest of the world.

Dr Anil K. Gupta raised the question of whether we could make a knowledge network which would link decentralized nodes around the world through multimedia technology. The next logical task is to link this communication means such that the historical gap between the have and have-not could be bridged.
He proceeded to provide the reasons as to why the solutions to the problems of managing networks and technology and institutions dealing with natural resource management have not been linked up. The people who think about such solutions suffer from isolation. When they solve problems in an extra-ordinary manner they are not aware that they have done an extra-ordinary feat. There is a general contempt in the minds of people for solutions that are easily available. Familiarity breeds contempt.

He focussed on the three entities that the knowledge network is trying to join. These three are the people who solve problems, the people who have investment funds but don't know where to invest, and the people who have entrepreneurial ability but do not know in what to invest or where to get the capital from.

Thus, the greatest challenge is bringing innovations, enterprise, and investment at the same place. This requires combination of the five aspects, i.e., excellence, environment, equity, efficiency, and education.

People working in the same field all over the world should have some means of communicating the developments in their work simultaneously. An area where we should work is the database on innovation. Honeybee Network has proved that this is possible.

Prof. Gurdev Singh gave a brief introduction to the Centre for Management in Agriculture and offered the vote of thanks.

In his address, Dr. Thomas Cottier, Professor of European International Law at the University of Berne, touched on one of the most important issues emerging globally: traditional knowledge, genetic resources, intellectual property, and international law. He remarked that resources such as biodiversity and traditional knowledge are getting eroded at an alarming rate. An increasing scarcity went hand in hand with this erosion. The pressing need was to straighten out property rights. Sadly, the wheels of international law are slow in turning.
Dr. Cottier pointed out that traditional knowledge was held in public domain in the past. Society was more communitarian with common knowledge and experience was available to all. The Industrial Revolution sucked dry this watershed and spat out the idea of exclusive property rights. Consequently, traditional knowledge has been eroded, while the material living standards of a few has skyrocketed. It contributed to non-sustainable development and borrowing of capital of future generations. The challenge, according to Dr. Cottier, was to create an integrated body of law involving new creative methods and approaches to deal with the age-old problem of resource allocation.

In his talk on ‘Mining Civilizational Knowledge’, Mr. Susanta Goonatilake remarked that the global axis is shifting economically to South East Asia. The present growth rate of Asia is 5-6% and in the coming 10-15 years, Asia would regain the status it had 500 years ago, thus, becoming a determining factor in economics, quality, culture, and science.

He recalled that Tagore was referred to as the ‘missionary of a failed civilization’, when he had visited Japan and Europe after winning the Nobel Prize. In the cultural field we find that the most prominent English writers are from our region.

Mr. Susanta has published a book with the same title in which he gives examples of South Asian inputs to modern science. He has taken major paths of psychology, medicine, mathematics, and some aspects of physical science and imaginative constructs to illustrate the shift towards Asia. His perspective is that of a western scientific framework. The book tries to probe as to where have the elements from South Asian framework lodged in modern science in the past 10 years.

Mr. Susanta gave some illustrative examples of the passage of traditional knowledge to the highest modern technical knowledge from India. Prof. Jhunjhunwala of IIT, Madras, found that his carpenter, who was educated only till the 5th grade, knew easier and quicker methods of calculation. He learnt the methods from him. He then collected similar traditional knowledge and published a book in which he has compared the traditional way with algorithms of the modern system. He found that the new combined system runs 30-40% faster! This has been published in regular computer journals.
Lots of research on translation devices is on at IIT Kanpur. Literature on Virtual reality (reality through computer metaphysics) is being published. There is resurgence in general evolutionary theory. Evolutionary theory now encompasses computer devices as systems together with cultural and social systems.

Mr. Susanta concluded his address with the optimistic note that the world has opened up and new opportunities are being offered. There is a wide variety of possibilities for cultures with a large reservoir of formal and informal knowledge like in our realm, the East Asian realm, and the Islamic realm.

In his talk on ‘IT for Augmentation of Creativity at Grassroots’, Mr. Ali Assam of Knowledge View, UK, remarked that we have to do away with the monopoly of knowledge. For that we need to develop appropriate mechanism and technology. At the same time we should not forget the social aspect of technology. Though technology like the Internet is providing opportunities for us, less than one percent of the population has ever heard of it!

He tried to probe the obstacles to grassroots innovations. He figured that the obstacles are the inability to access information, the inability to communicate with each other worldwide, governmental bureaucracy, and the lack of finance. The solution lies in autonomous production and information systems. The information system should always be linked to food production. It should use modular technical component, have advanced appropriate technology, and should be focussed on information and training.

Modular technical components will help in efficient use of resources. For example solar energy source could feed an irrigation system and at the same time could feed an information system such as a single computer in a village, a library or drive a set of cellular telephones. When we plan to build information system, we should think to build them in terms of such modules. People are working on how to bring everything under one concept. Then we can build the knowledge base of that particular local area, while emphasizing on training also. The approach should be to relate information technology to food production.
Technology has to be used by grassroots innovators. People who can create such remarkable innovations can also learn to use and maintain the software and, thereby, modify it appropriately. The technology should also allow for information exchange with other communities. For this we have to first build our own local information centre.

Although the information system is autonomous, it will be co-operative. Information would be exchanged between knowledge centres both within and outside the country. Information system should be communication focussed. Technologies like the Internet should be taken up by everyone and extended as per their own purposes and interests.

Jim Gardner of University of Manitoba, Winnipeg, Canada, addressed the integration of traditional knowledge and science in the University curriculum. The four main partners in the project are the group of First Nations chiefs, the Centre for Indigenous Resources, the University of Manitoba, and the Federal Government of Canada.

The project was initiated to train the youth in environmental resource management. It addresses the causes of environmental degradation such as power generation, deforestation due to timber harvesting, pollution by industrial waste, release of toxic wastes, and mining. The First Nations felt the need to develop expertise for environmental resource management as they were bearing the brunt of environmental degradation.

Informal knowledge has always been associated with oral traditions and taught through informal institutions. There has always been a conflict between the regular knowledge system and the informal ones. Thus arises the need to integrate the two.

With this background, the programme was set up. The University acted as a facilitator, though the First Nations controlled the programme. A steering and advisory committee of the First Nations was formed. The programme was structured to have elements of both the formal and informal education systems. Thus, it included field demonstrations and laboratory & classroom sessions.
In his keynote lecture, Anupam Mishra spoke about the unique water harvesting systems in the drought-prone regions of Rajasthan. The state boasts of any creative methods of water conservation. The water conservation structures are part of a living tradition. He remarked that a tradition that is not living is part of history. They have extraordinary institutions for the maintenance of these structures built within the traditional culture of the society. He provided examples of cities in Rajasthan that are surviving on water harvesting structures constructed about 700 years’ back.

The Chief Secretary of Gujarat, Mr. S. K. Shelat stressed upon the need to study the system of education and its relation to employment. Employment should not be solely on degrees but also on creativity, innovation, and capability. He emphasized the need for a means of communication between those with economic means and those who are not economically well-off.

He announced the setting up of a fund of rupees ten million for promotion of innovations. Ms Kuverben, a women innovator from Kutch, intervened to insist that such funds would be effective only when women are involved as equal partners in the process. Subsequent to the Conference, the Gujarat Grassroots Innovation Augmentation Network (GIAN) was set up. It is the first institution that is trying to convert innovations into products and linking excellence in formal and informal sectors.

In this context, the risk inherent in up-scaling small innovations was recognized and the non-suitability of conventional credit and venture capital institutions was also acknowledged. It was also underlined that value addition in some of the local innovations may generate opportunities at the global level. This implies that consumers of sustainable technologies and products need not be always found in local context. This would also imply need for a watch dog function to be performed by voluntary organizations and innovators networks. One would also have to avoid a familiar consequence of globalization, the non-sustainable extraction of local resources.

Talking of the need for changing the law, Mr. Shelat drew a parallel between Gujarat and Israel, with the mere difference that Israel does not have water problems. The reason cited was that they have declared water as a national resource. Talking of the Sardar Sarovar project, he remarked that allocation of resources should be done in a user-friendly manner.
He emphasized that the government should give up all those activities that can be handled by the private sector. NGOs should be involved in government programmes such as Guptban and percolation tanks. He focussed on trustees running the primary education programme of the Government. This requires the involvement of people. He announced the raise in allocation to primary education to rupees forty crores.

Dr. Cor Veer of the Regional Community Forestry Training Centre, Bangkok, dwelled upon the main constraints facing sustainable development of forest resources and their conservation & management. According to him, the government claims monopoly which is difficult to substantiate and the inadequacy of forest resource management is mainly due to policy constraints.

Prof. Sudarshan Iyengar coordinated the panel discussion among the innovative farmers.

Premjibhai drew his inspiration from Gopalbhai, a character in a novel by Manubhai Pancholi. Once he went about broadcasting seeds for 300 to 400 km using a jeep. He found the results to be haphazard. He then approached his son-in-law to provide a machine that could maintain uniformity by broadcasting seeds at a constant distance and pressure. His son-in-law made the machine that, after 10 to 15 alterations, is working as per his expectation.

Premjibhai believes that annual plantation should be carried out in places that are devoid of tree cover. For good plantations, the earth should be near canals or rivers and should be soft. In uneven areas, a pit of half-feet depth should be dug and then covered with soil. Sheep and goats are the best disseminators of seeds. They should be fed with the fruits of the tree to be planted and taken to the area to be planted. It works well for the plantations of fuelwood.

Bhanjibhai discussed the advantages of the three-wheeled tractor invented by him. The tractor is good for small farms owing to its smaller turning radius. It is fuel-efficient too, requiring half a litre of diesel compared to one and half litres required by conventional tractor. He used an oil engine, depression, and gear of a 10 HP jeep. The RTO officials refused to pass the tractor. He was fined Rs. 1,800 and had to
pay Rs. 6,000 to get it released. He was advised to lock the tractor in the shed or to dismantle it! Today, he makes use of the tractor only in the fields.

He desires government recognition for the tractor. He wishes to produce it cheaply with the help of village artisans rather than the big corporations. He feels big corporations have their own problems.

Prof. Mathur remarked that communities have built upon their experiences and have developed practices that conserve nature and sustain development. These have come about by behaviour values based on socialization. Our education is based on individual competition rather than co-operation or community behaviour. That sense of community is losing out for individual excellence and not for community excellence.

He reasoned that the government programs fail because of the uniformity of policy arising out of our mindset that regards a standard policy for the whole country despite its heterogeneity. He stressed that institutions, innovations, and creativity at local level are not just terms. They are recognition of peoples’ genius and strength. It is not the question of replication that we face. It is rather the question of dissemination. He defined dissemination as the ability of people to do things and to raise demands.

He remarked that we are redrawing the political map by not having a single intervention or policy emanating from the political system. A diverse political map is being created due to diverse strategies that are emerging. The ability to negotiate with the state has to be strengthened. The difficulty that we are facing is due to the laws and the absence of expertise at the local level. We are losing out in world trade negotiations in various types of patent laws because we are yet to develop the expertise required to unfold/ understand the complications/ implications involved, which has been done by the developed countries.

During the panel discussion on art, aesthetics, and culture, Shri Hakkubhai Shah remarked that artists have an instinctive creative behaviour, but it is not carried on in the latter life. He had worked with many villagers that gave him this insight. He recalled the tribals of Chotta Udhepur near Baroda. While in
Bombay, they erected a gate in front of the art complex, of bamboo in the form of a house. What was amazing is that they completed the gate in only four days and by using nothing but a knife!

During the panel discussion, Jorawar Singhji remarked that there is a basic instinct in human beings for drawing, colours, colour combinations, art, etc. Each one has the creative ability. Yet, the common man is not encouraged. Rather, he is denied the right to develop his talent.

Many a times, language comes as a barrier, leading to our inability to understand art. Jorawar Singhji recalled a family of labourers that used to work and sing. One of the members could draw beautiful pictures. These paintings were sold to foreigners. He emphasized on the need for conservation of folk art. There are communities that need encouragement. Otherwise, the art forms will slowly fade out and the communities will be lost. A Gujarat Folk Art has been formed, which documents these art forms and also promotes it. They have observed that the older generation has lost interest in the art forms and do not want the new generation to pursue it for livelihood.

Mr. Inderjit Khanna and Mr. S K Shelat chaired the plenary session on the 14th of January. The focus was on examining socio-cultural, educational, and administrative policy instruments to augment grassroots innovations.

In his keynote address, Mr. P. Kotaiah, Chairman, National Bank for Agriculture and Rural Development, stressed on the need to redesign the paradigm of development with emphasis on sustainability and eco-friendliness. He looked forward to international agencies and developing countries that would help in designing appropriate strategies for promoting grassroots level innovations.

He talked about the seriousness of ecological degradation and hunger that ought to be addressed by nations. The Convention on Biological Diversity, the International Convention on Desertification, and the Food Summit were all signs of this seriousness.

He stated that the economic growth of the country is largely dependent on how it sharpens its competitive edge and accesses the global market. Innovation has become a all-pervasive term
comprising technological, education, and socio-cultural institutions. Our farmers are second to none when it comes to creativity and innovations. Besides innovating agricultural implements and storage techniques, they have evolved rules and norms for the efficient management of common property resources.

He remarked that the top-down approach to planning made in the past has to some extent succeeded in achieving the objective of growth with equity, but these are often guided by short-term interests and that make it undesirable. The most important lesson that we have learnt from the past is that state intervention would not be effective unless people are empowered and their participation initiated.

In a country like ours, there cannot be a single solution or policy for addressing the problems faced by people in various regions. There is a need to evolve location-specific and problem-specific solutions. This calls for a shift from problem solving to solution augmenting approach. This entails learning from technological innovations brought about by individuals and local communities as part of traditional knowledge or contemporary solutions to problem faced.

It is equally important that efforts should be made for innovating low-cost solutions for possible scaling up. Such solutions should have applications across cultural boundaries. Such innovations are to be synthesized with scientific knowledge through participatory research and development. NABARD is conscious of its responsibility and is committed to create enabling conditions for steering agricultural development on to the path of sustainability and has designed its policies accordingly.

One of the corporate objectives of NABARD is to facilitate development. They also indulge in transfer and diffusion of technologies. Besides these, they are involved in evolving suitable promotional extension policies for enhancing technology absorption and creating flow in the various sub-sectors of agriculture and rural economy.

NABARD sanctioned a research project on documentation of decentralized industries. The project aimed at collecting success stories in agriculture, credit, marketing, village industries, etc. by appointing special correspondents in different parts of the country. Documentation of successful rural innovations is
intended to set examples for villagers as well as for production of low cost technology that would generate self-employment.

Mr. Kotaiah explained the idea of the formation of village clubs called ‘Vikas Voluntary Vahini’. These clubs formed since the inception of NABARD, provide a forum for farmers, weavers, artisans and other sections of the rural community to share their experiences and propagates the principle of development through credit.

He reiterated that peoples’ participation and community action were crucial to development. He added that distorted resource pricing could result in further degradation of natural resources and cause an irreparable loss of local knowledge and skills. Price is a double-edged sword. Too low a price may lead to wastage of scarce resources, while innovations may be out of reach of the poor farmers due to high price.

Innovation is essentially a two-sided coupling activity emerging from changing markets and changing technologies. Risks and uncertainties are integral parts of the process of innovations. Most innovations have a long history of unsuccessful trials. Such risky factors may often need friends for meeting capital costs and recurring costs. A Venture Capital Fund (VCF) is generally thought of in order to support systematically such risky ventures. The VCF known as Agricultural Rural Enterprises Integrated Fund has been established by NABARD with an initial contribution of Rs.5 crores. The objectives of the fund are to finance establishment, expansion, or diversification of innovative rural enterprises by adoption of appropriate technologies in farm and non-farm sector.

Mr. Kotaiah addressed the need to build a legal framework that would facilitate the adoption and commercialization of innovations. The education policy also needs to be oriented towards the goal of mass literacy. He also stressed on the importance of institutional innovations to support the technological innovations at the grassroots.
Dr. M. C. Bhandari, Executive Director of NABARD observed that banks may shy away from providing credit to small farmer innovations and that credit may or may not be the answer. Venture Capital Fund was therefore proposed.

Prof. V N Asopa proposed the need to understand the intricate conversion of innovations to products of quantitative significance at the global level and to evolve framework for conversion of innovations to technologies. He felt that it was important to facilitate transition lest the innovations get lost. He also highlighted that financial support and environmental & social issues were crucial to this transition.

Mr. Varshney, Managing Director of Gujarat Venture Capital Funds, characterised Venture Capital Fund in relation to innovations. He felt that risks were very high in grassroots innovations and evaluation of proposals was time consuming. He raised the issue of ensuring ensure returns and value addition, especially when no regulations were present. He tried to evolve the basis of qualifications to be supported by a Venture Capital Fund.

Mr. Inderjit Khanna dealt with the need to examine policy framework, individual to global transition, credit issues, tax regime and legal framework. He then took up the concept of Venture Capital Fund. He also proposed an action plan towards improving the quality of life.

After the tea break, the participants were divided into four groups to brainstorm on various instruments, incentives, and institutional arrangements for augmenting creativity.

The first group focussed on institutional support & market for innovations and the form of the institution. It felt a need for a panel of scientists and bureaucrats in the institution. The philosophy of Swadhyay and trusteeship needs to be imbibed. The group reasoned not only that funding was crucial, but also that village-level funds should be managed by the people themselves. They felt that interest-free loan rather than grants should be given. That women need to be given adequate space, was the final and crucial point.
The second group felt that a public policy environment using and propagating traditional knowledge was important. It emphasized the importance of an organization that would promote such a policy and also support local initiatives. It judged that not only has the attitude of public functionaries needs to be changed to support traditional knowledge, there is a imperative need to integrate traditional knowledge, local knowledge and technological knowledge in development programmes. It felt that an organization to identify, document, refine, validate, upgrade, and facilitate access to scientific knowledge for developing ideas was crucial. Funding should be a promotional grant. Venture Capital on equity basis with loss/no interest and with royalty provision is a must. This implies also that the organization should not become a captive of any sponsor. For this reason, funding has to be from many sources. Innovators should be helped in dealing with legal issues and grants should be provided to facilitate trial runs.

The third group expressed strong reservations on transfer of knowledge. It questioned if innovations need to be looked at the global level at all. It remarked that innovations are ‘static’, whereas creativity is ‘dynamic’. There is a need to provide ‘enabling environment’ for creativity. It also raised the measures for controlling resources and recognizing oddball institutions. It felt that in the Innovations-Entrepreneur-Investor triangle, the ‘Community’ was left out. We need to improve the cross linkages. If stated the need to improve ‘micro’ to influence ‘macro’, using existing financial mechanisms. It raised the issue of dichotomy between ‘global’ and ‘local’ and coming up with a cross-cultural definition of sustainable development.
Keynote speeches
Introduction

by Anil K. Gupta

It is a wonderful moment that, with all the spirits, we begin this International Conference on Creativity and Innovations at the Grassroots.

I welcome you all on behalf of the Indian Institute of Management- Ahmedabad, the Centre for Management in Agriculture, and all those people who have made this Conference possible.

This Conference brings together participants from more than forty countries. Farmers are the most distinguished participants of this Conference. They have produced new innovations, individually or collectively, at the grassroots level. There are artisans who have devised new kinds of implements for sustainable natural resource management. The purpose of this Conference is to bridge the gap between this knowledge system at the grassroots level and the policy makers- the scholars, the activists, and the voluntary sector people.

We all have been conscious of the great flaw in our accountability towards those from whom we learn. I became conscious of this more than ten years ago, when we started Honey Bee. All of us have to recognise more and more in the times to come the significance of the gaps in our accountability.

Firstly, we seldom share with the people at the grassroots level in their own language what we learn from them. So, research does not benefit those from whom data or information is collected. This is because the disposal does not take place in their native language. Not only that, these people- the contributors of knowledge, are not able to validate or question the inferences we draw from the knowledge they provide.

The second gap is that if we generate some wealth or resources out of this knowledge (by way of value addition or otherwise), nothing out of it goes back to the people.

We academicians complain that other social institutions - government, state, or market are not accountable. We ourselves have not introspected our role in dealing with the knowledge of people who have, so far, been kind to us by providing information, understanding, and insights about the change in society. This Conference is a bold attempt to correct this anomaly in the academic world.

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There are six foci of this Conference: technological innovations, institutional innovations, educational innovations, socio-cultural aspects of knowledge, rewarding creativity and innovations at the grassroots level, and how can markets (which have often been blamed for the ills in our society) be moulded in a manner that they provide space for local creativity to become the springboard of social transformation and development, so that hunger and poverty can be eliminated from society.

The idea of the Conference is that we should encourage dialogue and debate so as to generate some possibilities.

The very fact that the Conference is taking place at IIMA signifies something very important and profound. We are an institution that believes in changing the world of practice and not just theory. We are an institution that believes in change in all sectors of society. It is very important that this Conference helps us identify some initiatives and innovations at all levels of society- policy, implementation and conceptualisation, so that space for greater creativity expands in the society.

We have devised a mechanism, which, I hope, will satisfy our curiosity and our concern for the cause. In each session, we will have chairpersons, rapporteurs, and observers. The role of the observers is to help the chairperson and rapporteurs to keep things on track. My appeal to all the participants is that we have very limited time- one and half hours for 78 papers in each session. We will only have 6 to 7 minutes for every presentation. The presentation will be followed by a discussion. We must make sure that we have at least half an hour available in each session for discussing ideas and insights that we would be getting.

In your registration material you will find literature from various social movements that have taken place. I must highlight one of them- the Swadhyaya movement. This movement has done a great deal of transformation in terms of natural resource management in Saurashtra.

Similarly, you will find copies of ‘Vikalpa’ - the academic journal of the Institute, Honey Bee, and many other publications, which will draw your attention to what is going on around this place.

I am extremely happy that we have with us very distinguished people on the panel- people who have guided the destiny of the Country in different ways.

Dr. Kamla Chowdhury has been one of the founder members of the Institute and ever since has been involved in voluntary activities at the grassroots level. Formerly, she was the Chairperson of the National Wastelands Development Board (NWDB). Presently, she chairs the Society for Promotion
of Wasteland Development. Above all, she is still able to link the perspective of macro management with the micro level realities.

We have Elaben Bhatt, who is familiar to most of you. She was responsible for single-handedly changing the mindset around the world. This was, “We cannot be a civil society which claims to be cultured and responsible, if we can not provide opportunities to the poor women who often have to vend their wares on the street without any legal right to those spaces”. She, through her struggle in a true Gandhian style, created a space for these women- first at the grassroots level and then at the policy level around the world.

Self Employed Women's Association is a women’s movement that has significantly transformed the cultural, social, and spiritual life of the society. I would say that it is a source of inspiration to women’s movements throughout the world.

We have with us Dr. I. G. Patel, Chairperson of the Governing Board of IIMA. I do not think there is anybody around here who is not familiar with his distinguished contribution to the polity, the processes, and the thinking on Development Economics & Processes around the world. I would not describe to you his entire life. I can tell you only that Dr. I. G. Patel is one person who, in his own distinguished but profound manner, has influenced the polity in our society. He could foresee those changes at least 20 years in advance, which we are now coping with. If we had paid heed to the advice, we would have been much more advanced and would have been among those Asian Tigers the entire world talks about.

Dr. Patel was the Governor of the Reserve Bank of India. He was also the Director of our Institute. We are privileged that he would be getting his guidance and advice as to how this conference can take the recommendations into the realm of practice. He has combined in his personality concern for the macro level development with grassroots realities and is currently involved with several voluntary organisations.

We have with us Prof. P. M. Shingi, Director of our Institute. I am very proud to say that not only has he taught us a great deal, he has a personality that you will experience and realise as the Conference proceeds. He brings home certain subtle truths in a simple but significant manner. Prof. Shingi has done a great deal of research on peoples’ participation in natural resource management, whether through co-operatives, corporations, or institutions.

We have Prof. Gurdev Singh, Chairperson of Centre for Management in Agriculture (CMA). This Conference would not have been possible without the close involvement of the CMA faculty and
Chairperson. Prof. Gurdev Singh also brings with him rich experience of research in various fields of knowledge.

I would like to share with you the fact that this Conference is making a departure in our thinking from problem-solving mode (which is required and important) to solution-augmentation approach. I am not saying it is either-or. We need both the approaches. We have emphasised more on problem solving and far too little on solution-augmentation. We need to combine both of them into our polity.

I welcome you once again to this Conference. I request Prof. Shingi to formally welcome you and talk about the Institute.
Welcome

P.M. Shingi

It is a matter of great pleasure for us here at IIMA to welcome our distinguished guests from different parts of the globe. I am also delighted to welcome an equally distinguished group of academicians and prominent innovators from our own country.

This is the first ever-international conference that we have organised on such a scale and it is a matter of great pride for us. The prayer as conceived by Prof. Ravi J. Mathai- our first full time director way back in 1966, had use of knowledge as the centre of that wheel. This central focus influenced the institute’s activity mix in three significant ways.

Using knowledge to disseminate knowledge, internally as well as externally, led to a strong two-year post-graduate program, doctoral program, management development program, and faculty development program on the campus. Using knowledge to develop new knowledge strengthened our research program. Finally, using knowledge to assist others to use knowledge supported our consultancy and institution-building activities.

It is a matter of pride for us that we are able to mount and sustain a high quality of MBA level programme which has served as a model for later MBA programmes in other Third World countries; that we are able to train more than 20,000 managers from the public and private sectors; that we are able to generate more than 600 books and monographs, and close to 2000 research papers and articles; that we are able to undertake almost 60 new consultancy projects every year.

What gives us greater pleasure is that we are able to contribute meaningfully to professionalization of vital sectors like management of agriculture, management of forestry, management of health

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services, education sector, transportation, population control, energy, public administration, irrigation, fisheries, and rural banking.

Right from the beginning we have kept reminding ourselves that we are not a business school but a school of management. Therefore, we recognise that the development sector is an important sector for management education, research, consultancy, and institution building. In this process, we also recognised that management was not confined to profit-making enterprises but it pervaded through all types of organisation with different goals to pursue.

Given this background, the theme of the International Conference on Creativity and Innovations at Grassroots is of immense value to us. So is the case with most of us who have gathered here and who have been dealing with these concerns and issues more intimately.

The visiting guests must have realised that India is a multi-dimensional society. The heterogeneous character of the nation has many implications, both for development priorities and participative concern. This heterogeneous character is influenced not only historically, ideologically, and technologically, but also, ecologically. We have people living in the coastal regions, hilly regions, plains, deserts, in flood-prone areas, cyclone-affected areas, drought-affected areas, marshy lands, rainfed areas, and, also, in highly assured irrigated areas.

One can only imagine the scope that exists for creativity and innovations at grassroots, as problems of development are likely to be so different at different places. Besides, in a multi-dimensional society like India, one easily finds strong traces of pre-Industrial forms of society like gathering- and extraction-based tribal economy. One also finds strong traces of Industrial forms of society- making use of science and machine technology. Finally, one also finds traces of post-Industrial forms of society- harnessing of information technology. We have all of these residing side by side.

This nature and character of multi-dimensional society in India generates a multi-sided value system, expectations, priorities, and associated contradictions. On the other hand, it generates its own forms of creativity and innovations. Those realities of today are likely to be there in the foreseeable future.
The biggest challenge for us is how do we prepare ourselves to manage and build on this creativity and innovations at grassroots.

Like all of us who have gathered here, we at IIMA are also hopeful that the deliberations of this conference would be fruitful and their consequences real, timely, and of highly instrumental nature for us.

On behalf of the Institute, I once again extend a hearty welcome to all of you. We are indeed very happy by your presence in this campus. You will also be happy to know that with this Conference we are also inaugurating this auditorium and the centre. It is my privilege to invite Dr. I. G. Patel, Mrs. Elaben, Kamla Chowdhury, and Amrutbhai to kindly inaugurate the auditorium by lighting the lamp.

Thank you.
Amrutbhai Agrawat

Respected Union Minister of State, Dr. Alaghji, ladies and gentlemen from India and abroad.

Your presence and the glow on your faces are living proof of the monumental task that we all have undertaken to fulfill. I am a rural agriculture artisan from a remote village called Pikhar in Malia taluka of Junagadh district. This is a meeting of intellectuals, scientists, journalists, and researchers who have made remarkable contributions in their fields. It is beyond my capacity to carry on theoretical exercises and talks. I will present my ideas in the form of symbolic stories to tell you how agriculture and sage traditions are interwoven in our Indian culture.

The tale I am going to narrate is taken from the Shrimad Bhagwat Gita.

Once upon a time there ruled a king called Ven. He was very wicked and harassed his subjects. At last when people could no longer bear his oppression, they turned to the sages for help. The sages came to their rescue. They killed the king.

Sunitha, the mother of King Ven was bereaved by her son’s death. She preserved his dead body with the help of yog vidya (spiritual knowledge). On her behest, the sages created a boy from the dead body. He was named Pruthu.

The boy grew up and succeeded to his father’s throne. Pruthu was just opposite to his father in nature. As soon as he became the king he devoted himself to the welfare of his people. Due to the ill treatment of the previous king, the kingdom faced shortage of food. Knowing that the new king was kind hearted and generous, the subjects went to him begging for help. On hearing his subjects’ tales of woe, King Pruthu was overwhelmed with sympathy. He pondered over the reason responsible for their pathetic situation and found that the earth had swallowed all the seeds. He felt that Prithvi (the goddess of Earth) was the real cause of famine. He was angry and fixed an arrow in his bow to fight with her.

Assuming a human form, Mother Earth appeared before the King. She said, “O kind hearted and people-loving king, what is my fault?” Pruthu replied,”You take prasad (offerings) from us in form of yagna (sacred fire ritual) but do not give food grains in return. You get nutrition like a cow gets grass but you do not give anything in return to us. Lord Brahma has given you seeds of food grains for the nourishment of people on the Earth but you are hiding them away with you. There is nothing wrong if I killed you”.
Mother Earth replied, “O King, Lord Brahma created me to nurture and care of the *Srishti* (the Universe). The sages worked hard and thought out ways to get various things like food grains, fruits, flowers and medicines from me. But wicked and greedy people including the king went on exploiting me thoughtlessly. I understood that if this indiscriminate exploitation continued much longer, everything would be destroyed. So to save it all I swallowed everything. I have it all within me but if you wish to get those treasures back, get one calf and prepare a vessel to milk her. After that I will give you grains, medicines etc., which will give strength to humans and animals. Plough me and make my surface even so that the rainwater gets collected on me. If you care for me, your people also will be benefited”.

On hearing this, king Pruthu made the earth even with the help of the sharp point of his arrow and asked his people to plough the earth. The earth once again became rich in its natural wealth and made people happy, prosperous and fearless.

This small story carries many messages for us to understand. The earth demanded a calf, which symbolizes bullocks used for agriculture, the person to milk is the farmer and the vessel for milking is the king who is the caretaker of his people.

All the three points are presented as symbols. In those days there was knowledge like ‘*Yogvidya*’. The story also describes the qualities of a good king and his ways of ruling. His job is to milk, but how and for whom that also is described here. The last and most important of all is the thoughtless over-exploitation of nature’s resources and the consequences of it. This holds true in our times too.

I often wonder if we are going back to the distressed and troubled times of king Ven! But at the same time in this darkness of distress I can see many ‘Pruthus’, who are like silver lining around the dark clouds. Who are they? These ‘Pruthus’ are working in all the corners of world. They are ceaselessly working towards the solutions of these problems. They work on their own with the help of their intuition and their creativity. They work with the help of their experimentation towards the solutions of problems that can slowly but definitely take the world towards self-destruction. These innovative and creative ‘Pruthus’ give back to the earth more than they take. They are alone but they are adventurous who are going to triumph some day. They follow the call of the poet ‘proceed on your path all alone’. They are alone, so what? Only one seed is needed to produce thousands of other grains. Only one medicine can treat incurable diseases. Our Gandhivapu, who brought us the gift of independence walking on the path of truth, was also alone.

I too have gone through these disturbing feelings of loneliness and confusion. I am a ‘*pujari*’ by profession. But I like to work in fields. I used to work as an agriculture laborer right from my
childhood. I was also inspired to make agriculture tools. Till date, I have developed six new agricultural tools. *Aruni*, the bullock cart that I developed in 1995, is the latest among my inventions. My other five inventions are the *Bumpler*, *Janak Santi*, *Mini Kaliu*, *Ramp*, and *Patli* for sowing wheat.

I have always thought how farming with bullocks can be made easier for the farmers as well as their animals. I have gone through lots of trouble while doing this work, but I did not lose courage. I always went ahead with the trials. Inventing a new tool is not a simple job. One has to spend time and money. There are always the chances of failure.

I thought of making a new type of bullock cart that would spread manure and soil directly to the furrows. This would also reduce the weight on the bullock’s neck. Moreover, the size of this four-wheeled cart should be just enough to pass on the narrow walkways made for going in the field. To materialize my dream I needed large sum of money, which I did not have.

It was around that time that I had to go to Delhi to attend a advisory committee meeting of SRISTI. Feeling that some solution may be found, I expressed my idea of making a ‘hydraulic cart’. All welcomed my idea and SRISTI promised to provide me their cooperation and support. It was then that I started working on my project. I decided to set a hydraulic jack in the chassis of a four-wheeled cart. My sons, Ashwin and Bharat, and I brought a jack from Rajkot. We started putting pressure on the hydraulic pump. There was some obstruction in the passage of oil in the tank and the pressure of the pump increased. This resulted in the explosion of the tank. Luckily, no one was hurt. I thought that farmers in village might not be able to take care of such a risky and sensitive instrument. Disappointed, I returned the jack. The shopkeeper was kind enough to return my money, though I still incurred a loss of Rs 1,600.

It took me some time to get over this disappointment. But I had trust in God. We used to work at nights so that our work did not disturb people around. We bought horizontal gears to raise the cart but getting it back to its position was problematic. This time too we incurred a loss of Rs.2,000, but the spirit of invention possessed me. It did not allow me to rest. Again we brought vertical gears and tried. We were a little successful. Slowly we set 4, 6, and 8 gears and at last *Aruni* was born on the New Year’s Day in 1995 (Vikram Samvat 2052).

There are four wheels in the cart. As a result the weight on the bullocks’ neck is reduced. Manure can be directly put in the furrow. The frame with two wheels can be separated which may be used to carry fodder. There is also a brake in the cart so that going down the slope is easier. This cart gives double the amount of work than an ordinary bullock cart.
Now let us go back to the point where we started. There are many small inventors like me who have to face similar troubles. Their intellectual property, experimental attitude, self-reliance, spirit and ideology are a great capital. These are the modern ‘Pruthus’ to whom we have to reach. The most important question is, “Why the government or other systems have not reached them yet”? To give my own example, till now I have not received any kind of assistance from the government in this regard. I have never expected any such assistance. Such crazy people are found in every society, in every nook and corner all over the world. They can give a lot, but it is necessary that they be brought to light. They should be accepted by the society as important people. They can provide opinion and act as decision-makers. The first and foremost challenge before us is to find out such people and strengthen the development process.

I wish to say to all the administrators, scientists, intellectuals, sociologist and experts in various fields present in this meeting that I was lucky to get support and assistance from SRISTI, but there are many more like me who need a helping hand. If something concrete comes up at the end of this convention, I feel we would be marching towards the right direction. If you all contribute something to the society by exchange of ideas during these five days or if you can change the present condition of the society through your attempt, I feel that a new landmark in the success of this conference will be reached.

Before I conclude my speech, I would like to tell you a story, which is quite familiar to all of us.

Once there was an old man, he had three sons. The sons were lazy and always looked for chances to make a quick buck. The old man was on his deathbed. The sons asked if their father had to say anything. The old man uttered ‘money... in the field’ and died. After hearing this, the boys began to look for the treasure in the field but did not find anything.

They were quite disappointed and cursed their dead father. Then came the monsoons. As all people were sowing in the field, they too did the same. After a few days the field was radiant with new crops. Now the boys understood the meaning of their father’s words ‘money... in the field’.

Our elders have the knowledge of experimentation lying within them. If used in time, with proper respect, it can be a boon to the coming generations.

In the end I pray to God that may our desire and action for experimentation last forever. May he give us the strength and patience to go on trying. Once again I appeal to you all to take up the three
challenges, which I have mentioned earlier. I hope that this workshop succeed in getting gems of concrete results in one form or another.

Thank you.
Sacred Truths

by Kamla Chowdhury

This Conference on Creativity and Innovation at Grassroots is an important milestone, for it signals a turning point in looking at knowledge systems which have different roots, different language, and different concepts from the prevailing dominant model of scientific knowledge. This Conference also focuses on the rural poor and learning from their reality and their experience as to what development means to them. This is not development as conceived by the government in Delhi, or the World Bank, or other bilateral and multilateral agencies, but development as emerging from the needs of the rural poor and their reality. Through this Conference, we may understand what sustainable development means, not only ecologically but also socially and spiritually.

What are the sacred truths on which we have lived for the last 200-300 years of science and technology?

Sacred Truths: Science and Technology

The ‘believers’ and ‘practitioners’ of science and technology have believed that science and technology will solve all our problems endlessly, and that man must dominate nature to his advantage. However, as we approach the 21st century, we are becoming acutely aware of the global environmental crisis; the crisis of hunger and poverty in many developing countries; the problem of ecological refugees and increasing violence; and the inadequacies of the Bretton Wood institutions to deal with them. Although the Industrial Revolution based on the achievements of science and technology has resulted in enormous economic growth, the enormous cost of this affluence is being realized only now.

Western societies underwent a major transformation towards the end of the 19th century. Darwin’s concept of the ‘struggle for existence’ conveyed to the educated westerner that the origins of human beings were steeped in violence and conflict. Progress came to mean the conquest of the natural world by science and technology. The embrace of Darwinism and the transformation of science went hand in hand with rapid industrialization, rise of free market capitalism, and expansion of colonialism. As pointed out by Aaron Sachs “Darwin chose to focus on the violence competitive aspects of his theory”. He explicitly lent his support to the colonialist ethic when he asserted that an endless number of lower races had to be beaten and supplanted by the higher civilized races as part

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3 Chair, Society for Promotion of Wastelands Development (SPWD), Shriram Bhartiya Kala Kendra Building, 1 Copernicus Marg, New Delhi- 110 001, India
of the evolutionary doctrine. “The leaders of this emerging civilization and science were calmly calling for the massacre and repression of several indigenous nations in the Americas and Australia. Darwinism in effect captured the conscience of the modernizing, colonizing Western world.”

Another aspect of Darwinian thinking which had a major influence on the development of science and other branches of knowledge was the emphasis on specialization for survival - successful species were those that had bodies perfectly designed to perform a particular function or adapt to a particular environment. The emphasis on specialization began to influence almost every branch of science and technology, and other professional fields were offering highly specialized training in narrower and narrower areas. In industry, operations were divided into their smallest possible components with the aim of improving efficiency. Charlie Chaplin’s film ‘Modern Times’ captured the essence of the modern industrial world, namely, the enslavement and the dehumanizing of the worker in highly specialized operations.

Another important influence on the 19th century western ideology of the relationship between man and nature was that of Francis Bacon, acknowledged as the father of modern science. Carolyn Merchant, a science historian, quotes Bacon, “Nature has to be ‘hounding’ in her wanderings, ‘bound into service’ and made a ‘slave’ ... put in ‘constraint’ and moulded by the mechanical arts. The aim of the scientist is to ‘torture nature’s secrets from her’.” Bacon seems to have fashioned a new ethic sanctioning the exploitation of nature in any form of human benefit. Female imagery became a tool in adapting scientific knowledge to a new use of human power and control over nature. It does not require any psychoanalysis to see the ‘violence’ with which nature was regarded, and the way it was to be utilized and dealt with.” Merchant points out, “Ever since Bacon, the goal of science has been knowledge that can be used to dominate and control nature, and today both science and technology is used predominantly for purposes that are dangerous, harmful, and profoundly anti-ecological.”

The scientific methodology, that has dominated our knowledge base these last two hundred years or so, has been mechanistic and reductionist in its approach.

After more than a century of modern science and technology that was accompanied by values of domination and control, of subjugation and power, and images of superior and inferior races, a new world image is slowly emerging. Though it is essentially an ecological and a holistic view, it is also an ethical, spiritual view, and a pro-female view.

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Sacred Truths: Economics and Development

The sacred truths that the economists believe in are that economic growth is development, that development is progress, that capitalism, competition and free markets are essential for economic growth, and that unlimited economic growth is possible, feasible, and desirable.

Economic growth as it has taken place in the developed countries (and is taking place in the developing countries) has been largely at the expense of the environment. Forests, land, soil, water; underground minerals have all become casualties of economic growth. Pollution and toxic waste are other concomitants of industrialization and economic growth.

In cities around the world, with every breath we take we are paying a price for the belief that unlimited economic development is progress. Acid rain is not an act of nature. It is the byproduct of industry, a gift of death from Canada to USA, or the other way around, from Great Britain to Norway, from Germany’s industrial heartland to its neighbouring countries. Everywhere it falls, it destroys forests, lakes, and agriculture lands. Acid rain has no boundaries. It is estimated that eight million hectares (20 million acres) of forests throughout Europe are suffering from acid rain pollution.

India like many other countries is exhausting its underground water stocks. In the past decade water tables have fallen 25 to 30 meters (82 to 98 ft.). Thousands of villages and major cities are now facing serious water shortages.

There is violence in such economic growth and development leading to other acts of violence in other spheres as well.

E.F. Schumacher was one of the first economists who raised his voice against this kind of economic growth. He lobbied for a new way of thinking in economics, for a more holisitic and people-centred view, rather than just a narrow economic view. In the process of becoming scientific and quantitative economists ignored the influence of culture and the spirituality of man. As Schumacher said “surely there should be a difference between ‘science’ and ‘economics’ as there is between mindless atoms and men made in the image of God”. Schumacher, like Gandhiji, pointed out the violence inherent in the logic of large-scale production and, consequently, emphasized on ‘small is beautiful’.

At the heart of the matter is the need to make moral choices, to move towards a technology with a human face and a non-violent economics that would cooperate with nature rather than exploit it.
mindlessly. A technology with a human face and a non-violent economics can only be pursued on a non-violent way of life. We turn to Gandhiji, the messiah of non-violence for his sacred truths.

Sacred Truths: Gandhi

Gandhiji was a man far ahead of his times. Voices all over the world are now echoing what Gandhiji said about development, poverty and hunger, empowerment of the poor, mainstreaming women, importance of strengthening civil society, and need for a holistic approach including the spiritual dimension, for moving towards a sustainable society and reconciliation of man with nature.

Gandhiji was not swayed by technological achievements of the West. He wanted India to follow its own path of economic development taking into account its realities, its social institutions and its deep spiritual aspects.

The planners and economists in India have always been concerned about poverty. Removal of poverty has been the central theme of Indian political and economic thinking for the last 50 years. The results of the various Five-Year Plans have generally been disappointing. Poverty persists in large numbers. More than one-third of the world’s poor live in India.

Gandhiji asked, “Why must India become industrial in the western sense. The western civilization is largely urban. Small countries like England and Italy may afford to urbanize their systems. A big country like India with a teeming population, with an ancient rural tradition which has hitherto answered its purpose, must not copy the western model. What is good for one nation situated in one condition is not necessarily good for another differently situated. One man’s food is another man’s poison.”

Gandhiji was deeply concerned about the poor. His priorities were village industries and village development. Mechanization, he said “is good when hands are too few for the work intended to be accomplished. It is evil when there are more hands than required for the work is the case in India.”

Gandhiji believed that the purpose of society is to satisfy basic human needs. He suggested there are more important goals in life than the limitless accumulation of capital and money.

To Gandhiji, development and progress meant not the multiplication of wants, but deliberate and voluntary reduction of selfish wants. Voluntary simplicity in many parts of the world is gaining ground. Andre Gorz claims, “A richer life is not only more comfortable with the production of fewer goods, it demands it.” Thoreau too had said, “I chose to be rich by making my demands few.” There
are movements of young people emerging all over the world for simple living and reducing consumption.

Even in the World Bank there are echoes of Gandhiji’s voice. James Wolfensohn, the President of the World Bank, said recently after visiting several developing countries, ".... the World Bank’s central mission is to weld economic assistance with spiritual, ethical and moral development. It is in this context that we need to measure our progress and relate to the groups with whom we are dealing. At the Bank, we are trying to measure ourselves not by dollar value but by the impact and effectiveness of our programmes in terms that relate to the development of a society.” Echoes of Gandhiji’s voice emerging from the World Bank.

Issues of poverty and economic growth, of sustainable development, of equity between nations, within nations and between sexes can only be solved by employing ethical and moral means. Gandhiji always said look after the means, and the end will look after itself.

Gandhiji’s approach was holistic. His paradigm of development was based on basic needs and not on unending consumption. Catching up with the West was not his goal. The paradigm of development he proposed was based on a moderate demand on the earth’s resources. The pursuit of equity, of non-violence, of truth that he advocated are difficult with the kind of consumerism and life styles we have, based as they are on concepts of unending economic growth and development.

Gandhiji was not afraid to question the westernized paradigm of development based on science and technology, on a value system of a materialistic worldview. He rejected ideologies of domination whether it was colonialism, imperialism, racism, casteism, patriarchy, industrialization, etc., as exploitative, and violent in its intent and results.

It is difficult to follow and practice Gandhiji’s ‘sacred truths’, and yet millions followed him in India as also in other parts of the world. Gandhiji’s prophetic warning that the earth has enough for every one’s needs but not for everyone’s greed is being echoed by environmentalists all over the world.

This Conference on Creativity and Innovation at Grassroots is in the Gandhian tradition. It focuses on local people, on local conditions, and on local sacred truths. It takes the religious, spiritual and sacred into account in solving problems. This is the direction in which we must move - the sangam of traditional and scientific knowledge.
I. G. Patel

As the Chairman of the Board of Governors of the Indian Institute of Management-Ahmedabad, I welcome you all. It is a tribute to what IIMA has always stood for that you should all agree to assemble here for this very important conference. If there are deficiencies in the way in which we extend our hospitality during the coming days, please excuse us. We’ve been running a three-ring circus for the last two months and trying to get this facility ready. We have been trying to prepare ourselves and make you comfortable. We also have nine hundred students currently on the campus, meeting for the same number of days for this activity. We are feeding something like 1500 people on the campus. If there is anything lacking, please forgive us.

Please allow me one moment to thank my own people. It is my duty to thank all the people at IIMA-Prof. Shingi, Prof. Gupta, the Administrative Officer, and all other staff-the carpenters, the electricians, the security. The academic community has worked extremely hard. It is my duty, on your behalf and mine; to thank them for all that they have done in the last two months. Their work is not yet over! They have to keep at it, at least, for the next several days.

As I was listening to all the previous speakers, two thoughts crossed my mind. One was- why are we all here? What is it that brings so many of us from many walks of life, from all over India and from 40 different countries together? I think there is only one reason why all of us are here together. That is because we do believe (we have come to believe, if you like) in Gandhiji’s dictum that at the end of the day, the only thing that matters is that last man-the most underprivileged, deprived, and poorest human being on the surface of the Earth. It is that belief in the fact that what matters today more than anything else is the elimination of basic inhuman poverty from the world. There is a lot of it in this part of the world. There is a lot of it in Asia. And that has to be our first priority.

If this is our first priority, then what is the first priority in terms of what we can do about it? I think the first priority has to be the recognition that it is the very same poor people (helpless, as they say) that can be the basis of their own uplift, for their own well being, for their own welfare. Nothing else

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6 Chairperson, Board of Governors, Indian Institute of Management, Vastrapur, Ahmedabad 380 105
can. They have to be and they can. But if that is the case, then the first thing that all of us have to recognise is that it is only with their self-respect and sense of dignity that they can uplift themselves by their own bootstraps.

At the end of the day, nothing matters to an individual more than his or her self-respect and sense of dignity. The first step that we have to accept is that the reason why they have to be treated with self respect and dignity is not because they are poor or helpless, because they are not all that poor or helpless. Poor, helpless and deprived of resources, they may be but they have tremendous resources of wealth, creativity, innovativeness wisdom and knowledge that often surpass what we, the more privileged people, think we have.

We all talk of genes. Do you think that the poorest peoples’ gene pool is poorer than any of ours? That is as rich as anybody else’s. If those genes do not manifest themselves in as much success as in some of us, it is because of other factors and not because they lack the basic creativity or innovativeness.

I submit that we cannot rest merely by singing songs of creativity, innovativeness and the knowledge and wisdom of the traditional society. That is important, but that gives us an excuse for saying, “While there is so much knowledge, so much wisdom, so much of everything, they can look after themselves and we have nothing to do with it”. It can convey the so-called philosophy of liberalism. It would amount to saying that they matter and they will lift themselves up by their own bootstraps; nothing needs to be done by the rest of the society. I hope this conference will not fulfil this purpose.

The rest of us, who are not as unfortunate as some of our brothers and sisters are, have to focus on what should be done in order to add to that pool of knowledge, to increase their innovativeness, to enhance their creativity, and to boost their self-respect and sense of dignity. What is the responsibility that all of us have? I think all of us have a responsibility.
If we are an academic institution like IIMA, we have a responsibility. I hope we discharge it. We should not talk of just academic excellence, but talk of its relevance to the people. What we do in our teaching, research, and other activities should be relevant to them.

If we are scientists, we have to heed Dr. Kamla Chowdhury’s advice. We should choose that subject of scientific research that can result in maximum benefit to the poor strata of the society, without any detriment to the environment and without sacrificing the future. Science is only an instrument. The objective for which we employ can be many. They do not have to be power-driven or money-driven. They do not have to be driven by the Noble-prize, aspiration, or anything of that sort. They can rather be driven by moral values.

Similarly, even at the individual level, we have to believe what Dr. Kamla Chowdhury said, “No matter how necessary economic well-being may be, there has to be some limit to greed and consumerism. If we cannot preach it to the rest of the society, certainly we cannot preach it to the poorest man because we have no right to preach it to them. But, we have an obligation to fulfil. We have to exercise some austerity, restrain, and ceiling on our own sense of consumerism”.

If we are voluntary agency workers like Elaben, we have an obligation to say what do we do to link up these people to the rest of the society- the community of scientists, academicians, and the government, to see to that the channels are provided. This would not only bring to the attention of the world, creativity, knowledge, and innovativeness of the least advantaged people, but would see how their dignity, self-respect, and their ability to help themselves can be increased, with all of us doing a little bit of duty.

I hope this conference, apart from adding to your knowledge of problems, will also result in some recommendations and conclusions, which may be of use to some of us in the society to see what can be done better than what we are doing today to fulfil better the purpose- the only purpose, that bring us all together. I wish you luck.
Art, design, creativity, modernism, innovation, and technology—the popular perception is that only the rich and educated can afford them. How do we relate them to the common people? The key question is, "How do we relate them to the majority of the population?"

I am a housewife. I have a house of two rooms. How can I make it more livable and comfortable? Sixty percent of housewives live in houses with two or less than two rooms. Is design the prerogative of the rich?

I am an Indian woman of average height. My hands cannot reach beyond the second shelf of any cupboard that I buy from the market.

I am an Indian typist. My chair is not comfortable for working for long hours. My feet get swollen and they hurt.

I am a speaker. The podium is not to my size. I have to stand on my toes to address the audience. Do I have to fit into the man’s size?

I am a truck driver. I cannot rest my back on the seat. The seat adjustment is suitable for my counterpart in the West. Do I have to adjust myself to the body measurement of the Western people?

I am a traditional artisan. The training institute helps me to create new designs with new technology. Consequently, I produce a product of exquisite taste that only the King of Arabia can buy. I have no contact with him. Moreover, I have lost contact with my old market owing to the intervention of new technology and new designs. I have to touch the feet of the middlemen to sell my new products. I remain nowhere.

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7 Founder General Secretary, Self Employed Women's Association (SEWA), Sewa Reception Centre, Opposite Victoria Gardens, Bhadra, Ahmedabad- 380 001
What we artisans need is an expanded market within our reach. We need support to increase our durability, marketability, and productivity of our business. Help us to improve our baskets, brooms, and pushcarts. Help us create better tools for faster production. Even today, we have to hit fifteen times to make a hole in the tin sheet. The nation earns foreign exchange from export of groundnuts. We unshell groundnuts with our teeth. Our mouth gets so sore that we cannot drink a cup of tea during the season. When we unshell cotton pods, our fingers bleed. Our menstrual cycle irregularly breaks. We pull carts with two thousand kilograms, and lose our unborn babies. We boast of doctors who transplant hearts and kidneys, but we have not yet been able to place a proper brush in the hands of our housemaids who scrub our pots and pans daily.

India exports engineers when the majority of the working population is looking for a proper mask, a pair of gloves, or a hammer. We are trying to change the situation by creating alternatives. We organize and manage dairy co-operatives, saving groups, *pani panchayat*. Who will help establish our Management Information System? Where are the management schools for us?

Our world is still small because we are small. We may remain small but we are to be ready and prepared to combat larger forces. We are building our capacities to access and stand firmly in the competitive market. However, there are many constraints such as our illiteracy and lack of formal education. Our ignorance of the written word, of written laws and procedures, rules and regulations have become a major hindrance for us. We find it difficult to get things done in the written world in a way that is new and unfamiliar to us. Therefore, we need a middleman and broker. We end up exploited, helpless, powerless, inadequate, diffident, and dependent. We resort to corruption and bribes.

Our policy makers have made the written word the only valid word. We can become legitimate only if we can become part of the written world. How will the nation tackle exploitation and inequality if it fails to recognize the vast world of informal, self-engaged, verbal culture of the people? We have to develop forums for the meeting of both worlds. I believe this is the reason behind this conference.
The poor population is seen as users of services, but not as makers of national wealth. They are not only consumers of revenue but also contributors to the economy. The productive and city-making role of the poor (and the women among them) is more evident in our cities. Invest in the people because they are the nation. Wherever given support, peoples’ initiative has shown the way to change. They have protected forests and helped in eco regeneration. They have created viable health system and banking organization for the illiterate poor. They have stopped forced migration from desert regions by creating water harvesting and local employment programs. Today, they have created their own management tools.

Art, knowledge, creativity, innovation, and progress are not the prerogative of a few, but of all. Creativity and innovations are not elsewhere. They are here around us and within us.

Thank you
Vote of Thanks

by Gurdev Singh

From the beginning, we have the inclination that we would like to apply management science not only to business, but also to all other sectors of the economy. Agriculture was the first sector we chose. Way back in 1964 we had set up a small group - Agriculture & Cooperative group, with a faculty strength of four to work on the agriculture sector and applying management science to agriculture and allied activities. Over time the group grew in size and activity. It was renamed, as the Centre for Management in Agriculture (CMA) in 1971. The mission of the Centre is to apply management science to the agricultural sector and to rural development. To achieve this mission, the Centre takes up various activities, which include teaching (in educational programmes and Management Development Programmes), research (project and case research), institution building (helping other institutions to develop capabilities) in agricultural management, and consulting.

We have two educational programmes where CMA faculty teaches. One is a two-year programme with specialization package in agriculture where we take up to 30 students every year with background in agriculture or experience in rural areas. First year they go through the common training. They take up specialization course in agriculture in the second year. CMA offers 20 courses to this group. The second educational programme is the Fellow Programme in Management (FPM) in agriculture where the students take some special package of courses in agriculture and related subject.

The other programmes where CMA faculty participates are the Faculty Development Programme (FDP) and Management Development Programme (MDP). In addition, CMA also conducts workshops and seminars on themes of current significance. This conference is one such activity.

CMA also carries out project research. So far we have carried out about 200 research projects. Each year, CMA provides five research projects to the Ministry of Agriculture. All CMA research is published in monographs. So far it has published 180 titles.

Faculty, Centre for Management in Agriculture, Indian Institute of Management, Vastrapur, Ahmedabad- 380 015
Other type of research is case research - input which goes into teaching. CMA has produced nearly 800 teaching material - cases and notes. CMA uses this input in educational programmes as well as in MDPs.

In the area of institution building, CMA is providing help to other institutions in their set-up as well as development. First such effort was the Indian Institute of Forest Management, Bhopal for which the blueprint was prepared at CMA. CMA also prepared a 10-year perspective for the Centre for Agriculture Marketing at Jaipur. Similarly, CMA prepared a perspective plan for Institute of Primary Cooperatives Management for Gujarat.

CMA takes up special problems of the organizations and provides solutions. CMA has undertaken 150 consultancies in CMA so far. CMA is planning to expand into new areas related to environmental and global issues.

**Vote of Thanks**

It is my privilege to propose a vote of thanks to all those who have made this conference possible. First of all, I should thank all the delegates, farmers, artisans, students, scholars, scientists, policy makers who have come from different parts of the country and world. When participants from forty countries meet, there is bound to be a cultural exchange and mutual learning. I must thank the Chairperson of SEWA, Smt. Elaben Bhatt, and Dr. I.G. Patel who have agreed to conduct the proceedings today and set the ball rolling. Elaben is a source of inspiration to us all for the global impact she has made by organizing and mobilizing poor women into viable and sustainable economic and social force. Dr. I.G. Patel has guided the policymaking at macro level not only in India but also abroad and has strong interest in voluntary activities.

Amrutbhai Agrawat, an innovative artisan who has inaugurated this conference is no ordinary artisan. You will see his innovative bullock cart in the exhibition where he has brought many other new implements.
I am grateful to Dr. Y.K. Alagh, Union Minister of State for Science and Technology for a very encouraging address and thoughtful suggestions. I have no doubt that Dr. Alagh’s deep understanding of grassroots realities will help forge bridges between formal and informal science and innovations. Dr. Alagh has been a member of CMA’s Advisory Committee in past and we in CMA look forward to his continued support and guidance.

Dr. Kamla Chowdury, one of the first faculty members at IIMA has been a very long-standing student of social change through voluntary activities at grassroots level. As Chairperson of National Wasteland Development Board, she had introduced several new schemes for people’s involvement. We are very happy that she has benefited us with her advice and will continue to be with us in the conference and subsequent follow up activities.

The National Organizing Committee, International Advisory Committee and Steering Committee members deserve thanks for an excellent organization of the conference. I have to specially thank all the administrative staff led by Chief Administrative Officer, Shri Anil Dua who worked day and night to make this conference possible. I want to thank each one of them who you will not often see but who are trying their best to make your stay here comfortable and joyful.

Prof. P.M. Shingi, officiating Director and Prof. Khandwalla, previous Director provided all the help that was needed from time to time during last two years that the conference was in preparation.

Last but not the least, I thank all the co-sponsors of the conference but I must single out NABARD and Forest Tree and People Programme (FTPP) of FAO, without whose support, this conference would not have been possible.

Please make your stay as productive as possible so that we can all contribute towards increasing the policy and action space for grassroots innovators who contribute to sustainable natural resource management, unnoticed and unsung.
CMA is very pleased to thank you all for coming and making this conference such an outstanding gathering of minds.
Policy Alternatives for Augmenting Innovations at Grassroots
by P. Kotaiah

I am happy that this International Conference is organized at such a crucial juncture when the winds of change are sweeping across the globe and there is a growing awareness about the need to redesign the paradigm of development, with emphasis on sustainability and eco-friendliness. I also look forward to sharing of experiences of delegates from abroad, representing International Development Agencies and Developing Countries, which will help in designing an appropriate strategy for promoting grassroots, level innovations. The Convention of Biodiversity, the International Convention on Combating Desertification, and the recently concluded Food Summit in Rome are all signs of the seriousness with which the problems of ecological degradation and hunger are sought to be addressed by nations. India too has shown its commitment to the principles of sustainability in its development programmes. With the establishment of the World Trade Organization and the provisions like Market Access, TRIPs, Trade-Related Investment Measures (TRIMs), etc., under the GATT, the economic growth of a country would largely be dependent on how well it can sharpen its competitive edge and access the global market.

Today, ‘innovation’ has become an all-pervading term encompassing technology, institutions, management, education and even socio-cultural aspects. Our farmers are second to none when it comes to creativity and ingenuity. They have, without any formal scientific training, successfully experimented and innovated appropriate technologies using locally available resources, for plant protection and for soil and water conservation. They have designed and effected improvements in the design of agricultural implements, devised methods of seed and food storage, evolved optimum spacing norms in certain plantation and horticultural crops as well as for some species under farm forestry. Many of the rural communities had also evolved rules, norms and values for efficiently managing common property resources such as forestry, fisheries, grazing lands, etc. However, with the passage of time, as the modern technology made a dent, such practices have fallen into disuse.

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9 Chairman, National Bank for Agriculture and Rural Development (NABARD)
The top-down approach of planning followed in the past has to a limited extent succeeded in achieving the objective of growth with equity. The market-induced as well as the state-influenced technology interventions have often been guided by short-term interest. The problem solving approach followed in the past have often overlooked crucial factors such as local knowledge, skills, resources, aspirations and wants An important lesson learnt from the past experience is that unless people are empowered and their participation enlisted, the state intervention would not be effective. The 73rd Amendment to the Constitution is the right step in the direction of empowerment of the people.

In a country as diverse as ours, there cannot be a single uniform solution or policy for the problems faced by the people in various regions. There is a need to evolve location and problem-specific solutions through a shift from problem solving to solution augmenting approach. This would entail learning from technological innovations brought about by individuals or local communities, whether as a part of traditional knowledge or contemporary solutions to the problems faced. It is equally important that efforts should be made to inventorize and analyze low cost solutions for possible scaling-up and for cross-cultural applications. Such innovations are to be synthesized with the scientific knowledge, through participatory research, and synergy developed in selecting the appropriate technology.

The National Bank, as an apex institution, is conscious of its responsibility and is committed to create enabling conditions for steering agricultural development on to the path of sustainability and has designed its policies accordingly. One of the corporate objectives of the National Bank is to facilitate development, transfer and diffusion of technologies, besides evolving suitable promotional/extension policies for enhancing technology absorption capacity and credit flow in the various sub-sectors of the agricultural and rural economy. A number of grassroots level innovations in various areas were identified and financial support from R & D Fund has been extended by the National Bank for their promotion. Construction of farm ponds for in-situ conservation of moisture in rainfed areas, commercial production of bio-control agents and neem-based pesticides for integrated pest management, silo pits for storing green fodder, development of low-cost synthetic catamaran for fishing, development and commercialization of vermiculture are some examples.
The National Bank sanctioned a research project on documentation of decentralized industries. The project aimed at collecting, storing and documenting success stories in the field of agriculture, credit, marketing, village industries, etc., by appointing special correspondents in different parts of the country. Documentation of such successful rural innovations at the grassroots is intended to set examples for fellow villagers as well as adoption of low cost technology, generating self-employment, etc. The Centre for Studies in Decentralised Industries, Vaikunthbhai Mehta Smarak Trust, Mumbai, has set up a documentation centre-cum-reference library unit for dissemination of information on such aspects. SRISTI has also done pioneering work in building up a database through its knowledge network “Honey Bee” and has documented more than 1500 innovations all over the world.

The National Bank has also taken the initiative to introduce a number of institutional innovations. These initiatives are based on the realization that formal and informal systems of knowledge need to be linked together to facilitate the process of identification of the constraints as perceived by the rural communities and developing innovative ideas for overcoming the same. The formation of Vikas Volunteer Vahini (VVV), since the inception of the National Bank, provides a forum to the farmers, weavers, artisans and other sections of the rural communities to share their experiences and propagate the principle of development through credit. “Vanarai”, a voluntary organisation at Pune has been given financial assistance to motivate the farmers in drought prone/ water scarce areas to take upon themselves the responsibility for construction of cost effective structures called “Vanarai Bandharas” across the rivulets and streams by using empty cement bags filled with sand/ oil to harvest run-off water and use it for irrigation.

People’s participation and community action are critical to the development and acceptance of innovations at the grassroots level. Instances of strong and committed community action and the results that they bring about are available from some of the pilot projects supported by the National Bank. The programme for developing watersheds in Maharashtra, with financial assistance from the Kreditanstalt fur Wiederanfbau (KfW) of the Federal Republic of Germany under an aid agreement between the German and Indian Government is one such example. The development of the watersheds is sought to be achieved through the active involvement of the watershed community and
a strong catalytic role of Non-Governmental Organizations (NGOs). The different agencies of the State Government, the Agricultural Universities and Research Centres, Banking Institutions and the National Bank are playing a supportive and advisory role to the NGOs and Village Watershed Communities. Community action is ensured right from the selection of the projects by making sure that the population is willing in principle to participate effectively in the project. The watershed community commits itself to reduce the livestock population to the carrying capacity of these lands, social fencing, stall feeding and desists from growing water intensive crops. The initial results from the programme are encouraging and there are clear indications of increase in area under crops and agricultural output. The decision to ban free-grazing and felling of trees coupled with soil and moisture conservation measures on a watershed basis has improved bio-mass production which in turn has led to a stronger reliance on dairying. With strong community involvement, the repayment of bank loans is reported to be cent percent even during drought.

Realizing the fact that innovative approaches are required in social engineering for providing equal opportunities for the poor people, the National Bank has embarked on a programme of linking the Self-Help Groups (SHGs) constituted by the rural poor with formal banking sector to increase the access of the poor to the banking channels. As on March 31, 1996, 16 States and a Union Territory have been covered under the programme and 4,757 SHGs have been linked with the banking sector. Studies conducted by NABARD have revealed increase in savings rate and volume of loan business of SHGs, shift in the loaning pattern to the members from non-income generating activities to purchase of income generating assets/ production activities, nearly 100 per cent recovery performance, and significant reduction in the transaction costs for both the banks and the borrowers.

A unique programme of poverty eradication, exclusively involving women, is under implementation in Alappuzha district of Kerala, where the poor themselves are planning and implementing anti-poverty programmes as per their own perception. Here National Bank, United Nations Children's Fund (UNICEF) and State Government Departments have joined together to create a people-based structure to help the people to identify their problems, prepare a plan, generate resources and implement their own programme. Neighbourhood Groups (NHGs) of 25 to 40 poor and downtrodden women residing in different localities are federated into formal Panchayat Ward-level Area
Development Societies (ADS) and all the ADS are federated into town-level Community Development Society (CDS). The women identified for the purpose belong to illiterate families without sufficient wage employment. The CDS encouraged thrift societies to mobilize savings in small amounts. The success of the innovation can be gauged from the fact that within one and half years 10000 poor women from 350 NHGs could save more than Rs.14 lakh.

Recognizing that promotional strategy is a useful and essential adjunct to the core financing function, NABARD has in active collaboration with NGOs designed a number of promotional programmes for Rural Non-Farm Sector also.

Policy Framework

The success of the innovations, in terms of its acceptability and adoption at the grassroots, would, *inter alia*, depend on the policy framework through which it is nurtured. Policies, which are intended to encourage innovative ideas and promote innovations, must take cognizance of the linkages amongst the four factors, viz., innovators, investment, enterprise, and knowledge network, to provide a conducive environment. Policies will have to be designed in a manner that will easily enable the adoption of innovations. With the liberalization of the Indian economy, the policy environment favors competitiveness, promotes sustainable economic activity, and is conducive for encouraging creativity and innovations at grassroots. Nevertheless, there are important issues relating to technology, management, ensuring community / peoples’ participation, social engineering, etc.

Issues

One of the fundamental issues concerning the rapid agricultural and rural development is how best we can convert indigenous innovations into globally competitive products and services for meeting the domestic and international market demands. The transition from “innovations” to “product” is a complex process requiring high level of knowledge and consummate skills, which are often found lacking in the local-level innovators. In fact, there have been quite a number of innovations but very little “breakthroughs”. It is pertinent to go into the question as to what went wrong. How do we
evolve a system that can facilitate this process of scouting, spawning, supporting and marketing of contemporary innovations?

It is evident that the process of agricultural and rural development can be sustained only by continued increases in productivity. In the context of the plateauing of the yield potential under the green revolution technology, increases in productivity may have to come about not merely by stepping up savings and investments but primarily through encouraging a continuous flow of growth-inducing successful innovations at the grassroots. Efforts should, therefore, be directed towards building up a policy apparatus that will provide for recognition and reward innovations.

Technological backwardness perpetuates itself in a circular manner. Low rates of capital formation act as a major hindrance to generation of skills and aptitudes conducive to technological progress. Therefore, the objective of comprehensive science and technology policy should be not only to develop a specific stage of the process but to initiate the process of technical progress at its roots and also to generate forces which will help it survive through all its stages until the final culmination in the form of a new product or process. Research focused on a specific stage would, therefore, be of limited relevance to the requirements of policy-makers. This implies that since innovations are influenced by a wide range of factors, viz. socio-economic, institutional, political, etc., the formulation of a full-fledged and sound policy for augmenting innovations at grass-roots must encompass this whole range of factors.

The intimate relationship between credit and innovations has long been recognized in the literature. Credit facilitates rapid adoption of innovations, which in turn renders credit productive thereby making a signal contribution to the growth of Gross Domestic Product (GDP). Nevertheless, mere massive planned investment financed by credit-subsidy instrument not only may fail to stir up the fundamental growth-inducing process but end up in a “credit trap” without resulting in the growth of the economy. Credit acts as a facilitator in the process of capital formation and is an important instrument of introducing innovations. Innovations emerge and disappear, making development a process of “creative destruction”, to use a Schumpeterian metaphor. This process demands a liberal and efficient credit system because credit is expected to act as a catalyst by making the introduction
of innovations possible. A moot point, which is crucial to the development and adoption of innovations, is whether cost of credit or access to credit should be given primacy.

Theoretical and empirical research studies have attempted to show that farmers are induced by shifts in relative prices to search for technical alternatives, which save increasingly scarce factors of production. The needs and priorities of society are reflected in the input pricing. Farmers do respond to these scarcities by demanding new technologies/innovations that would help economic use of the scarce factors. Such a scheme of things assigned a central role to factor-price change for signaling the nature of innovations demanded but lost sight of grassroots level innovations.

There are many regions in the world, which are biologically rich but economically poor despite their wealth of knowledge, skills and resourcefulness due to imperfections in the pricing mechanism. Distorted resource pricing could result in further degradation of the natural resources and irretrievable loss of local knowledge and skills. Price is a double-edged sword. Too low a price may lead to wastage of scarce resources while the innovations may be out of reach of the poor farmers due to high price. Can we evolve a mechanism, which may minimize the distortions in resource pricing and help augmentation of autonomous innovations in regions which are less responsive to market mechanism and networking with other facilitating factors?

National Bank has been particularly appreciative of the need to encourage and support such innovations at the grassroots because of the realization that innovation is essentially a two-sided coupling activity emerging from changing markets and changing technologies. Formal scientific knowledge has to play an important role in inventive activity because science and technology are closely inter-linked. An innovator is not necessarily an entrepreneur having business acumen and may not aspire to be one. How then do we build a strategic alliance amongst the innovator, knowledge network, research institutes, financial institutions and government departments which will enable innovations to be cost-effective and acceptable to the market? We should also discuss in this context as to how do we enable the concerned institutions to perceive the nature of demand for such innovations - is it weak, inarticulate or scattered? The younger scientists should be encouraged to take the initiatives to study such issues.
Risk and uncertainty are integral parts of the process of innovations. Most of the innovations have a long history of unsuccessful trials. Such risky ventures may often need funds for meeting capital as well as recurring costs. A venture capital fund is generally thought of in order to systematically support such risky ventures. A Venture Capital Fund known as Agriculture and Rural Enterprises Incubation Fund has been established by the National Bank with an initial contribution of Rs.5 crore. The objectives of the fund are to finance establishment or expansion or diversification of innovative rural enterprises adopting appropriate technologies in farm and non-farm sectors. The detailed guidelines are being finalized. Credit package evolve as a result of financial innovations that tend to reduce the transaction costs and risks and as a result facilitate adoption of the innovations at the grassroots level. Risk, of course, can be reduced with better and accurate information but this would increase the transaction cost. How can we reduce the risks of an innovation without increasing the transaction costs to an institution? This calls for appropriate costing of the innovations and designing financial systems and financial instruments, which will be responsive to the requirements for promoting innovations. The existing credit institutions have acquired expertise in transacting credit of a traditional nature and do not have the required skills to transact business-involving development of innovations for the market. How do we build up their skills?

Innovations, besides financial assistance, also need legal support. In the absence of appropriate legal framework, the resource-rich often tend to manipulate the commercial use of the innovations and earn “super normal” profit, while the brain behind the innovation is often unrecognized and unrewarded. We should endeavor to enhance the capabilities of the rural people.

There are also sectoral policies like agricultural policies, industrial policies, particularly, with regard to rural industries, policies towards extension machinery for appropriate diffusion of innovations, the institutional innovations to support the technological innovations at grass roots, etc., that also have a bearing on evolving of innovations. It may not be possible with constraints of time to go into each and every aspect. I have highlighted some of the issues, which have been bothering us, and I am sure the deliberations in the Panel Discussions would resolve many of the issues that I have raised. I
assure you that the National Bank would seriously consider the suggestions while formulating its policies for encouraging innovations at the grass root level.
Mobilizing Local Communities for People’s Action for Water Management
by S.B. Nyamagouda

I Background

Bijapur district in Karnataka state is one of the famous historical centres with a variety and rich cultural heritage. The Gol Gumbaz, one of the wonders of the world, attracts the people from different parts of the world.

The district is blessed with five rivers viz, Krishna, Malaprabha, Ghataprabha, Bhima and Doni besides the fertile plain land. But lack of proper planning and utilisation of natural water resources has resulted in acute shortage of water for irrigation and drinking purposes. The harvest depended entirely on whimsical and unpredictable monsoons, leading to a precarious existence. Jamakhandi taluk, once a princely state, and its neighbouring Athani taluk, were not exceptions to it.

With the construction of Koyna Hydroelectric Project in 1960, the regular inflow of water in the down stream was affected to a greater extent. With reduction of inflow, the scarcity of water was felt for both irrigation and drinking purposes.

The situation was more intense on either banks of river Krishna in Jamakhandi taluk and also part of Athani taluk where bare-footed women walked miles in the scorching sun to fetch a pot of water. Temporary arrangements for storage of water with sandbags were not economical and also caused heavy losses when they were washed away due to heavy floods. The poverty and misery of the people was compounded by perennial drought. Migration of landless labourers, small and marginal farmers to neighbouring districts and states for livelihood was a common sight. The worst affected were children as they were deprived of education. In general, the very dignity of human life was at stake for want of basic needs.

Supported by Anand K. Joshi and B.S. Aparanji
To put an end to the long standing grievances, the people of this area, especially the farmers, made several representations to the State Government to take up the construction of the barrage across river Krishna at Chikkipadasalagi village of Jamakhandi taluk, since 1965. This would have catered to the irrigation needs of an estimated 26,000 acres of land besides providing drinking water facility to Jamakhandi town and 21 villages of Bijapur district and also six villages of Athni taluk of Belgaum district.

The government prepared the estimates for the construction of barrage at the cost of 35 lakhs in 1976. But the project was not taken up due to negative report of the Technical Committee set up for this purpose. However, in 1986 again, the government revised its estimation to the tune of 1.8 crores, but never implemented the projects on several grounds.

II   Accomplishment:

Peoples' Thinking:

The pleas for an irrigation project in the area failed to move the authorities. The public was fed up of looking up to the government for help. At this stage, S.B. Nyamgouda, a farmer leader and social worker, made a first move by calling a meeting of farmers at Algur village to decide the future course of action. He conceived the idea of constructing the barrage on their own by mobilising manpower, money and material. The farmers responded to the call spontaneously and decided to help themselves in what is considered to be first ever of its kind in the country. This led to the formation of a co-operative movement for self-help in the name of Krishna Teera Raitha Sangha (Krishna Basin Farmers Association).

The Krishna Teera Raitha Sangha (KTRS) sought the government for administrative approval for the construction of the barrage on their own with the project report and estimates prepared by Sri Amminabhavi, Retd. Chief Engineer (Irrigation). After a year-long interaction with the state government, the KTRS got its approval. The man who made things happen (getting the government's
approval) was the unassuming farmer leader, Sri S.B. Nayamgouda. Though the conditions laid down by the government were not conducive, the Sangh accepted, as it had no alternative leftover.

**Peoples' Action:**

With the administrative approval from the government for the construction of the barrage, the farmers, with an unprecedented enthusiasm and massive co-operative effort, were determined to construct the barrage, on their own. The farmers performed Bhoomi Pooja on October 2, 1987 (Gandhi Jayanthi day). What a befitting tribute to the Father of the Nation! The construction of the barrage was taken up in two phases viz., from January to May 1988 and January-June 1989.

**Mobilization and Management of Money:**

The mobilisation of funds is a story of trust, confidence and enthusiasm of the farmers, in particular, and the people of the area, in general, to contribute to the cause of humanity. This is a story when enterprise and privatization were not still buzz words.

The major highlight of this project is its daring “People’s Project”. It was estimated at the cost of Rupees One crore. The farmers, under the leadership of Sri S.B. Nayamgouda, were confident of mobilising the money as scheduled. It was decided to collect funds from beneficiaries at the rate of Rs.500 per horsepower irrigation pump set used.

During the second phase of construction there was increase in the cost of the project due to the price escalation. To complete the construction as scheduled, Sri S.B. Nyamagouda gave a call to the general public to contribute to this cause of humanity. This appeal was followed by door-to-door and village-to-village campaign to meet the villagers to rejuvenate the confidence and to raise the required funds. In spite of several hurdles in the process, the farmers managed to raise the funds as per the revised estimates.

The notable contributors in the mobilisation of financial resources were;
• 250 farmers who mortgaged their property in a local urban bank and contributed for the project
• Beneficiaries
• General public
• Educational institutions
• Merchants Associations of Jamakhandi, Sangli, Rabkavi, Banahatti, Terdal, Bijapur, Mudhol, Athani
• Pontiffs of various religious institutions
• Weaver’s Association of Rabkavi, Banahatti, Terdal, Mahalingpur, etc.
• Employees of Banks, P&T Departments
• Advocates Association
• Zilla Parishat, Belgaum
• People from the states of Karnataka, Tamilnadu, Andhra Pradesh, Maharashtra have also responded to the appeal
• CAPART (Council For Advancement of People’s Action and Rural Technology), New Delhi, an organization sponsored by the centre, studied the progress of the construction and extended financial assistance
• Jamakhandi Urban Co-operative Bank, not only contributed but also helped in sanctioning loans to the farmers on time.

In the end it was the sheer enthusiasm of the people that provided the impetus.

Mobilization and Management of Man Power (Shramadana or Karseva)

Another notable feature of this project is that the labour cost of the project was considerably reduced. Sri S.B. Nyamagouda convinced the people that if one has the capability, one could convert that capability into an opportunity to one's advantage. The opportunity of performance, challenge, creativity, growth, crisis ultimately results in exploiting the potential towards performance. These
calls sent waves of awareness and motivation among individuals, groups, associations, communities and institutions.

At the commencement of the contribution, both beneficiaries and non-beneficiaries came forward to render voluntary labour contribution. The participation of one individual, groups, associations, communities, institutions inspired the other to come forward to offer voluntary labour to the cause. On several occasions, the turnout of the people was more than the actual labour requirement. This prompted the KTRS to concentrate on “People Management” to utilize this resource intelligently and effectively hence the work was planned around the clock. Each one was acknowledged as a member of the group and his expectations and anxieties were respected since this human resource is also an Emotional Resource.

The Hindu Ekatha Samithi, Anjuman A Islam Committee Merchants Association, Educational Institutions, Students Associations, Auto rickshaw Drivers Association, Bank and Postal employees agriculture and non-agriculture labourers, besides the general public have contributed their enthusiasm in the form of voluntary labour service, which reduces the labour cost of Rs.7 lakhs.

With active support from the people, the construction of the barrage was completed. The qualities demonstrated by Sri S.B. Nayamgouda, that the leader cannot be “manufactured” in an organization through structures and systems. It just came out of demand commitment of a high order to become a cornerstone of effective team building and team integration.

III Unique Features of the Project

- First private barrage in the history of the nation without government help.
- The farmers conceived the idea, planned the project and executed it with mobilisation of men and material and money of their own.
- Transformed the entire region from poverty to prosperity.
- Labour cost of the project is considerably reduced.
• Set an example to others of mobilising local communities for people’s action for ‘self help’.
• Standing example for concepts of modern management like leadership, motivation and
  turnaround strategies for the development of irrigation, which ultimately resulted in the socio
  economic development of the region.

IV Category of Beneficiaries

<table>
<thead>
<tr>
<th>Beneficiaries</th>
<th>Families</th>
<th>Extent of Land (in Acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small and marginal families</td>
<td>4582</td>
<td>12193</td>
</tr>
<tr>
<td>SC/ST</td>
<td>440</td>
<td>1086</td>
</tr>
<tr>
<td>Big Farmers</td>
<td>1302</td>
<td>12746</td>
</tr>
<tr>
<td>Since 1991 to 1996 irrigation facility extended to</td>
<td></td>
<td>8975</td>
</tr>
<tr>
<td>Total</td>
<td>6424</td>
<td>35000</td>
</tr>
</tbody>
</table>

V Technical Details

<table>
<thead>
<tr>
<th>Name of Barrage</th>
<th>Chikkapadasalagi Barrage</th>
</tr>
</thead>
<tbody>
<tr>
<td>River</td>
<td>Krishna</td>
</tr>
<tr>
<td>Location</td>
<td>Chikkapadasalagi Village, Jamakhandi Taluk, Dist. Bijapur, Karnataka State (India)</td>
</tr>
<tr>
<td>Length</td>
<td>430 Meters</td>
</tr>
<tr>
<td>Height</td>
<td>8 Meters</td>
</tr>
<tr>
<td>Storage Capacity</td>
<td>2.8 TMC</td>
</tr>
<tr>
<td>Width of Reservoir</td>
<td>0.45 kms</td>
</tr>
<tr>
<td>Length of Reservoir</td>
<td>45 kms</td>
</tr>
<tr>
<td>Project Cost</td>
<td>One crore</td>
</tr>
<tr>
<td>Period of Construction</td>
<td>11 months</td>
</tr>
</tbody>
</table>

VI Economics of the Project

Irrigation Facilities Attained: 35,000 acres
Comparative Statistics:

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Before construction</th>
<th>After construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Irrigation facilities</td>
<td>8000-1000 acres (8 months)</td>
<td>35000 acres (12 months)</td>
</tr>
<tr>
<td>2. Land cost</td>
<td>Rs.25000-30000 per acre</td>
<td>Rs.1,00,000 - 1,25,000 per acre</td>
</tr>
<tr>
<td>3. Sugarcane yield</td>
<td>25-30 tons per acre</td>
<td>40-45 tons per acre</td>
</tr>
<tr>
<td>4. Total Sugarcane growth</td>
<td>1,75,000 tonnes</td>
<td>11,25,000 tonnes</td>
</tr>
<tr>
<td>5. Foodgrains production</td>
<td>4000 tonnes</td>
<td>1,30,000 tonnes</td>
</tr>
<tr>
<td>6. Total cost of the crop</td>
<td>Rs.8,20,000 crores</td>
<td>Rs.91,20,000 crores</td>
</tr>
<tr>
<td>7. Generation of employment</td>
<td>50,000 man days</td>
<td>2,25,000 man days</td>
</tr>
<tr>
<td>8. Wages rate</td>
<td>Rs.15 - Rs. 18 per day</td>
<td>Rs.40 - 45 day</td>
</tr>
</tbody>
</table>

Drinking water facility: Jamkhandi Town

21 villages in Jamkhandi Taluk

Six villages in Athani Taluk

Totalling to a population of 2.5 lakhs

VII Issues

a) Mobilising local communities for peoples action

In the United Nations Educational, Scientific and Cultural Organization (UNESCO) document the term ‘participation’ is defined, as ‘collective sustained activity for the purpose of achieving some common objectives especially a more equitable distribution of the benefits of the development, and the real participation is to develop human capabilities for development, decision making and action. This concept of ‘participation’ is clearly visible in the present study.
Highlights

- Awareness was created in the community about the existence of the problem. Clear-cut insight was given to the possible means of solution and the implications of solution on the beneficiaries.
- People were consulted from the very start and they actively participated in the planning and management of the project.
- The participation began at grassroots level with opportunities for participation and decision-making resting with those who had few acres of land holding on either banks of river Krishna.
- People's action started with pre-planning exercises, development of plans, and design of implementing mechanisms to the actual implementation.

Level of participation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Category</th>
<th>% of Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>72%</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>28%</td>
</tr>
<tr>
<td>Age Group</td>
<td>18-35 years</td>
<td>53%</td>
</tr>
<tr>
<td></td>
<td>36-65 years</td>
<td>47%</td>
</tr>
<tr>
<td>Landholding</td>
<td>Landless</td>
<td>19%</td>
</tr>
<tr>
<td></td>
<td>Below five acres</td>
<td>29%</td>
</tr>
<tr>
<td></td>
<td>More than five</td>
<td>52%</td>
</tr>
<tr>
<td>Occupation</td>
<td>Agriculture</td>
<td>55%</td>
</tr>
<tr>
<td></td>
<td>Business</td>
<td>06%</td>
</tr>
<tr>
<td></td>
<td>Employed</td>
<td>08%</td>
</tr>
<tr>
<td></td>
<td>Housewives</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>Coolie</td>
<td>19%</td>
</tr>
</tbody>
</table>

b) Modes of communication adopted for mobilising resources
• Processions and meeting were organised in villages and towns
• Photographs of the people working at construction site were exhibited in panchayat offices and other places
• Recorded video tapes of the day’s work of the construction were released for display in the villages
• Recorded audiocassettes, which contained folk songs related to the farmer’s innovation, dedication, strength etc., were played.
• Various religious leaders/ pontiffs were invited to the barrage site to give call on self-reliance, confidence, and services to humanity.
• The scenes of enthusiastic and committed response were video taped and shown in the public gatherings at every village and town.
• Motivated by the response of the farmers, other segments of the society such as lawyers, doctors, bank employees, business class, government employees, etc. joined the movement, making it participation by public in general.
• Women were called to participate in the construction work.
• The leader Sri. S.B. Nayamgouda, gave a call in the news papers of the progress made in the planning and execution of the project to volunteer labour and money in this noble cause.
• Sri S.B. Nayamgouda with his followers started door-to-door and village-to-village campaign to persuade, convince, and create awareness among the different segments of the society.

c) **Role of mass media**

• The leading national as well as regional newspapers and weeklies have published articles since beginning of the construction.
• The All India Radio, the Doordarshan, and the Information and Broadcasting Department have flashed the news about the farmers’ movement.

The field survey reveals that the mass media is still not able to motivate and inspire the people at large. This media inspired only 18 per cent and 61 per cent were inspired by the continuous visits by
the dedicated leader, and 21 per cent of the people were inspired by farmers meetings for participation.

d) Leadership

The greatest fact that contributed to the success is that there was a leader acceptable to the community. He belonged to the local community and was acceptable to them since he was aware and concerned to their problems, and had proven his managerial capabilities and commitment. He is none other than Sri S.B. Nayamgouda. As a Chairman of the local urban co-operative bank and also as a social worker, he came into contact with farmer folk and public at large that provided him an opportunity to understand their burning problems. His high commitment in people involvement, teamwork and empowerment has helped him to set the goal and realise it. Hailed affectionately as the “Barrage Man”, he was not only an initiator but also a facilitator. He proved himself to be a team builder.

Easy accessibility, openness to suggestions, easy adaptability, ability to take risks, converting crisis into opportunities, withstanding stress and strain, capacity to make best utilisation of resources, and effective time schedule were some of the leadership qualities that he demonstrated.

VIII Progress

a) Heggur Barrage

The success of this unique experiment encouraged the KTRS to take up the second challenge of constructing the barrage across river Krishna near Heggur village of Bilagi taluk in Bijapur district. The Heggur barrage was completed in a record period of 89 days at the cost of Rs.35 lakhs, which irrigates 8,000 acres of land and provided drinking water to 11 villages.

b) Sugar Factory - (Jamkhandi Sugars Ltd.)
The construction of two barrages assured the continuous irrigation facilities to the extent of 43,000 acres of land. This prompted the local farmers to undertake cultivation of cash crops, especially sugarcane. It is estimated that the sugarcane production of this area is 25 lakh tonnes per annum but only two sugar factories existed in the area with an intake capacity of 10 lakhs tonnes only. Due to lack of market, there are instances wherein the farmers burnt their sugarcane crop. This prompted the KTRS team to establish a sugar factory of their own, Jamakhandi Sugars Ltd., under the Chairmanship of Sri S. B. Nyamagouda, with estimated cost of 49.5 crores. The JSL is being installed in a rural area, which serves as a powerful media for augmenting the socio-economic condition of the farmers. It is formed of the farmers, by the farmers and for the benefit of the farmers, with the active co-operation of the people at large.

A co-generative plant with a capacity of generating 8 MW of electricity is proposed to be established along with sugar factory. The industry needs only 4 MW and rest of the electricity is to be supplied to the farmer’s for their pump sets; thus achieving complete self-reliance.

**Conclusion**

Participation of the people in the development process ensures the timely completion of projects and brings a lot of accountability on the part of the people and breeds a new culture of development, one with dignity and responsibility.

The indigenous technical knowledge with some of useful ideas from the rural community give them some representation in the planning and developmental process.

With a certain level of participation, the people feel the sense of belongingness to the project, which helps to monitor the developments and its perfect maintenance.

The government can encourage the Non-government and voluntary organisation wherever the projects are technically feasible and economically viable. This achieves self-sufficiency by mobilising local resources for the socio-economic developments with some reasonable restriction.
The Chikkapadasalagi barrage constructed by the farmers happens to be the project already approved by the government, but not taken up for implementation. What would be the consequences if the public decides to execute a project where the government approval is not available, or is not sought? This question is all the more relevant since water resources projects are generally in the government sector. It is of significant relevance in the present day context where privatisation and liberalisation are given increased thrust.

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Fax : 08353-41179
The Protection of Genetic Resources and Traditional Knowledge in International Law: Past, Present, and Future

by Thomas Cottier

Introduction

In history of law, we observe a close relationship between economic and commercial value of resources, both natural and man-made, and the attribution and allocation of legal entitlement. The advent of knowledge (skills, science and technology) developed by mankind renders natural resources economically valuable and eventually scarce. It is at this stage that the law starts to develop allocation of property rights, withdrawing the matter from public domain. There is a basic choice between exclusive and shared, communitarian rights, both on the domestic and international level. In domestic law, it is conceptually a matter of allocating private property rights to individuals (natural or judicial persons) or leaving matters in the public domain. In federal structures, it is also a matter of allocating rights between central and decentralized federal state powers. In global law, it is traditionally a matter of allocating sovereign rights among different states. Increasingly, however, global law also deals with harmonizing and prescribing the allocation of private rights with a view to protect foreign interests which are not sufficiently represented in the domestic political processes of resource allocation. The protections of investment and of intellectual property are examples in point. The latter was recently strongly expanded in the World Trade Organization (WTO). The absence of adequate protection of intellectual property rights had emerged as a third generation of trade barriers, following the generations of tariff and non-tariff measures.

The classical example of resource allocation, of course, relates to land and territories. Much of human political history turns around this subject. Wars were mainly fought for such purposes. More recently, much of the second part of the 20th Century centres on allocation of oil, gas and minerals resources located at sea. The evolution of the continental shelf doctrine in the 1950s, eventually

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11 University of Berne, Institute of European and International Economic Law, Hochschulstrasse 4, CH-3012 Bern, Switzerland
followed by the 200 mile Exclusive Economic Zone (EEZ) in the 1970s brought by far the largest part of economically valuable resources under control of coastal states. It is not a coincidence that present day and future territorial disputes mainly relate to islands: the exercise of sovereignty over them brings along control over vast expanses of increasingly scarce marine resources. At the same time, the high seas, as well as the deep-sea areas - destined for the exploitation of manganese nodules - remain common grounds and barred from appropriation (the latter under the new term of common heritage of mankind). The 1982 Convention of the Law of the Sea\(^{12}\) codified such allocation and brought the struggle to an end, for the time being. Remember that science and technological innovation, in particular the invention of the combustion engine and other uses of oil and gas and minerals, ultimately triggered much of this process.

I recall these evolutions here to remind that the advent of biotechnology and genetic engineering is merely a new stage in a long-term legal process. The problem is not fundamentally new. Resources, of little commercial value before, are increasingly valuable as a potential for future research and exploitation because of scientific advances. They become scarce, and, therefore, enter the historical process of allocation of rights. Mankind again is facing the choice of creating exclusive or communitarian rights over these newly discovered resources both in terms of sovereign and private rights. We just embarked on this journey, and the matter looks complicated for a number of reasons.

First, while previous periods mainly deal with the physical feature of natural resources, non-movable and movable (land, airspace, coal, gas, oil fish, etc.), we are now essentially dealing with the appropriation of information. Such information, genetically encoded, is either exclusively contained in nature, yet untouched by man, or exists in combination with human knowledge as how to make good use of such information or know-how - with or without knowledge of the gene code. Appropriation of such information poses different problems than appropriation of physical matter. It is not specifically located and contained in matter, but may exist at many different places at the same time. It is ubiquitous. It is important to retain this feature. The law has some experience in dealing with appropriation of ubiquitous information in the field of intellectual property. Yet, it will be seen that such protection stems from a very different conceptual tradition, which in fact contributed itself

\(^{12}\) 21 I.L.M. 1261 (1982).
to the loss of traditional knowledge. It will need extensive adaptation for the purpose of protecting natural resources and traditional knowledge.

Second, the pace of scarcity is greatly accelerating. Never before, even when creating the EEZ, was the law confronted with allocation while such resources were subjected to such a pace of mass extinction. This is true for the loss of both biodiversity and traditional knowledge. The matter is urgent and does not allow for all the time that international law making processes have usually taken in the past.

Third, the allocation of these new resources poses fundamentally new challenges. Traditional modes often served uninhibited exploitation. In fact, the very situation of mass extinction is closely related to the traditional legal models of resource allocation and exploitation. We face a new situation. It is generally expressed in terms of the need for sustainable resource development. Justice has to be done among existing populations, in particular between the economic North and South. Conceptually, and unlike before, the rights and aspirations of future generations have also to be taken into account.

In conclusion, while we face an age old problem of property allocation, the new resources of ubiquitous information can not be dealt within traditional terms, and new approaches are needed without much time for action available.

**Protection of Genetic Resources and Traditional Knowledge in the Past**

It is hardly astonishing that a chapter on past legal protection of genetic information and related knowledge is bound to be short. Before the advent of biotechnology and genetic engineering, there was apparently no need to protect genetic information from unfair appropriation. There is virtually no discussion on sovereignty over genetic resources before and during the process of decolonization when fundamental assertion of permanent sovereignty over natural resources was made. Minerals, oil and gas, and fisheries were at the forefront, and nationalization and expropriation of foreign property and investment was at issue in a period of interventionist approaches to economic regulation in newly independent states.
As to traditional knowledge and know-how, it was left to the public domain. Traditional society was more communitarian than contemporary modern, urban and specialized societies. It was best served in making such experience available to all. This was a constant trait in stable and rural communities all over the world, and only changed in the 19th Century with the industrial revolution, mainly in Europe and the United States. In fact, much of this revolution was built upon common knowledge in public domain readily available. Inventors and producers were allowed to make good use of it in the process of developing new products. The emerging claim for exclusive rights was met with the opposition for a long time in Europe. For example, while the patent system was introduced at an early stage in the United States, it took much longer in Europe. Copyright laws were only introduced with the advent of appropriate technology to multiplication; the expressed idea as such always has remained in the public domain.

But once the IPR system was fully established, they undeniably contributed to the loss of traditional knowledge in industrial society. New products replaced the need of such knowledge, and generation after generation, it was increasingly lost and no longer passed on, while at the same time, standards of living were raising for most people. Medicine is an example in point. More powerful and specialized tools, leading to efficiency have replaced traditional knowledge. This has also put great financial burdens in Western society.

In sum, the combination of traditional knowledge being in public domain and the granting of exclusive intellectual property rights proved a very dynamic and successful mix in developing industrial societies. At the same time, this success accelerated the loss of traditional knowledge and to the current mass extinction of genetic resources. It contributed to non-sustainable development and borrowing of capital of future generations.

**Current Trends and Protection of Genetic Resources and Traditional Knowledge**

Under pressure of environmental and ecological movements, efforts started to cut this successful yet destructive circle of specialization and to preserve genetic resources and traditional knowledge where
they are still available (mainly in developing countries). It is reported that some 90 percent of genetic information and traditional knowledge are to be found here. Yet they are declining sharply, being overridden by industrial development in order to achieve the task of raising living standards in many quarters of the world.

The current situation in international law for the protection of the genetic heritage of the globe and the world's traditional knowledge shows all the symptoms of law-in-making. The way has not yet been settled, apart from the basic norm that permanent sovereignty over natural resources also extends to genetic information to be found within the bounds of territorial sovereignty of a state. Developing countries clearly did not see any advantage of qualifying such resources to be common heritage of mankind for obvious long-term economic interests. As to almost all other aspects, there is an intense process of claims and responses. These claims are attempts to discipline the exercise of sovereign rights with a view to preserve the heritage. Aspirations in international relations are framed in soft law instruments, such as Agenda 21\textsuperscript{13} and the principles of the 1992 Rio Declaration\textsuperscript{14}. General principles are gradually emerging and becoming part of the law. Some serve as aspirational norms, transmitting basic ethical values and claims. Equity expresses and symbolizes both as distributive and intergenerational justice. The concept of sustainable development seeks to halt exploitation of resources at the expense of future generations, and as a main stay of the effort to stop mass extinction. The concept of common concern: while leaving formal sovereignty of the state unabated, it creates a title of intervention with a view to promote sustainability. There is a claim for new human rights, especially protecting the habitat and traditional lifestyles of traditional indigenous people and their intellectual property rights. In fact, the protection of traditional knowledge in international law seems to focus on these minorities, leaving aside ordinary rural communities. The precautionary principle requires protective government intervention even short of scientific evidence in causation. These concepts and principles increasingly find their way into treaty obligations, yet mostly in still fairly unspecific terms. A good example in point is the Climate Convention\textsuperscript{15}, leaving specific measures to nation states. Presently, the most important treaty is the 1992 Convention on


\textsuperscript{14} 31 I.L.M. 874 (1992).

\textsuperscript{15} 31 I.L.M. 851 (1992).
Biological Diversity\(^{16}\). While the Convention has entered into force, its application and interpretation is still a matter of controversy. In the new field of protecting genetic information and knowledge, the relationship to traditional IPRs the right to access to biotechnology and to revenues is left to private or state contracts between bioprospecting firms and public authorities are private research entities. Moreover, the issue of financing the extensive programs of the Convention is not settled\(^{17}\). In a long-term perspective, their implementation will depend on the creation of stable royalties derived from the industrial use of genetic resources and traditional knowledge the variety of which needs to be preserved. Finally, an increasing number of multilateral conservation agreements relating to specific species have been operating for some time.

In domestic law, the state of affairs is not much more advanced in most countries. The modern evolution of ecological law is one of an increasing number of fields which need tight coordination on the international level with a view to avoid distortions detrimental to competition in a globalizing economy. Far reaching intellectual movements, replacing homocentric concepts of law by way of granting rights to nature and animals as subjects of law (and thereby ban e.g. all patents on life forms) are at the waterfront. While direct impact and an outright change of legal paradigm is unlikely, these schools exert increasing influence within present legal evolution towards a body of law supporting sustainability.

Finally, case law has started to contribute to the evolution. In a landmark case, the Supreme Court of the Republic of the Philippines recognized in *Juan Antonio et al. v. Fulgencio S. Factoran Jr.* the right of the people to a balanced and healthful ecology, including a responsibility for future generations\(^{18}\). Perhaps the most important and landmark case is *Moore v. Regents of the University of California*\(^{19}\). The Supreme Court of the State of California held that the exploitation based upon tissue and, therefore, a genetic resource detracted from an individual does not create property rights.

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\(^{17}\) S. e.g. Walter V. Reid et al., Biodiversity Prospecting: Using Genetic Resources for Sustainable Development, World Resources Institute (WRI) USA; Instituto Nacional de Biodiversidad (INBio), Costa Rica, Reinforst Alliance, USA, African Centre for Technology Studies (ACTS), Kenya (1993); A.F. Krattiger et al., Widening Perspectives for Biodiversity, International Academy of the Environment, Geneva 1994.


\(^{19}\) 793 P.2d 479 (Cal. 1990).
The personality is merely protected by his rights to prior consent. The genetic information, as it exists, therefore, remains in the public domain unless altered by a patentable invention. An important Australian case, *Mason v. Tritton*, mainly relates to the protection of traditional resources, such as fishing rights of indigenous populations, basically acknowledging historic rights\textsuperscript{20}. This is of particular importance with a view of protecting the habitat of indigenous peoples. (Going beyond indigenous peoples, we recall that international law has a long tradition of protecting historic rights which are defined by constant patterns of usage and acquiescence by neighboring states, in particular, in the field of fishing. Yet, these rights did not contain any limitations as to how and to what extent these fishing grounds can be exploited).

**Future Protection of Genetic Resources and Traditional and Grassroots Knowledge**

It can be readily seen that the law is far from settled. Lawyers face the challenge that ecologists and economists who have mainly dominated the field dealt with the subject in their own ways. From a legal perspective, the field is still one of confusion, and it will be necessary to step up the analysis from the point of view of law, with a view to elaborate possible solutions. For example, the notion of protectable traditional knowledge is far from clear; should it be limited to indigenous minorities? Should it encompass all, or only the knowledge or know-how whose use has sustainable effects? Yet, one of the basic problems which needs to be addressed before options can be worked out is the relationship of traditional IPRs and a new generation of possible rights in the present field of protecting genetic resources and existing traditional knowledge.

*The Modern Concept of Intellectual Property Rights (IPRs)*

Intellectual Property as it is known and established today, i.e. the protection of inventions (patents, plant protection), trademarks, geographical indications, industrial designs, integrated circuits, copyright and data compilations, and of undisclosed information, stems from economic needs of modern industrialized society. Economically speaking, it provides incentives for and serves the protection of investment by granting exclusive rights, either limited in time or unlimited. Generally

\textsuperscript{20} Supreme Court of New South Wales, Ct. of Appeal, 34 New South Wales Law Reports 577-605 (1994).
speaking, the essential common feature consists in granting protection to innovation, novelty or distinctiveness, either under a doctrine of inventive steps (patents), sufficient levels of creativity (copyright and industrial designs), or distinct feature (trademarks). In all cases, protections depend on the newness of knowledge generated.

It is obvious that this concept stemming from industrial progress was not made, and is not suited as such, for the protection of existing knowledge or know-how, either genetic information per se or traditional knowledge. While it provides a basis for new knowledge, existing knowledge remains in public domain. This is also true for contemporary discoveries. For example, stock taking of human gene code (Genome project) cannot be patented as such for such reason. It cannot be appropriated and published maps can therefore be used freely. An exception exists in the field of undisclosed information. No requirement of novelty exists. Thus, new and traditional knowledge undisclosed to a wider public of society, and perhaps limited in access to shamans or other institutions, would also enjoy protection under modern law.

Modern IPRs, however, can well be used to protect emerging grassroots knowledge. We recall that the concept of traditional knowledge is not static, but dynamic. It is not meant to merely conserve traditions, but should further develop. A recent report stated:

“What is ‘traditional’ about traditional knowledge is not its antiquity, but the way it is acquired and used. In other words, the social process of learning and sharing knowledge, which is unique in each indigenous culture, lies at the very heart of its ‘traditionality’. Much of this knowledge is actually quite new, but has a social meaning, and legal character, entirely unlike the knowledge of indigenous peoples, acquired from settlers and industrialized societies....”

The concept of modern intellectual property is basically apt to provide protection to this type of innovation based on traditional knowledge and experience. This is not to say that existing systems necessarily favour and encourage their use for such purposes. Patent registration in many countries is costly, cumbersome, and out of tune with the way of life of rural and, in particular, indigenous

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21 Submission to the Executive Secretary from the Four Directions Council, Canada, 15 January 1996, quoted from Convention on Biodiversity, Traditional Related Knowledge and the Convention on Biological Diversity, Note by the Secretariat, UNEP/CBD/SBSTTA/2/Inf. 3 (19 July 1996) at p.19.
peoples. The very concept of IPRs, however, does not prevent from introducing feasible systems that are cheap and simple. Such systems exist. They are often called petty patents, and complement the more sophisticated patent system designed for industrial purposes. Switzerland for example, relies upon a national patent system that is cheap and simple, mainly by way of the fact that novelty is not examined at the stage of examination and registration. Such questions are left to courts only in case those patents are being challenged. Interestingly, these patents do not fare worse than patents that had been examined for novelty at the registration stage.

A movement and drive to protect grassroots innovation should, therefore, seek the introduction of such simple and inexpensive systems that would provide incentives and returns on licensing such inventions. Such systems may either replace expensive patent registration systems or complement these with special design for the needs of rural communities. It is apparent that patenting a genetically engineered product and a grassroots innovation do not require the same level of substantive and procedural sophistication. The same may also be true for other forms of IPRs which require registration, in particular, design protection to the extent that new patterns are being developed. Traditional knowledge may also qualify for copyright protection in the arts (music, paintings), and it would be worth examining to what extent changes would be required to make best use of this form of protection which does not depend on registration. In all cases, such rights may be used to monopolize production (subject to compulsory licensing) or as a basis for licensing with a view to generate additional income. It will be necessary to examine what type of simple and standard licensing agreement can best serve the commercial use of sustainable knowledge.

Indigenous people often do not operate on the basis of individual property systems. The idea of appropriation is strange to them and, therefore, it is argued that the approach of modern IPRs is not suitable. This, of course, is a fundamental issue that goes beyond IPRs, but addresses the entire culture and concept of ownership, including real estate and other forms of private property. To the extent, however, that these communities seek protection from the industrial world and want and need to interact with it, capacity building and assistance in asserting such rights will be necessary. The problem also exists in ordinary rural areas, but to a lesser extent. Settlers and farmers are accustomed to operate in terms of private property, and it is a mere matter of education, capacity building, and
assistance to bring the possibilities of such rights to their attention and use. Again, IPR systems could adapt to such needs, in particular, by way of introducing new forms of ownership. Nothing prevents it from introducing novel communitarian titles; the system need not be limited to individual ownership. It was seen that the same holds true for simplifying procedures and licensing agreements.

In sum, modern IPRs, appropriately adjusted, can make a considerable contribution to valuation and dissemination of grassroots innovation and building of sustainable technologies around the world. They help enhancing self-confidence and awareness of own potential.

*The Protection of Existing Knowledge: Traditional Intellectual Property Rights (TIPRs)*

While new and recent knowledge can be absorbed by modern IPRs, as adjusted, things are entirely different with respect to existing traditional knowledge. Changing the concept of novelty would fundamentally alter the system and should not be envisaged. Referring to intellectual property protection in the context of traditional knowledge, as it exists, needs a new post-modern definition. Terms such as *sui generis* IPRs or Traditional Resource Rights (TRRs) have been proposed. It could also be contemplated to call them Grassroots Rights, or Traditional Know-how Rights, to the extent that we talk about practical skills. Since the notion of knowledge may be broader than that, we suggest the formal term of Traditional Intellectual Property Rights (TIPRs).

It was suggested that courts, by way of constitutional rights of equal protection, could protect such rights. The argument is not likely to be successful. We recall that the protection of intellectual property has never been dealt with on a same footing as real property, both in national and international law. Information has traditionally been in the public domain and was only, step by step, privatized by legislation, and not by courts. This was carried out over many years, as economic needs to do so prevailed in the legislative process.

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Nothing in law, however, prevents the adoption by way of legislation of a concept of TIPRs, which does not rely upon novelty. Neither does protection of real property and movable property rely upon it, nor is this a requirement for the protection of undisclosed information. Implicitly, the Convention on Biodiversity recognizes such rights, when Articles 15, 16, and 19 establish the basis for contractual relation between donors and prospecting firm and for transfer of technology and compensation for the use of existing resources and knowledge. Legislation and treaties may further elaborate on this. Permanent sovereignty over natural resources leaves ample room to this effect.

At this stage of preliminary analysis, it is important to recall two fundamental distinctions. First, between genetic resources, yet untouched by man, and natural resources that are being traditionally used by communities, and which, therefore, are in combination with existing human knowledge. Second, the distinction drawn between sovereignty rights of states and private property rights of individuals or communities.

Both the resource categories are subject to permanent sovereignty. Yet, only the second one is open to appropriation by private law title, either of individuals or entire communities. I would propose that untouched and potential resources should be exclusively in the realm of sovereignty and therefore under public interest control of the state. On the other hand, existing traditional knowledge should exclusively be a matter of post-modern TIPRs and sovereign rights are to be limited to prescription and enforcement. The situation is not different from private law. While states enjoy sovereign rights over each and every domain under its jurisdiction, the effective power to use and dispose of it within the law is within the hands of the private owner. This may also include the state, but only to the extent that it acts as a private owner (e.g. as public research institution).

From this perspective, it is evident that potential proceeds of use of untouched and potential resources under sovereign rights would go to the state. On the other hand, the proceeds of the use of existing knowledge fall to the respective owner, individual or communitarian. The state has no entitlement therein, expect when acting as a private owner itself.
It may be argued that the exclusive appurtenance of proceeds from potential and yet untouched resources to the state is unfair in the sense that communities and farmers have often looked after such resources over generations and have preserved such potential. This aspect, however, can be dealt with by appropriate use of proceeds in favour of such communities and individuals. While returns are basically at free disposal of sovereign states and therefore of the government, nothing would exclude to develop appropriate criteria for use of such proceeds in favour of sustainability and conserving communities in national and international law, including allocation to international funds.

Sovereign rights over genetic, yet unused resources with potential are currently being developed and rendered more specific. To some extent they are addressed in the Convention on Biodiversity, in particular by the principle of prior informed consent contained in Article 15.5. Australia is proposing further elaboration. Australia is among the 12 most mega bio-diverse countries which together contain some 70% of the world terrestrial and aquatically associated biodiversity. A number of principles are proposed:

(a) “Australia will control access to indigenous biological resources in accordance with the provisions of the Convention on Biological Diversity,

(a) International access to Australian indigenous genetic resources may be granted on the basis that the contracting parties recognize Australia’s rights,
(b) Australia continues to have ownership of the genetic material collected,
(c) Australians should be involved in research on biological material of Australian origin,
(d) Australia will receive fair and equitable returns on, and proportionate ownership of, commercial products developed from Australian biological resources, and
(e) The Commonwealth and the State Governments reserve the right to set fees/ royalties or other charges relating to the granting of access to Australia’s genetic resources and to receive all data, materials and reports of research relating to the commercial potential of those resources.”

25 Id. at 234.
We note that these principles all emanate from the concept of permanent sovereignty and exclusively address rights and obligations of central or state governments.

These principles are considered to be complementary to a National Strategy for the Conservation of Australia’s Biological Diversity, which includes

“Controls and regulations that should

(a) Insure that Australia participate in research and development, and shares in the benefits from any commercial opportunities, including the development of biotechnology that are based on genetic resources collected from areas within Australia’s jurisdiction,
(b) Ensure that collection of genetic resources for research and development activities does not adversely affect the conservation status of the species being collected,
(c) Encourage and support the establishment of screening programs within Australia to identify genetic products of social and economic benefit, and
(d) Establish property rights that relate to the development and sale of genetic products and establish intellectual property rights derived from knowledge of genetic diversity, particularly regarding Aboriginal and Torres Strait Islander peoples.”

These principles partly address sovereign functions; partly they are providing framework conditions for private participation. This is clearly so for the creation of property rights (d), but possibly also for participation in research and development (a). It is submitted that the distinction of sovereign rights and private rights in accordance with a distinction of genetic resources of potential use and existing knowledge could help to further clarify such principles and rights. This would help in the allocation of revenues to the states on the one hand, and individuals and communities on the other hand.

*How should Traditional Intellectual Property Rights be acquired?*

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26 Id. at 234-235.
Borrowing from the experience of modern IPR dealing with immaterial, ubiquitous rights, two basic options exist:

First, such rights may exist *ipso jure* as soon as legal conditions are met. This is the approach used by copyright and undisclosed information.

Secondly, such rights may exist upon formal registration. This is the approach chosen in all other areas (patents, trademarks, geographical indications, and integrated circuits).

The advantages and disadvantages of either approach are apparent. While the first one automatically grants rights that can be invoked before law courts without further formalities, the second one offers the advantage of clarity and legal security and vice-versa. Formal registration delineates private and public domain in a practically clearer manner.

Studies should be undertaken to analyze the problem with respect to traditional knowledge. Two points are important here. First, it would seem to me that the issue is not exclusively limited to indigenous people and their particular situation (as the current trend seems to do). It should be addressed with a view to engulf such knowledge from wherever it may derive, in particular, farming communities all over the world. The system faces an enormous amount of potential information. Secondly, solutions should not only grant clear legal title. They should also contribute to awareness and building of pride in traditional knowledge, in the view of actual and potential contribution to sustainable development.

There are many reasons in favour of establishing simple registration systems. Given the vast amount of traditional knowledge, it would be necessary to make a deliberate effort to register those parts of it which may be considered to be commercially and economically interesting for further development in industrial processes and which communities would wish to capitalize on. Subject to already existing protection of undisclosed information, only registration is in a position to achieve sufficient legal clarity and business at the outset. Moreover, registration only can make an important contribution to stocktaking and preservation from a point of view of ethnology. Much could be
learned from existing efforts and experience, in particular the Honey Bee system as developed by Professor Gupta.

Registration would need to observe a number of issues:

Given the frequent difficulty to clearly allocate traditional knowledge, registration would need to be open to opposition. Successful opposition would result in annulling of registration or joint ownership, as the case may be. Experience can be drawn from trademark registration systems to that effect.

It would also be necessary to address interim periods covering the passage from the entry into force of the law and registration. For a certain period of time, commercial use of non-registered traditional knowledge would remain subject to legal protection, if claimed by the holders concerned. It may even be necessary to prescribe retroactive protection in order to avoid preventive appropriations by interested firms. The experience of excluding ex situ conservation from CBD coverage will be remembered.

Independently of whether or not registration is required, it will foremost be necessary to elaborate specific criteria and definitions of traditional knowledge, which qualifies for protection as a TIPR, removing its content from the public domain. Such criteria need to define the scope of communities entitled (as discussed above). They need to define whether all or only such knowledge with a potential use for sustainable development should qualify. This is an important point that needs further discussion. They need to determine whether such removal should have general effect or limited only to further industrial use of the resource. The balance sought between patent rights and traditional knowledge would suggest the latter approach. But other types of information beyond know-how may also be involved. Moreover, the protection of such rights should not impair continued use of it by other individuals or communities.

Finally, it would be necessary to define the scope and effect of Traditional Intellectual Property Rights. They could be similar to those in the field of modern IPRs. They provide the means to
prevent third parties from commercially using traditional information or the license such knowledge in return of licensing fees. On the other hand, it could also be contemplated that such rights would be more limited and merely giving raise to compensation for their use by third parties in light of the fact that such knowledge had been in the public domain before.

How to Bring about the System of TIPRs - The WIPO and WTO Connection

A system of TIPRs, with or without registration, could be conceived on a national or international level, or a combination of both. Modern communications could greatly assist the task in the elaboration of data banks and the dissemination of such knowledge. It is possible to start on the national level in countries interested to do so. It is, however, also possible to seek international registration from the very beginning. It is also possible to build structures at the same time. An exclusively international approach may take longer and may need more capacity-building than a purely national approach. On the other hand, more expertise can be made available. Also, I assume that communities will and should be supported by specialized NGOs and agents. National or international registration does not make a big difference to them in the electronic age. Direct filing e.g. with the specialized World Intellectual Property Organization (WIPO) has a long tradition and could also be made effective in the field of post modern TIPRs.

The main reasons, however, for going international in the first place relies in the fact that the matter and problem is essentially and international one and closely related to protection of modern IPRs which have found a high level of harmonization in global law. TIPRs should therefore be addressed on the same regulatory level from the very beginning.

The protection of traditional knowledge is essentially designed to balance modern and existing IPRs that rely upon the use of such knowledge. Moreover, such rights should revalidate traditional knowledge with a view to support sustainable use of resources around the world. This is not merely of interest to developing, but also to developed countries. The rapid erosion of genetic resources renders the project one of common interest. In particular, pharmaceutical industries share a long-
term interest in preserving biodiversity and that rapid action is necessary\textsuperscript{27}. The constellation offers a change for action and for building coalitions, which do not necessarily follow North-South demarcations.

A major, and perhaps the main incentive, however, on the part of Northern partners relies in a necessary expansion of patent protection of genetic engineering in coming years. The Uruguay Round concluded with results below the aspirations of the United States, Japan, the European Communities and other industrial countries with major pharmaceutical companies. Article 27:3 of the TRIPS Agreement\textsuperscript{28} allows for the general exclusion of “plants and animals other than microorganisms, and essentially biological processes for the production of plants and animals other than non biological and microbiological processes”. It is obliged to introduce plant protection, including \textit{sui generis} systems that allow taking into account novel TIPRs.

Member States of the WTO are presently not obliged to introduce extensive patent protection in a field of growing importance to export interests of industrialized countries. The effect of non-granting patents in these areas amounts to the possibility to freely counterfeit and reproduce the product for the market concerned. Not today, but perhaps already in a near future, this could give raise to bitter trade wars in the field of genetically engineered products. Only harmonized rules on patenting life forms will be able to prevent such perspectives.

The provision of Article 27:3 of TRIPS Agreement is up for renegotiations in 1999. Rich countries in terms of mega bio-diversity will have an opportunity to link the expansion of patent rights with the need to protect traditional knowledge and to introduce IPR Protection. Such juncture will allow to progress in a balanced way, at least in the field of know-how that can be used for patenting genetically engineered products. The balance is not only required in terms of equitable sharing, but

\textsuperscript{27} “The alarmingly rapid rate of species extinction which we are currently witnessing, due in part of habitat destruction, not only lends a certain urgency to the quest for plant-derived drugs, but also calls into question the ability to acquire large amounts of a plant from natural populations to support a development program. As chemical diversity is important to our goals in drug discovery, we are faced with, in essence, a now or never situation”, R.P. Borris, Natural products research: perspectives from a major pharmaceutical company in: Intellectual Property Rights (supra note 10) at 29-34.

\textsuperscript{28} 33 I.L.M. 1197 (1994).
also to overcome increasing opposition against patenting life forms which can be currently witnessed, in particular, in Europe. The juncture will allow to technically combining patent protection and protection of traditional knowledge. The granting of a patent could be made dependent on full disclosure of traditional rights used and licensed. The validity of a patent in a country could be dependent on effective and prompt allocation of royalties to the licensor, and other requirements prescribed.

Evidently, the elaboration of the juncture of patents for life forms and the protection of traditional resource rights will be a time-consuming operation. The process has only started. In the meantime, cooperation should continue on the basis of contractual model provided for the CBD. But a full recognition of rights will not be achievable without a strong link to trade policy. The matter should therefore be introduced and developed within the World Trade Organization. This does not necessarily mean that the concept of Traditional Intellectual Property Rights needs to be elaborated therein. Yet, an instrument would need to be ready to be incorporated and refer to in future negotiations revising the TRIPs Agreement. The TRIPs Agreement is already now a perfect example in point of incorporating other intentional agreements into WTO, and the same approach is likely to emerge with respect to conservation agreements, including the Convention on Biodiversity.

Let me finish this outline with a note of caution. As much as industrial progress, specialization and mass extinction of natural resources was not primarily due to the evolution of modern IPRs, the evolution of TIPRs in itself will not be able to halt the process of erosion and displacement of traditional knowledge and lifestyles in a process of specialization. In fact, the very protection of TIPRs may further accelerate the sell-out of traditions in the real World. Yet, the combination of both may in the future assist in shifting technological advance towards sustainable products, lifestyles and use of the globe’s resources. It may end the war between IPRs and ecological concerns. It may contribute to creativity, self-confidence, higher incomes, valuation and awareness of those who still owe a capital that has been lost in other quarters of the globe.
Introduction of Traditional Knowledge and Science in a University Curriculum

by J.S. Gardner

One of the things that India and Canada share is a colonial history - at least in the last 200-300 years. In Canada, we too are trying to shake off some of the effects of colonization. We do see some of the effects of colonialism in our formal institutions. We too have a long way to go.

The example is a Certificate in Indigenous Environmental Resource Management and the certificate is part of the offerings of the University of Manitoba. The partners in this project are:

- A group of First Nations Chiefs
- A Centre for Indigenous Environmental Resources (centre established by the First Nations Chiefs in Canada)
- The University of Manitoba
- The Federal Government of Canada. It is funding the pilot part of the project.

This programme was initiated by First Nations people - specifically, eight of the Chiefs of First Nations communities and territories in Canada. There are about 620 First Nations Communities and territories in Canada. Eight of the most influential chiefs decided that they needed opportunities for aboriginal or First Nations youth to be trained to manage environmental resources in those First Nations Communities and territories in Canada.

The University of Manitoba is a facilitator of this. We didn't initiate the programme and do not own this, per se. We are there to facilitate it. My role, in particular, as the Vice President of the University was to set in motion the University processes that will allow the introduction of informal knowledge into academic curriculum. I am not an expert in indigenous knowledge. Far from that, I know relatively little about the indigenous knowledge of the First Nations people in Canada. What I do know is that if our formal institutions in a country like Canada (which has a relatively small population and a vast territory) do not adjust and adapt to the changing aspirations of the various segments of our society, we will be out of date very quickly.

The Federal Government financed this project. The work of International Development Research Centre (IDRC) and Canadian International Development Agency (CIDA) is well known around the world. One of the things that Canadians and often other people in the world forget is that we have projects and problems at home that are equal to any found in the countries that we are providing aid

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to. Mind you the number of people is smaller but, none the less, we have very serious problems. Some of these relate specifically to the indigenous people - the First Nations people of Canada.

The programme is implemented through a partnership.

**Rationale for the Programme**

Despite the fact that Canada has vast territories, it is undergone very significant environmental degradation. This has been caused through extraction of primary resources, alteration of the waterways for hydroelectric power generation, and harvesting of timber for pulp and paper over vast territories of the sub-Arctic, Western Canada, Northern Quebec, and Northern Ontario. Huge areas of forests have been harvested, mostly by clear cutting practices. The usual effects of pollution from industrial wastes are present in many areas of Canada. Mining of minerals has been a base of the Canadian economy for the past 200 years. Mining has effects through the release of toxic wastes through disruption of land surfaces and building of road and other infrastructure.

First Nations communities and territories have been particularly affected by the extraction of primary resources in Canada. So that was one rationale. First Nations communities needed to develop expertise to manage the environment and environmental resources that they are very rapidly assuming sovereignty over.

In Canada we see an example of cultural genocide of the people over the period of about 500 years such that the traditional social structures of our first community have been completely destroyed in almost all cases. The social degradation produces all kinds of symptoms of dysfunction in the society, substance abuse, alcoholism, use of drugs, breakdown of the traditional clan and family structure, loss of language. One of the great social and political movements in Canada over the last two decades has been the move to First Nations self-government and the settlement of land claims with the federal government.

Huge tracts of land in Canada are being turned back to First Nations Communities. And the basis of this turn back of land is some notion of the traditional land areas that were used by particular tribes and communities.

For our institution situated in Manitoba we know that over the next two decades, there will be an increasing number of people of aboriginal or First Nations background coming to our University for regular degree programmes. So we have built into our mind set adjusting to these kinds of demands.
Shared philosophy and Vision

In order for any experiment or project like this to even get off the ground (begin the planning), the people who have some influence e.g. the Grand Chief of the Assembly of Manitoba Chiefs, has to buy into the notion that this is something that is important. We have to buy him to the idea that the legitimization of traditional knowledge and traditional ways of knowing is needed at this time and should be part of a formal curriculum.

Not everybody will buy into that vision.

Secondly, one has to agree that there is a need for education and training which is credential by the broader society and this is something that can be difficult for the First Nations Communities. They have to say, “Yes, we want people who can walk in the broader society as doctors, environmental managers, engineers, etc.” That has to be accepted and that has to be a part of the shared vision.

The Tensions

The tensions are obvious. We are dealing with formal knowledge, which we generally refer to as science. It could be natural science, physical science, social science, and life sciences. The framework, the structure - the way of thinking, the way of knowing is science.

The institutions, the universities, the schools, the colleges are influenced by how science goes about doing its business. The structure of our institutions are highly regulated and controlled by the structure of science. Therefore, we have departments of zoology, microbiology, civil engineering, English, psychology. The whole institution is highly formalized, using the model that western science gives us.

On the other hand, we have informal knowledge- the knowledge that was largely transmitted by oral traditions in the native communities of Canada. There are also informal institutions associated with that knowledge. They are structured in quite different ways. One of the core institutions in First Nations Communities has a `sharing circle’. This is a situation where a group of people from the community gathers in a circle to discuss an issue. They may be the most influential people in the community. It has same relation to the `Panchayat’ that you find in south Asia, but the `sharing circle’ is very important institution. Somehow, we have to build that institution into our instructional programme.
So, there was constant tension between the formality of science, the legitimization of science by the broader community in Canada and the world, and the informal knowledge and institutions. We need to bring them together to do something practical.

**Who is Involved?**

The First Nations Communities own this programme. The University is only a facilitator and I am only one cog in the facilitation process. The University had to be involved though because we have a highly formalized system of providing credit.

**Requirements**

The First Nations people had some very specific requirements. Firstly, First Nations had to control this programme. Now, universities do not like to give up control. Universities in Canada have academic senates and that is where the control of the academic programmes rests. So, somehow we had to convince the University Senate that they need to give up a little but control for this one small programme, and they did that. The First Nations have a steering committee and advisory committee, which is essentially the First Nations Senate for this particular programme. However, they wanted University credit, which meant that there, had to be an element of University control.

The courses have to pass the senate. Therefore, we have a steering committee, which has a mix of First Nations people, elders from First Nations, University professors, and University Administrators. This committee does the work that is required to get these courses approved by the University Senate and, thus, provide university credit, which is a form of legitimization in the broader society.

The second requirement was a curriculum, which included experiential learning and formal courses. One of the pillars of learning in the First Nations Communities in the traditional sense is that it is largely experiential and the ideas and information are passed on by demonstration in the field. People learn how to hunt by watching and doing. The curriculum also had to include formal university courses. These are highly structured and usually take place in a milieu of a classroom or a laboratory.

Finally, the course instructors had to include a university professor (a professor who was qualified to teach the material under the university’s regulations), a traditional knowledge instructor of First Nations origin (usually a hunter or a fisherman who was recognized in the community as being particularly successful and knowledgeable).
One of the effects of the social degradation of the First Nations Communities in Canada over 200 years is that the traditional knowledge has been lost. We find today that some of the best sources of traditional knowledge in Canadian context, particularly that which has to do with animals, plants, implements and technology, are the people of non-First Nations Origin - the White People.

The third partner in the instruction team for each course is an Elder. An Elder is an older person with life experience, who is recognized in the community for that life experience which gives wisdom, and who has been able to retain and practise the spirituality that goes with the wisdom. What the Elders bring to this particular programme is the wisdom of age and experience and the spiritual connections that are part of that wisdom.

Therefore, for each course we have an integration of knowledge systems, which is meant to occur at individual course level. That is different than providing one course over here on traditional knowledge of medicinal plants and another course over there on the botany or taxonomy of plants that may or may not be medicinal.

**Substance**

We have 16 formal courses taken over 15 months. Each course is taken as a block. In other words, people take one course at a time. The courses range from 30 contact hours over a couple of weeks to 210 contact hours spread out over 6-8 weeks. As part of the programme, there is a 3-month field practicum where students go into a community and work on a particular environmental problem under the supervision of a First Nations Elder and a University professor. The programme finally winds up with a 9-month job placement. The whole objective of this programme is quite practical. It is to get people into practical situations where they are doing a job and helping the First Nations Communities.

This gives the student a certificate. If they choose to go on and do a degree, a B. Sc. in Environment Science, they can take up to 60 credit hours of what they have done in this programme and transfer into a B. Sc. in Environmental Science or Biology. This amounts to half a degree program.

**Conclusions**

We began this experiment only 18 months ago. We have the first group of 20 students completing the programme only now. So we have some on the ground experience of how this works or does not work.
This is supposed to be a nation-wide programme. It happens to be offered in Manitoba but the students are chosen from across Canada. Therefore, they come from very different cultural, historical and linguistic background. That creates significant problems.

Bringing people in who have different preparation in the sense of speaking and writing English, and Mathematics requires lot of work in bringing them to the same level where they can take full advantage of the courses.

**Role of the Elders**

Elders have been involved in all the courses but they have been wondering as to why they are there and what their role is. One of the problems emerging from these questions relates to the next question, “What is traditional knowledge, who owns it and who is responsible for transmitting it?” For example, we have a group of plants that one used in the traditional sense for medicinal purposes. The biology instructor in the university for the same reason knows the same group of plants. So there is some confusion involved and the role of the Elders needs to be defined more carefully. Elders are the ones who hold up the translation of physical world into spirituality. That, spirituality has been lost in our First Nations Communities except, for a relatively few number of people which, includes the elders. How you bring that type of teaching and that way of knowing into a formal structure is probably one of the most difficult problems we have seen across. The university curriculum is devoid of anything relating to spirituality. We are all the worse off because of that.

**Language**

If you lose language, you lose a basis of traditional knowledge. This is particularly pertinent in the North American context, where each First Nations Community has its own language. There are 52 languages in all. Most of the languages will die out and with them some of the traditional knowledge.

The Inuit people living the north have 13 to 16 different words to describe snow. In English, we have one word for the cold white stuff that falls out of the sky and lies on the ground. It is an important part of our environment and yet we have only one word to describe it. The Inuit people have 13-16 separate words to describe different types of snow. They have a different noun to describe snow that is blown by the wind. They have a different word for snow that is very compacted. They have a different word to describe loose snow that you find in the woods. They have a different word to describe snow that rests on the trees.
This goes on and on. If you lose the language, you lose the understanding of snow. Now, as a hydrologist, a scientist, I know different types of snow. I understand its mechanics, role of densely and all that kind of stuff, but I have only one word and a bunch a adjectives to describe snow. The traditional knowledge of the Inuit is very precise and rich.

With the loss of language we suffer a severe handicap in the presentation, transmission, and understanding of traditional knowledge. That is unfortunate.

At this stage, the process is more important than the end. This is an experiment. I don’t believe it is a totally unique in Canada or North America. Among the large, research-intensive universities of Canada, it is unique.

The fact of Aboriginal people (First Nations people) is a fact of life in our part of Canada. In twenty years’ time they are going to make up 25 per cent of the population of young people in the university age group. We have to be prepared to give them a form of education that is sympathetic and sensitive to their cultural heritage at the very least, and a form of education that is probably more useful than the science we are giving them now.
The *Honey Bee* Network started about eight years ago. It was a network of like-minded people from Gujarat, Delhi, and Tamil Nadu. We began very small with the notion that there was a great deal of dissatisfaction in my mind and that of many other friends. This was related to the way the discourse on local knowledge and innovation was going on in our country. It was that dissatisfaction that led us to ask ourselves some fundamental questions. One question that we asked ourselves was, “When we collect knowledge from people, do we become its author?” Imagine somebody is taking down notes in this conference, and that person publishes a paper as an author, without giving any credit to anyone of us. This is precisely what many of us had been doing. We have been talking to people, writing papers about their knowledge as if we became author of that knowledge. We are merely documenters, with a little bit of interpretation.

There was another question that was much more relevant for an institution of management studies than many other academic institutions. We do a lot of consultancy here apart from teaching and research. Consultancy is an income that we generate and that also helps us learn about the client needs. The question was, “Was this income that accrued to some of us entirely because of our brilliance or should some part of this income go back to the people whose knowledge made this consultancy possible?”

The questions were very personal but their implications were very professional. The implications were much more widespread. One could not say that this was the problem of one person. It was the problem of the academic profession all around the world. The profession had to ask this question which it somehow was not asking for so long. I do not think even today, in our country at least, any professional society has yet developed a code of conduct, be it sociologists, economists, or any other profession. In the West, such codes of conducts are emerging in many academic societies. In our country (and many developing countries) we do not have a code of conduct which will guide by its
mandate, suggest, or persuade the professionals to follow certain rules regarding the way they should access this knowledge which people produce and share with us.

When these questions arose in our minds, we began with this Newsletter. The first issue was a Xerox copy of 8-9 pages. I had enclosed with this newsletter a letter by a person from Bihar. In the letter, he had written, “The best tea which is grown in our country is not available to the people in our country. It is sold in tea auction in London and obviously the choicest tea produced in Darjeeling goes to the most affluent people in the world.” He also asked, “Would it not happen as that the knowledge we are collecting from people (we add value to it also), becomes unavailable in due course to those who produce it.” I think it was a very valid question because it raises the issue about knowledge production, reproduction, value addition, and dissemination process. Under no circumstance could one say that whatever we all produce is only a means of extracting, accumulating and disseminating to those who can afford to get it at that price.

The concept of *Honey Bee* evolved around these questions. *Honey Bee* philosophy seemed to reflect metaphorically what we are trying to achieve. *Honey Bee* does what we do not. It collects pollen from the flowers and the flowers do not complain. It connects flower to flower through pollination.

Since we publish most of our work in English, there was no way people could have validated or convicted what I was doing, taught me what I was doing wrong, or known whether I learnt the right thing from them. It is quite possible that, since I was learning second hand, I might not have understood the things rightly. There was no way that they could have taught me or corrected my fallacies. There was a tremendous scope for blunder. Probably, I committed many. But once this concept evolved, we realized we have to share our finding with the people in their language to fulfill our ethical and scientific responsibility. It is ethical, because we had no right to use this knowledge without their permission. Secondly, we had no business sharing this knowledge only among our own kind without making it possible for them to learn from it. Life became more difficult. The quota of hypocrisy increased a little bit rather than decreasing.
This newsletter started and it became a voice on the issue of IPR much before WTO or GATT came into the picture. Seven years ago, nobody was talking about GATT (not about IPR, atleast) in developing countries. At that time, we were asking one question, “Will you stand by IPRs of peasants?” It was before the Rio Summit took place. And the reason was that in our country there were people who had asked the question before - K.M. Munshi had talked about this in 1953.

Years ago, K M Munshi, Cabinet Minister of Food and Agriculture, in his lecture on the Gospel of the Dirty hand (1953) bemoaned that even his daughter did not want to soil her hands and he himself dirtied it with only the ink of the fountain pen. Most researchers do not understand what the gospel taught. For the soiled hand of the worker on the land is the magic touch that starts the unbroken chain of action and reaction from the soil to the spirit, transforming the organism of life.

Dr. Y. P. Singh, former professor of Extension in Indian Agricultural Research Institute (IARI), had guided two theses on indigenous knowledge in 1964-65. You will not find them cited in any international publication. This is not because these are not known. Ironically, most international and even national publications on the subject still feel shy to acknowledge the contributions of such an eminent scholar. No lesson was learnt, though there has been considerable upsurge in the recent years in the traditional knowledge of people.

Otherwise, leadership on this subject will move towards the developing countries. Then Dr. Y.P. Singh becomes the leader of the research on indigenous knowledge so far as the academic world is concerned. This is not what is going to happen in the academic discourse. It is not that it is not cited in the West, it is not cited in India also. This is because Indian professionals behave no differently. They would rather seek legitimacy by quoting Western authors than quoting their own countrymen. So it is a deep-seated notion of inferiority in the colonization of the mind itself which is preventing the discourse to take place in the way it should.

This network started and slowly mobilized the civil society. What we realized after a while was that the contribution that we are getting from all sectors of the society was far more from individuals (what I call NGI - Non-Governmental Individuals) than from NGOs. In fact, we had the smallest
contribution on indigenous knowledge from NGOs. Why that voluntary sector is has not been able to scout, spawn, and sustain creativity and innovations at grassroots? Not that what they are doing is not useful. They created new standard of efficiency in the rural areas. However well intentioned that may be, it does not give the local communities as much leadership and control on ideas and their implementation as it could if it was building upon local innovations.

This network now has spread to 75 countries. In India, it is published in six languages. We have with us Mr. Vivekanandan from Tamil Nadu, who was working in an insurance company and getting a very good salary. He resigned and set up a voluntary organisation in Madurai. He brings out ‘Nam Vazhi Velanmai’. Similarly, T.M. Prakash, faculty member in University of Agricultural Sciences, Bangalore, brings out ‘Hittalagida’. Dr. Geervani, Vice Chancellor of Padmavati Mahila Vishwa Vidyalaya in Tirupati and her team brings out the Telegu version ‘Tenetiga’. We have Sudhirendar Sharma who brings out the Hindi version ‘Sujh Bujh’. We publish the Gujarati version ourselves.

Our dream is: “If you are really talking of knowledge networks, then it should be possible in future for the communities across the world to communicate with each other in their own language and yet be able to build bridges”.

It required tremendous effort and persuasion on everybody’s part to understand that this conference should have farmers, artisans (men and women) and people who do not understand English. It is going to make the conference very difficult and few will have to put up with things they do not understand. Yet imagine the fate of the colleagues who have been providing this knowledge without participating in the discourses. Probably some stress is desirable and necessary.

We send a lot of copies of *Honey Bee* on exchange basis to colleagues, but the Network is not just the publication of the newsletter. We are trying to do many other things. I will try to enumerate 4 or 5 initiatives. We will try to see how we can build around the world a consciousness that can be based on such a philosophy, which in some sense, makes us more accountable towards people whose knowledge we are talking about.
One initiative that began 3-4 years ago was biodiversity contests among school children. The idea was that there are many little geniuses in our society whom we do not know and whose only fate is to become unskilled laborers since that they do not know “A for Apple”. So we started biodiversity contests among primary school children in the biodiversity-rich, economically poor regions. We discovered to our surprise that there were children who were able to identify 111 plants. The most knowledgeable herbalist in the village knew 240 plants. Now, this child had achieved about 50 percent of the maximum potential of the community be the age of 12. Yet, there was no future for the child because he would soon be a dropout, given the high dropout rate in the region.

We have had Madhav Bhatt, a 11 year old student in Banaskanta who could identify 300 plants. We are talking of conservation of biodiversity and knowledge about it. What are the mechanisms in our society, which can help this little genius to move forward as naturalists and grow in their own turf, without having to necessarily unlearn everything that they know in the formal schooling system?

We have also been working with natural scientists. We have worked with Jai Research Foundation in Vapi, College of Pharmacy in Ahmedabad, M S University of Baroda, and Indian Institute of Science in Bangalore. In the last five years, our work with Gujarat Agricultural University has been extremely encouraging and supportive. We have several working groups there on different themes: biodiversity conservation, herbal pesticides, germplasm conservation, veterinary medicines, etc.

We are trying to add value to local knowledge so that commercialized products can be developed and profits from this product will plough back into the work we are doing and also to people who are producing this knowledge.

All said and done, we believe market forces are here to stay. Unless and until we use the same market that exploits people, we have no choice. Obviously, State, market, or any other institutions may not be fair in dealing with peoples’ knowledge. This does not mean that they will go away or that they should have no role to play. The challenge is to mould them in favor of the disadvantaged. Obviously no one individual can do it and that is the reason why we want the knowledge network to be set up. This would empower people all around the world who produce this knowledge. We will not
necessarily get hung up about which model of rewarding creativity is most advantageous. We should look for both material and non-material, individual and collective instruments of compensation.

We are preparing a multimedia database that will use modern technology to overcome the biases of communication. Many colleagues were saying that modern technology would be used only to dominate and exploit. The database is an example, which can make knowledge accessible to people who cannot read or write but can hear and observe.

We have been able to proceed in the development of natural products. Last year, Council for Scientific and Industrial Research (CSIR) had offered to enter into a MoU with SRISTI, an NGO supporting *Honey Bee* Network, in four areas: microbial diversity, natural products, farm implements, and veterinary medicines. The idea was that excellence in the formal sector should join hands with the informal sector. So it should be possible for us to use modern science, blend it with traditional or contemporary creativity, and produce products, which will reach the market where the demand is present, and generate profits, which can be shared with the people.

I will close by saying that the *Honey Bee* Network has, in some way, proved that the modern institutions (whether in education or management) can, given a will, blend with the best of local knowledge systems and contemporary creativity.

When Dr. Thomas Cottier was speaking, many of you must have realized how critical the issue of traditional knowledge is. Equally important is the issue of contemporary creativity. There are lots of people who have produced innovations in the past few years. One of our effort has been to impress upon the society that “Let us not concentrate just on traditional knowledge, but also on contemporary sources of creativity which are as important as traditional knowledge; both should be woven together to generate incentives for conservation.”
Sustainable Management of Natural Resources and the Social Institutions of Sri Lanka: A Comparative Analysis of the Past vis-à-vis the Modern Context

by Anura S. Widanapathirana

Introduction

The management of land, water, forestry, crop plants, livestock and other resources has received top priority since the earliest times in Sri Lanka. Civilization itself has been centred on water management. The early settlements in the drier parts of the country depended solely on rainfall as source of water. Thus, water had to be conserved for use in the dry season. The society had several arrangements for use and management of water and other resources, including a well-articulated mix of institutions. The role played by the natural resources (NR) is important even in the present context. For instance, 22 per cent of the GDP (1991) was attributable to land, water forest resources. Over 80 per cent of the population depend on agriculture for its livelihood that is based on the management of land, water and crop plants, together with livestock. The articulation of local institutions with resource management is different now from what it was in the past. As a result, serious management problems and concerns, including several conflicts on resource use, have occurred in the recent past. Compared to above, fewer problems of utilization of water and resources have occurred in the past (Widanapathirana, 1995). In this context, a study of management of NRs in the past through institutions would be an eye opener in improving the management.

Objectives

The objective of this paper is to discuss the management of NR in the past through the aid of social institutions and to compare such procedures with the modern context. It then draws several lessons from the past that could well be applied to the present context to improve management of NR.

Natural Resources Management in a Historical Context

Water was the basic commodity for agriculture as well as for domestic purposes from earliest times. Forests were managed to protect the land and to maintain the flow of water into tanks that were constructed in such a manner as to form a cascade. There had been various hydraulic structures and the location of tanks for managing irrigation water in the past (Parker, 1909; Brohier, 1939).

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However, there is less documentation on the type and nature of institutions involved in water and other resources management and their methods of operation. Several authors indicate water management through various isolated institutions in the past (Nicholas and Paranavitana, 1959; Coward, 1980). What is not documented is the entire spectrum of institutions whether in the past or present, the mechanism through which management was undertaken.

It has now been recognized that the management of water and other resources had an integral relationship with the functioning of society. The responsibility of their management is vested with several social institutions and their combinations.

After a comprehensive study of social institutions relevant to irrigation management (water resources) in the ancient times, Widanapathirana (1995) indicates that there had been five main types. They are Gamarala, Ganasabhawa, customs and rituals, village headmen and kinship. A very brief discussion on them follows.

Gamarala is the agricultural leader at the village level who is an authority on village agriculture, including irrigation. The people had high respect for the Gamarala and his technical advice. There is evidence that this institution had functioned since the earliest times until 1867 AD when it was replaced by an appointed official. Ganasabhawa is an ancient institution that originated in about 425 BC (Ievers, 1889). Ganasabhawa was a council consisting of leaders of the village who resolved any civil or criminal dispute after an inquiry. Customs are traditional “laws” made by the people themselves over several generations for their own benefit. They are informal and have deep culture roots. Resource management is governed by a set of unique customs. Rituals, on the other hand, are socio-religious actions planned for and implemented by the people. It is believed that the rituals bring in blessings for the people and their resources. Proper discipline is indispensable for the efficient management of resources. The Kinship institutions influence the use of land (and in turn water) and its transmission from one generation to another.

The above institutions and their role in resource management are summarized in the following table:

<table>
<thead>
<tr>
<th>Institution</th>
<th>Role and Function</th>
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<tbody>
<tr>
<td>Gamarala</td>
<td>Provides leadership in planning and resource management; overall in-charge of land, water and forest use in accordance with local customs</td>
</tr>
<tr>
<td>Ganasabhawa</td>
<td>Resolves all conflicts - resource management, functioning of society including social disputes - amicably. Enforces punishments on offenders</td>
</tr>
</tbody>
</table>
Customs and rituals | Procedures in management of land, water, forest and societal functions laid out in customs. Every member participates in the performance of rituals. Important activities are preceded and/or proceeded by a ritual
---|---
Village Headman | Matters relating to the functioning of the village administration are vested in the Headman. He also helps to bring about discipline of people
Kinship | Resource allocation and use rights are available only to kinsmen. It acts as a binding force of all members including their leaders

Perusal to Table 1 indicated that each of the past institutions had a specific role in resource management. Further, the inputs provided by each of them in their totality lead to the provision of all essential aspects of resource management shown below:

(a) generation and dissemination of technical know-how;
(b) facilitate adoption of technical knowledge;
(c) conflict resolution;
(d) bring about required discipline;
(e) access to and equity in resource distribution; and
(f) facilitate that each person abides by laws and regulations.

It is important to recognize that although the above institutions have their specific roles to play, in actual practice, each one of them function as an integral part of a larger system. The entire system operates smoothly because of linkages of one another; any disturbance may affect the functioning of the entire institutional system. As an example, the Gamarala institution cannot operate effectively if it is not integrated with the Ganasabhawa thereby to resolve agriculture-related disputes. Similarly, Gamarala position is useless if there are no customs and kinship ties.

There are several important features of the past institutions that should be highlighted. First, they are locally based. This means that their services are available to local people any time of the day and night. Secondly, the institutions are controlled locally. Thus, the services of officials based elsewhere are not required for their operation. The use of locally available inputs and services facilitate the functioning of the institutions in a sustainable manner. Thirdly, the institutions such as Gamarala and the Ganasabhawa are accountable to the local people. Finally, institutions involved in the management of resources are articulated with the functioning of the society. Hence, both the society as well as resource management are made sustainable. Widanapathirana (1995) has shown that the presence of institutions covering all the areas of management and their inter-linkages in the past have contributed to the sustainable management of irrigation systems.
Changing Landscape of Institutions and the Impact on Resource Management

Social institutions are dynamic entities and are subject to change. Analysis of these circumstances indicates two main types. First, there are natural changes in the institutions through an evolutionary process. The second type of changes has been imposed on the institutions from above from time to time. The latter, in general, are sudden and are introduced without sufficient analysis of their relevance or suitability. History provides ample evidence of institutions that failed due to natural factors and help the institutions to move with the times. The author, in his study of irrigation management, shows that 7 out of 9 institutions responsible for water management have been changed due to imposition from above over the past 200 years. The author demonstrated that the inefficient functioning of the modern institution mix as well as the poor sustainability of the resources in the modern context as a direct result of the impositions made on them.

The Modern Context

In the modern context too, the institutions are responsible for resource management. Let us take a quick look at the modern institutions and how they function.

There are four institutions that dominate resource management in the modern context of Sri Lanka. The bureaucracy over the years has grown large. It is dominant in all the sectors of the economy, from the grassroots to the top and in private to public entities. The bureaucracy is well articulated into the economy and, in fact, the economy as a whole operates through the bureaucratic system. The basic framework which enables bureaucracy to operate is provided by “Laws and Regulations”. These laws and regulations are made by the officials without consulting the people, unlike in the past. Hence, their applicability in the local context and adoption by the people are questionable. The violators of laws, regulations as well as the bureaucratic procedures are brought before the courts, which is the third type of modern institutions. Finally, the politicians representing the larger political system wield a considerable influence on the functioning of the bureaucracy as well the laws and regulations. In the recent past, the politicians have also interfered with the functioning of the court system too. For these reasons, the fourth type of institutions may be considered as the most powerful form in the present context of the country.

There are several features of modern institutions from their former counterparts. Table 2 provides a vivid picture of these features.
Table 2: Comparison of Past and Modern Institutions

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Past institutions</th>
<th>Modern Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accountability</td>
<td>To local people and organizations</td>
<td>To central government/dept</td>
</tr>
<tr>
<td>Centralization</td>
<td>Centred in villages</td>
<td>Centred in towns/cities</td>
</tr>
<tr>
<td>Involvement of people</td>
<td>Local people and their leaders involved in design, planning, implementation and evaluation of all interventions</td>
<td>Design, planning and implementation mainly by people and organizations external to the village</td>
</tr>
<tr>
<td>Knowledge &amp; resources</td>
<td>Indigenous knowledge and resources have a dominant place</td>
<td>Exotic inputs and services over shadowed indigenous knowledge and service providers</td>
</tr>
<tr>
<td>Power</td>
<td>Centred on local leaders and institutions</td>
<td>Centred on institutions based away from village</td>
</tr>
<tr>
<td>Availability of Service</td>
<td>Flexible hours of operation with service available day and night</td>
<td>Inflexible hours of operation; confined to Monday through Friday</td>
</tr>
<tr>
<td>Integration</td>
<td>Resource management aspects well integrated with those of functioning of the society. All institutions have strong links among them.</td>
<td>Institutions involved in resource management separated from those of the functioning of the society. Low or absence of linkages among institutions.</td>
</tr>
</tbody>
</table>

As shown in Table 2, the past institutions offer a high degree of flexibility, are accountable to people and are based in the villages. The participation of the people in the past institutions is very high and they are well integrated with the functioning of the society. The modern institutions are based away from the local scene, offer a low degree of flexibility, are accountable to the bureaucracy and the participation of people in their functioning is much less. The institutions involved with the management of resources are not integrated with the functioning of the society. Both the past and present institutions contribute to polarization of power in the few leaders.

Two dominant features of modern institutions which should merit attention are that they have a very high degree of formalization (underlined by formal procedures) and compartmentalization (by way of separate departments, ministries and groups). All the modern institutions, to a very large degree, have far less linkages with each other compared to their former counterparts. For instance, the
bureaucrats involved in the functioning of one ministry (or sector such as land) have nothing to do with the functioning of another ministry, say water. They have failed to recognize the fact that land cannot be managed satisfactorily if water is ill managed and vice versa. In the modern context, the place for informal institutions in resource management is much less compared to their counterparts in the past. Resource management involves considerable interaction with informal methods, procedures and institutions. The local customs, organizations and other non-formal interactions with local bodies have a very important role in the management of resources. In fact, much of these non-formal institutions are based at the local level the service of which is available to local people, throughout the day. Through the process of institutionalization, much of the functions performed by non-formal bodies at the local level have been taken over by the bureaucracy, which unfortunately functions only within a period of eight hours, Monday through Friday. The very high degree of formalization in modern institutions has resulted in a lot of hardships to resource users including high level of expenses such as in the case of dispute resolution in the courts. Some clear examples of resource management problems created by modern institutions are:

(a) increase in costs and the low profits;
(b) high degree of resource degradation and pollution; and
(c) greater conflicts with slower pace of their resolution.

The extinction of indigenous knowledge, inputs and institutions have aggravated some of these problems.

**Lessons from the Past**

One basic issue that must be given due attention to is that when the society is complex (means it has new relationships over those existed in the past), management methods should also be complex. In other words, it has to make use of a variety of institutions and arrangements including the time-tested past institutions with appropriate modifications to suit the new context and the modern ones. There is no justification to have replaced some of the indigenous institutions with modern counterparts, if the former operates satisfactorily even in the present context. It is also important to make use of not only formal but also non-formal ones as well. What has actually happened is that past institutions, methods and procedures have been replaced by new ones some of which have not even been tested in the present context. It is in this context that we must learn from and not discard, past methods of resources management.

There are several lessons that we can learn from the past. They are inter-institutional linkages, integration of institutions with the society, use of formal and non-formal institutions. Fostering of
inter-institutional linkages and integration of modern ones will contribute to sustainable management of resources. By making use of both formal and non-formal institutions will also facilitate resource management.

Apart from above lessons, it is also necessary to make two other changes in the modern institutions so that they will contribute more effectively towards resource management. One is the formation and strengthening of resource user organizations and the other is the re-organization of the bureaucracy.

Facilitation of the formation of resource user organizations (RUOs) and strengthening of already existing ones should be given top priority. After formation, the RUOs should be facilitated to plan and implement resource management plans in consultation with both modern as well as indigenous technical knowledge. Planning and implementation of resource management should become the responsibility of RUOs and not bureaucracy as practiced at present.

As discussed earlier, the bureaucracy has grown so much that the manner through which it operates undermines rather than facilitates the management process. It does not have a regard for the customs and rituals. The functioning itself is inefficient with the misuse of resources, failure to attend to resource use issues and conflict restoration at the local levels. Therefore, reorganization of the bureaucracy is an urgent need. Such reorganization should consider, among others, the following aspects:

• making it accountable to RUOs;
• making it obligatory for the officials to work through RUOs;
• obtaining views and recommendations of RUOs with regard to promotions and transfers of officials;
• sensitization of officials with regard to local customs and rituals and should facilitate their functioning.

It is also necessary to develop strategies whereby the efficiency of the bureaucracy is increased through incentives provided by the RUO.
References


On-Farm Economically-viable Micro-Irrigation achievements by Innovative Farmers in Maharashtra

by S.S. Magar\textsuperscript{32} & Y.S. Nerkar\textsuperscript{33}

Introduction

Water for agriculture is a limiting factor in Maharashtra. Present 2.8 mn ha irrigation area may increase to 72 mn ha with great efforts. On the other hand, Water Use Efficiency has to be enhanced significantly. Hence, micro-irrigation would be an excellent substitute for traditional irrigation methods. The drip technology is modest, sophisticated and required some need-based modification for its fast spread. Farmers had brought certain changes in drip design and components that had proved technically feasible and economically viable. There was a saving in capital investment due to adoption of pair-row planting pattern in sugarcane and other cash crops to the extent of 30-35 per cent. The changes made by the farmers at grassroots level concerned with replacement of and plug and position of lateral in grape and yielded results. The economically viable micro-irrigation achievements of about 1.0 lakh ha were mostly concentrated among innovative farmers in the state.

Maharashtra does not belong to the category of with abundant water resources. It is estimated that about 15 per cent of 18.8 m ha gross cultivable area is under irrigation in the state. However, potential area under irrigation after harnessing maximum possible water resources will not exceed more than 7.2 m ha. The productivity of food grain crops in command areas of a major irrigation project was dwindling by about 2.0 t/ha per annum in the state (Anonymous, 1993). In general, the irrigation efficiency is comparatively low ranging from 30 to 35 per cent. It is also pointed out that the major share of water resources is diverted to sugarcane and banana crops. Excess irrigation to these crops had resulted in water logging and salinity problems.

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This situation has compelled the farmers to switch over to micro-irrigation systems. There was strong technical backup from Agricultural University and the State Government financial support. In spite of all this, the drip irrigation system in Maharashtra has not spread fast enough because of lack of participation of grassroots level farmers prior to 1990. Subsequently, an area of 1.0 lakh ha has been reported under drip irrigation owing to farmers’ participation in a span of five years. Now, the state Government is planning to bring an area of one million hectares under micro-irrigation system during the coming decade.

However, the success and credit go to the grassroots beneficiaries because of their innovations while adapting to the drip/ trickler irrigation. The design and installation are technical aspects, but maintenance and operation of drip system solely depend on farmers’ initiatives and innovations. Mahatma Phule Agricultural University, Rahuri, passed on several recommendations on design, operation and maintenance for successful implementation of drip irrigation for vegetables, orchards and cash crops on different types of soil during the last decade. Research achievements of drip irrigation during last decade are reported in Table 2 (Magar et. al., 1987).

Lusk (1987), an eminent irrigation sociologist, has given some considerations for strategy of appropriate technology for effective water management. These are (i) local materials (ii) encourage self sufficiency (iii) reduce dependence on energy (iv) cut input and output costs (v) provide local employment and maintain local expertise.

**Innovation in Design Aspects**

The design of drip system includes the diameter of main, sub-main and lateral which are important technical parameters in uniform distribution of water. Farmers are aware of diameters of different tubings because the selection of the next class of lateral would involve additional cost.

The details of technical aspects, modifications in respect of lateral dripper position, and plug fertilizer tank etc., brought out by the farmers are reported in Table 3. The reduction in the cost of end plug due to introduction of ‘O’ rings was significant.
Specially designed PVC and plugs normally close the end of lateral tubing. The cost of such end plug was ranged from Rs.2 to Rs.4 depending upon the design. Simple ‘O’ ring was prepared from 25 mm PVC pipe by the farmers from the Baramati area under the guidance of Agricultural Development Trust, Baramati, Pune District. Fertilizer tank for irrigation purpose has decreased the cost by 50 per cent as compared to Ventury. Some farmers have used the micro tube in a manner of coiling which has served the purpose of drippers adjusting their diameter and length. Sugarcane growers from Kopergaon Sugar Factory, Kolapewad, District Ahemednagar, have successfully used the micro tubes technology for sugarcane crops.

As per the recommendation, the lateral pipe is laid down on the soil surface for each grape row, which was posing problems for inter-culturing and fertilizers application. At the same time, lateral pipes ruptured due to mechanical operation. Hence, grape growers from Narayangaon region of Pune district and Kasegaon region of Solapur district had changed the position. They to get maximum uniformity co-efficient also provided the change in position of lateral.

It is essential to maintain desired pressure in the drip system to get expected uniformity in water distribution. For example, the desired pressure of 1 kg/cm² is necessary to get uniform emitter discharge throughout the lateral length. The reduction in pressure may cause variable discharge at initial and extreme ends of the field. Generally, the water discharge is adjusted with the help of pressure values. The tube well in drought-prone areas of the State had low discharge ranging from 30-60 litres per minute. Under these circumstances it was difficult to maintain the optimum pressure in the system.

Such low discharge of tube well was successfully utilized by the farmers. The requisite drip plot is planned precisely considering the NIR of crop and soil type, which would be matched perfectly with the low discharge of tube well. Farmers from drought-prone areas of Sangola, Solapur district, have adopted this system.
The farmers based on their experience manifested earlier recommendations of construction of water storage tank and subsequent use with higher discharge. This has become the general practice for adoption of low discharge tube well drip model in Solapur and Ahmednagar districts.

It has saved the cost of construction of water storage tank. Shri Dynaneshwar Krishi Vigyan Farm, Dnyaneshwarnagar, set up an excellent example. It is reported that 50 per cent tube wells are generally categorized under low discharge (75 litres per minute). Such tube wells are treated as “Failed borewell” as per standard norms of NABARD for the financial purpose. The grape and pomegranate growers from Tasgaon, Sangali district and Sangola, Solapur district, proved that farming could be made profitable even under acute shortage of water. The fruit growers had super-imposed the perfect plastic mulch over drip irrigation system under severe water resource constraints for export of quality fruits.

**Innovation in Crop Geometry (Non-Cash Inputs)**

Normal solid planting system with recommended spacing for sugarcane and banana is not suitable for drip system. The recommendations of agricultural universities were restricted to the paired row planting, maintaining the same plant population per unit area. This has reduced the cost of LDDE lateral pipes to the extent of 50 per cent. However, it did not help in solving the problems of emitter checking due to heavy loading in sugarcane, and inter-culturing in banana. The higher productivity is coupled with soil, water and nutrient management aspects.

Many farmers of Alephata village, Pune district, adopted an integrated approach of the above inputs super-imposed with BBF technique developed by ICRISAT, Hyderabad. The details of recommended practices and the modified version of the drip system with different crop geometry for different crops, are given in Table 4.

Ingale and Sagane (1992) have elaborated the constraints in the use of drip irrigator system in Maharashtra state. The distribution of respadets according to knowledge and adoption of drip system
indicated the farmers are well aware of the drip system. It is interesting to note that further scientific experimentation on this work proved the hypothesis. The minimum lodging of sugarcane and day-to-day inspection of emitters due to skipping a row after every four rows are the striking features of agronomic innovation made by them. His demonstration plots motivated hundreds of sugarcane and banana growers. The yield of banana to the tune of average of 100 t/ha was excellent achievement by them. Experimental yield levels of sugarcane in drip system were mostly reflected up to 166 t/ha in the earlier work. However, it was creditable to the grassroots workers that they could achieve the yield levels of about 200 t/ha.

It is concluded that scientific experiments and recommendations for package of inputs management have scope for improvement on location specific basis. Farmers' participation and innovations would be encouraged to avoid the location base shortcomings. Such innovative farmers would act as catalytic agents between research institute and grassroots level farmers.
References


Annexures

Table 1. Yield and response and saving of water

<table>
<thead>
<tr>
<th>Crops</th>
<th>Yield (g/ha)</th>
<th>Water applied (cm)</th>
<th>Water saving per cent</th>
<th>Per cent increase yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Surface</td>
<td>Drip</td>
<td>Surface</td>
<td>Drip</td>
</tr>
<tr>
<td>Cotton</td>
<td>23.30</td>
<td>29.50</td>
<td>89.53</td>
<td>42.00</td>
</tr>
<tr>
<td>Ladies Finger</td>
<td>152.61</td>
<td>177.24</td>
<td>53.68</td>
<td>32.44</td>
</tr>
<tr>
<td>Tomato</td>
<td>164.00</td>
<td>171.86</td>
<td>29.70</td>
<td>20.84</td>
</tr>
<tr>
<td>Brinjal</td>
<td>280.00</td>
<td>320.00</td>
<td>90.00</td>
<td>42.00</td>
</tr>
<tr>
<td>Bitter gourd</td>
<td>154.34</td>
<td>214.71</td>
<td>24.50</td>
<td>11.55</td>
</tr>
<tr>
<td>Ridge gourd</td>
<td>171.30</td>
<td>200.00</td>
<td>42.00</td>
<td>17.20</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>1582.81</td>
<td>1667.00</td>
<td>195.0</td>
<td>78.47</td>
</tr>
<tr>
<td>Cabbage</td>
<td>195.80</td>
<td>180.00</td>
<td>66.00</td>
<td>26.67</td>
</tr>
<tr>
<td>Banana</td>
<td>551.00</td>
<td>605.00</td>
<td>262.00</td>
<td>131.00</td>
</tr>
</tbody>
</table>

Magar et al., 1987

Table 2a: Cropwise area covered under drip irrigation in Maharashtra State

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Crop</th>
<th>Area (ha)</th>
<th>Sl. No.</th>
<th>Crop</th>
<th>Area (ha)</th>
<th>Sl. No.</th>
<th>Crop</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Grape</td>
<td>20026.38</td>
<td>12.</td>
<td>Lemon</td>
<td>115.11</td>
<td>22.</td>
<td>Sugarcane</td>
<td>14918.45</td>
</tr>
<tr>
<td>5.</td>
<td>Orange</td>
<td>7946.66</td>
<td>15.</td>
<td>Fig</td>
<td>147.97</td>
<td>25.</td>
<td>Betal vine</td>
<td>26.59</td>
</tr>
<tr>
<td>7.</td>
<td>Papaya</td>
<td>875.79</td>
<td>17.</td>
<td>Cashew</td>
<td>159.90</td>
<td>27.</td>
<td>Tot. Area</td>
<td>82922.34</td>
</tr>
<tr>
<td>8.</td>
<td>Chiku</td>
<td>2167.12</td>
<td>18.</td>
<td>Flower</td>
<td>64.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Ber</td>
<td>2831.87</td>
<td>19.</td>
<td>A/nut</td>
<td>5.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Guava</td>
<td>1051.86</td>
<td>20.</td>
<td>Awala</td>
<td>17.69</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2b: Districtwise area covered under drip irrigation in Maharashtra State
<table>
<thead>
<tr>
<th>Sl No.</th>
<th>District</th>
<th>Area under drip (ha)</th>
<th>Sl No.</th>
<th>District</th>
<th>Area under drip (ha)</th>
<th>Sl No.</th>
<th>District</th>
<th>Area under drip (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Raigad</td>
<td>216.32</td>
<td>12.</td>
<td>Sangli</td>
<td>4317.64</td>
<td>22.</td>
<td>Akola</td>
<td>1558.25</td>
</tr>
<tr>
<td>6.</td>
<td>Dhule</td>
<td>1181.43</td>
<td>16.</td>
<td>Beed</td>
<td>1235.35</td>
<td>26.</td>
<td>Nagpur</td>
<td>1109.05</td>
</tr>
<tr>
<td>7.</td>
<td>Jalgaon</td>
<td>11534.12</td>
<td>17.</td>
<td>Latur</td>
<td>2670.36</td>
<td>27.</td>
<td>Bhandra</td>
<td>345.014</td>
</tr>
<tr>
<td>8.</td>
<td>A’nagar</td>
<td>6677.08</td>
<td>18.</td>
<td>Osmanabad</td>
<td>1254.41</td>
<td>28.</td>
<td>Chandrapur</td>
<td>107.20</td>
</tr>
<tr>
<td>10.</td>
<td>Solapur</td>
<td>6931.58</td>
<td>20.</td>
<td>Parbhani</td>
<td>2473.36</td>
<td>30.</td>
<td>Drip demon</td>
<td>476.08</td>
</tr>
</tbody>
</table>

Table 3: Details of technical modification/alteration/replacement of parts etc. in drip system brought out by the farmers (cash inputs)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Recommended design part</th>
<th>Altered modified design part</th>
<th>Important features</th>
<th>Added advantages</th>
<th>Cost saving if any (per cent of total cost)</th>
</tr>
</thead>
</table>

157
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Specifications</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Specially design PVC end plugs 'O' ring fabricated from 25 mm PVC pipe</td>
<td>Simple in operation, Useful for both 12 or 16 mm laterals</td>
<td>1.00</td>
</tr>
<tr>
<td>2.</td>
<td>Ventury fertilizer Assembly Fertilizer tank Inflow outflow method</td>
<td>Large quantity can be applied at high speed. Water soluble fertilizer use</td>
<td>8.00</td>
</tr>
<tr>
<td>3.</td>
<td>Pressure compensating or sophisticated emitter Online micro tube with cooling system</td>
<td>Free from clogging, Checking low cost</td>
<td>7.50</td>
</tr>
<tr>
<td>4.</td>
<td>Construction of water storage tank under low discharge tubewell Low discharge is coupled with drip irrigation for maintaining the pressure by valves Optimizatio n of discharge and pressure through block system Automation. Human error is eliminated</td>
<td>Automation. Human error is eliminated</td>
<td>Separate item cost reduction</td>
</tr>
<tr>
<td>5.</td>
<td>Adoption of drip system Introduction of earthworm compost and green manuring with drip Recycling of plant biomass after harvest</td>
<td>Optimizatio n of soil physical properties and maximizatio n of nutrient transformati on and availability.</td>
<td></td>
</tr>
</tbody>
</table>
Table 4: Details of recommended practice and modified version (non-cash inputs) in drip irrigation system brought out by the farmers

<table>
<thead>
<tr>
<th>S No</th>
<th>Recommended practice</th>
<th>Modified version by the farmers</th>
<th>Added advantages</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lateral on the ground in the grape row</td>
<td>Hanging lateral at one meter height</td>
<td>Easy for interculturing. Laterals are not disturbed. Life increased. Rodent prone.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Pair row planting of sugarcane</td>
<td>Skiprow after four rows</td>
<td>Becomes possible for dripper and lateral inspection for clogging rectification</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Normal planting (5’X5’)</td>
<td>Pair row planting (2.5 - 8X5 ft) BBF</td>
<td>Initial cost reduction. Reduction in labour due to mechanical inter-culturing Organic farming. Reduction in the cost</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>ISI standard materials</td>
<td>Low cost PVC emitters with sliding collar (stumps)</td>
<td>Operates at low pressures-small scale manually operated.</td>
<td>No subsidy is provided. UC is Questionable</td>
</tr>
</tbody>
</table>

My Mind is made up, do not confuse me with Facts: An Analysis of Bureaucracies and Use of Local Knowledge

by S. Manikutty

Introduction

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In a drought-prone village in Karnataka, hand pumps, piped water and cattle troughs were provided to help the residents and their cattle. Two years after completion of the project, the hand pumps became useless as the water turned out to be brackish. The cattle troughs remain completely unused.

In another village, the drainage channel cuts across the road through which bullock carts pass. Stones are laid over the drains to enable the carts to pass. The villagers just covered the drainage to enable smooth movement of their carts.

In a Rajasthan village, bathrooms and household toilets are constructed as a part of a water and sanitation project. They are used as store rooms!

Such instances occur regularly in many development projects, as the facilities do not meet the requirements of beneficiaries.

This paper examines why officials who implement such projects are unable to assess and understand the needs of their beneficiaries and deliver accordingly. Local knowledge is vital to the success of such projects and the officialdom is not equipped to absorb local knowledge and use it to carry out modification required in the projects to match beneficiary needs.

**Barriers to Utilization of Local Knowledge**

Bureaucracies are reluctant to use local knowledge. The reasons are
1. Their internal structure makes such absorption difficult;
2. Their incentive structure makes such absorption unlikely;
3. Absence of community pressure leading to a sense of complacency.

• **Problems from Structural Factors**

An “ideal” bureaucracy as conceptualized by Weber functions like an oiled machine with interchangeable parts. It does not depend on persons and the decisions are made as per rules and not on the whims and fancies of individuals. This ensures temporal and longitudinal consistency of decisions and requires a set of standard operating procedures (SOPs) (March and Simon, 1964) to ensure “rule of law”. There is a procedure for buying materials, awarding contracts and spending funds, etc.
These SOPs sometimes leads to rigidities making it difficult to modify procedures. Adapting the designs and procedures in response to every local need demand can lead to serious loss of efficiency and may also be impossible. Even in cases where local knowledge could lead to better outcomes the bureaucracy finds it difficult to carry out the needed modifications. Karnataka provides an interesting illustration. The Public Health Engineering Department (PHED) on the advice of the Department of Geology drills the bores in that state for the hand pumps. In most of the projects, PHED is guided by the advice of the geologists and the community was not involved except to show convenient sites.

In many cases the villagers, however, pointed to sites that were not merely more convenient - but which were likely to yield sweet water. These did not correspond to those chosen by PHED. In one village, it was decided to go solely by the recommendations of the villagers. The success rate was an amazing 90 per cent. Encouraged by this, the method was extended to three more villages. The results were the same. PHED officials followed the residents’ recommendations in the remaining villages. The PHED did not, however, adopt the practice to its other projects. One reason was that despite the positive experience, there was no “scientific basis” for the villagers’ methods.

The geologists could identify but they could not locate sweet water, while the villagers’ “hunches” seemed to lead to sweet water in a number of cases. The result: large number of hand pumps could not be used due to brackish water. The officials were afraid of another problem. If the villagers’ methods turned out to be wrong who is to account for the failure. They played safe by following procedure to save their skin.

Local knowledge challenges established knowledge and quite often this may have no scientific basis and so the likelihood of such knowledge leading to changes in SOPs is small.

But why can local modifications not be made without changing the SOPs? One reason is that such adaptations disturb uniformity in working. It is difficult for officials to work with a different design in every location. This according to them enhances their efficiency. The second reason is that few in the bureaucracy have the incentive to undertake such modifications.

Local knowledge gained is distributed across many units. For the beneficiaries it is one project, to the bureaucracy it consists of numerous sub projects, each executed by a different wing. Even though in a particular case the learning might have taken place collectively (as for example, the officials from Geology Department as well as PHED may have imbibed some local knowledge), once the particular learning episode is over, it is each to his/her department.
Frequent transfer of officials is another barrier to local knowledge. Officials, who know their tenure at a given place is limited, do not feel enthused to imbibe this local knowledge which may not be relevant in another area. Thus, every time an official is posted to a new location, he/she has to learn afresh. There is, therefore, marked reluctance to learn purely local knowledge and the tendency is to stick to “general principles and procedures. In many organizations, short-term activities take precedence over long-term activities with the result learning which may lead to long-term benefits gets little attention.

**Incentive Systems in Bureaucracies**

Bureaucracies tend to base their system of rewards on sticking to rules rather than encouraging initiatives. Accountability is not for results achieved but for observance of procedures. The boss interprets rules and an official feels secure so long as he scrupulously follows the rules. This mindset does not promote innovative ways of finding a solution. The beneficiary does not normally exist in the scheme of things.

Thus in water supplies project the convenience of the beneficiaries or usages of facilities by them are generally not the parameters on which the implementing officials are assessed. There are “inward oriented” parameters such as the time required to construct the facilities, the cost at which they are constructed and the ease with which they could than the external efficiency (Rhenman, 1973). The Kerala Water Authority (KWA), for example, found that it was preferable to locate the taps on sides of the main roads rather than where people actually live. This way; maintaining the facilities is a lot easier and cheaper.

KWA which was the implementing authority in a bilateral project with community participation sited the taps based on different norms that emphasized the convenience of beneficiaries (the maximum distance for a tap was 250 ft. from any household). This led to greater convenience and satisfaction for the beneficiaries (Manikutty, 1996). Privately, during our discussions with KWA officials, most of them felt that this was a good model to follow. Yet this procedure was not transferred to KWA’s other (and subsequent) projects; no one had the incentive to do so.

Incentives are always organizational. The local elite offer incentives such as status in local society. Perhaps preferential access to services and resources controlled by them (e.g. schools) or outright monetary rewards to local officials who then tend to have far less objections about bending of rules and procedures in favour of the special beneficiaries. At first all are given access. (after all they are public pumps). But slowly only persons favoured by the leader are given access. Access to the water
source then becomes a means of patronage. In extreme cases, leaders are known to fence off the pumps, making them their private property with the connivance of officials.

- **Absence of Community Pressure**

The community could put pressure on officialdom to improve the designs and modify the procedures to improve the services. In Kerala, for example, in the bilaterally aided project, the community, through its local water committees and elected members of the village local bodies, could exert pressure to improve maintenance and fault repair procedures. This was possible because the local members of the bureaucracy live in the community and need their cooperation in their personal and even official life.

We do not claim that the barriers discussed above are exhaustive. It was our purpose to highlight these three barriers which seemed to us as major. We now proceed to discuss how they could be overcome.

**Will the Bureaucracy See Facts?**

This section proposes three methods to overcome the barriers: community participation in development projects, use of intermediary organizations such as NGOs; and building bureaucracies as learning organizations with incentives for learning and utilizing this learning.

- **Community Participation**

Community participation means an active role for the people in making decisions. As noted by Paul (1987). Community participation can vary considerably in degree and kind: it can de vary all the way from mere information dissemination to having the final say a substantial say in all decisions affecting them. We use the term in the sense of the community having, if not the final say, a substantial say in the decisions so that it would be difficult to carry out a decision without concurrence from the community. The operating procedures stand modified at the beginning of a project.

The decision making has to be democratic and interactive. The bureaucracy will identify the options and present them to the community. They would then set the parameters like the overall budget. The community would examine the options (and the costs involved) in the light of their local knowledge.
An example of how this can work in practice is in the selection of sites for common facilities such as hand pumps or taps. The community would jointly decide the facility location. The plan would be displayed in a public place such as the office of the local Panchayat and objections invited. Only after taking these objections into account would the plans be finalized.

Another example would be the identification of beneficiaries for different levels of subsidies (in facilities such as household latrines). This is an especially sensitive subject. With great scope for rent seeking by local elite and officials. Again the process should be transparent.

There is no reason to believe that such decisions by “unsophisticated villagers” would lead to inferior decisions. In a pipeline water supply project in Gujarat, it was found that roots of certain trees and bushes could penetrate through the small gaps and gaskets in the pipeline joints and grow inside the pipe, blocking it eventually. Where to locate the joints for the pipe lines was a decision whose quality would improve greatly if local knowledge of the people as to which trees and bushes could thus penetrate could be used.

Many water supply projects are designed on the basis of the static population of the areas they are to serve. In two projects we had studied, the impact of migrant people on water consumption patterns was ignored altogether in demand formulation. Taking migrant population into account for estimating the water requirements simply did not figure in the ‘SOPS of the respective Water Boards, who were the implementing agencies for the projects. The bureaucracy in both the states knew neither about the extent of the migration nor their routes. The result was that after the projects was implemented the migrating, people would frequently break open the pipelines to get water for themselves and their cattle. Pipeline breakage became a serious problem during certain seasons of the year. This situation could have been curtailed if the community had been involved in the decision making from the planning stage itself.

Gupta (1980) has argued that the interplay between communication and power at the grassroots level can be conceptualized through a 2 X 2 matrix with the direction(s) of the communication taking place between the bureaucracy and the beneficiaries on the one hand, and the power relationships between the two on the other (see Figure 1 below). He has argued further (1996) that knowledge network, in general, move the relationship towards a greater degree of two way communication and power sharing. What community participation does. Through generation and communication of local knowledge to the bureaucracy is also similar, it paves the way for better involvement of the community. More humble approach on the part of the bureaucrats towards the tasks on hand, and eventually, towards higher empowerment. This is seen from Figure 1 below.
Figure 1: Communication vs. Power

<table>
<thead>
<tr>
<th>Communication</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>No way</td>
<td>Indifference</td>
</tr>
<tr>
<td>One way</td>
<td>Street singer</td>
</tr>
<tr>
<td>Two way</td>
<td>Collegial learning</td>
</tr>
</tbody>
</table>

- **Use of Intermediary Organizations**

There are two major difficulties in direct community participation. First, unorganized community finds it difficult to match the superior education and power of the bureaucracy. Thus, the bureaucracy may continue to take the decisions; or the elite may pose as the representatives of the community and take decisions in their own interest.

Intermediary organizations provide one answer to such problems. In the extreme case, they could take over the full responsibility of implementation. This was the case in a water supply project in Rajasthan where an NGO took the entire responsibility for implementation. There could also be groups of professionals who serve as a link between the community and the government. This was the arrangement in Kerala where “Socio-Economic Unit” (SEU) was formed, consisting of professional, and this group could exert considerable influence both on the community members and bureaucracy. A third arrangement could be local village committees consisting of local leaders, social workers and grassroots organizations. Depending on the compositions of these committees and the extent of real power delegated to them, they could wield considerable influence on bureaucracy.

- **Building Bureaucracies as Learning Organizations**

Bureaucracies both learn and modify their procedures provided they have the incentives and the will to do so.

Organizational learning is essentially how the learning of individuals get translated into a collective learning available across the whole organization. A learning organization in one that has skills of creating, acquiring and transferring knowledge, and at modifying its behaviour to reflect new knowledge and insights (Gavin, 1993). With regard to organizational learning, there are two dimensions to be considered. The first is the learning of the local conditions that necessitate modifications in SOPs. The SOPs need to be made flexible so that local knowledge can be imbibed and the procedures modified. The second dimension is the acquisition of local knowledge from one
place that needs to be applied in another place. Here the learning involved is essentially for institutionalization of transfer of learning.

How do we build such learning organizations? The building blocks of learning organizations are: systematic problem solving, experimentation, learning from past experience, learning from others, transferring knowledge to other units of the organization and utilization of this knowledge in future decisions and actions (Gavin, 1993).

Incentives to encourage learning are the first step. This is related to the accountability question, and the question really is whether greater accountability from bureaucracy can be extracted through a suitable system of incentives. Much has been done in this regard in the U.K. and Canada, the political dimension of this problem can not be ignored before presenting a similar solution to a country like India.

The next step is to foster an environment conducive to learning, provide opportunities for adequate reflection and thought and periodic evaluations that are non threatening.

Building mechanisms for learning and transfer of learning is less difficult. Several mechanisms have been discussed in literature such as institutionalization of the processes of learning and utilization of this learning, identification of people interested in learning, and devising of supporting systems and processes (see, for example, Ramnarayan and Bhatnagar, 1993). Tours in other project areas, rotation of personnel and specific incentives for application of knowledge brought from one situation to another are other means.

**Concluding Remarks and an Agenda for Research**

Effective utilization of local knowledge has been conceptualized here along two dimensions: the organizational dimension and the trade-off dimension. It has been argued that by their very nature, bureaucracies are not suited for effective adoption of local knowledge unless there is considerable pressure on them to do so and suitable incentive systems are devised. Even so there is a trade off between the need for local adaptation and the need for standardization. Evidently no point of “golden mean” can be prescribed for this dimension but it is important to reorganize that this point does not lie at the extreme of complete standardization. Non-standardization can lead to inefficiencies, but not catering to local needs and conditions and not using local knowledge can lead to even greater inefficiencies.
Intermediary organizations offer the best chance for effective absorption of local knowledge in development projects. Community participation, unless insisted upon and supervised by bilateral and multilateral agencies, seems to be too fragile to stand up to the bureaucracy in a sustainable manner. From past experience, it seems that reforming the bureaucracy has been a frustrating process. But having intermediary organizations also carry major risks. The organizations may not be competent; in some cases they may be little more than front organizations run by vested interests. They could have serious problems of scale replication. They may be unable to transfer their own knowledge to another location or different circumstances. They may be too highly driven by ideologies. They may give priority for an ideological position rather than the overall objectives of the projects. But it would appear that, given the importance of the need for utilization of local knowledge in development projects, intermediary organizations offer the best bet.

This would imply a fundamental shift in the way projects are handled. The government must see itself as the provider, rather than the implementers of projects. It has the responsibility of specifying the overall parameters and specifications for the project and for its timely completion, but the actual implementation would be left to the intermediary agencies. This way, among other advantages, the barriers discussed earlier could be bypassed. Of course, this would involve learning of quite new skills on the part of bureaucracy, but learning of new skills could be a lot easier than modifying existing SOPs. Besides, other organizational devices such as separate project organizations or organizational units could be considered.

Some interesting questions for future research are indicated by our analysis. Among these are:

(a) Documentation of how local knowledge has been utilized by different organizations (including bureaucracies) in different kinds of development projects so that the conditions that are conductive to such adaptation could be identified.

(b) Documentation of instances when, despite useful local knowledge being available and offered, bureaucracies failed to take them into account, and why they did not do so.

(c) Effective mechanisms for learning and transfer of learning.

(d) Intermediary organizations as carriers of local knowledge: their strengths and limitations.
References


Local Practices and Innovations in Common Property Management in Northern Vietnam

by Ly Van Trong & Tran Thi Thu Ha

Introduction

This study presents local practices and innovations in common property management in forestry and agriculture. The results indicate promising socio-cultural and technological practices that could help integrate sustainable rural development projects. The results also show the need for further learning activities.

1. Background

1.1 Rural Status before Revolution, August 1945

Vietnamese Economy was based on a backward agricultural platform before the revolution of 1945. Production depended on natural conditions. Rice yield was 1.2 ton per ha. by 1930-1944 while in Japan it was 3.4 ton and in Thailand 1.8 ton. Peasants comprised 95 per cent of the total population and held about 40 per cent of the total agricultural land but had to pay 40 per cent of total income as tax. In 1945, two million out of 12 million died of starvation in Northern Vietnam. Out of the 12 million peasants, more than 90 per cent of the peasants were illiterate. There were only 650 doctors and nurses. The income difference between the poor farmer and the landlord was one and 500. The scenario in the rural areas was the darkest-ever in history.

1.2 Present Situation of Rural Area in Vietnam

At present, 70 per cent of the 47 million Vietnamese live in rural areas. They consist of 9,652 households in about, 9,000 communes (among them 400 communes are still not accessible by car) or 50,000 hamlets (1992). The villagers contribute more than 200 million farm workers and their population growth rate is 2.4 per cent.

The farming area in rural zones is 6.993 million hectares occupying 21 per cent total area (per capita land national wide is 1,030 sq. m.). Agricultural land is classified into 5.339 million hectares for annual crops growing or 76 per cent (among them 4.300 million hectares for rice producing), 1.405 hectares or 15 per cent land for perennial trees planting and some other land for pasture. Forest land

35 University of Agriculture and Forestry, Bac Thai, Thai Nguyen city, Vietnam
36 See Chu Huu Qui, 1995
is 9.395 million hectare (per capita is about 1,400 sq. m.) or 28 per cent total area. Among those, natural forests are 8.723 million hectares and man made forest are 0.671 million hectares. Forest production is estimated at 600 million cu. m. of wood and 5 billion bamboo stems. There are more than 20,000 hectares of valuable plants as pine, anise, cinnamon, etc. The forests cover about 7,000 species of vegetation and 1,000 species of wildlife and insects. After ten years of Doimoi (Renovation) rural areas get some success, especially in agriculture, forestry. Followings are some main significant aspects:

- The annual rice production is increasing but is still not sufficient for rural areas.
- Annual average afforestation is 10,000 hectares, deforestation, however, is pronounced: One H’mong family of 11 members destroy 1.5 hectares of forest a year.
- The main source of rural income is agriculture. Crops occupy 74.5 per cent livestock, 25.5 per cent and forestry 4.7 per cent (where is forested 15-20 per cent), the rest are handicraft: 16.6 per cent and service: 5.3 per cent. Vietnam economy still is a ‘rice economy’ as it provides 70 per cent of the income. Poor, backward infrastructure is the bane of farming activity. Credit service and foreign investment are inadequate.
- Rural population growth rate is relatively high. Job opportunity is not sufficient.
- Socio-economic policy system still lacks stimulating motive power like consumption and extension policy.

2. Rationale

Most of the villagers are living in mountainous areas; the economy based on farming and forestry. The long-term strategy for forestry should be changed to “People's forestry” (Nguyem Quang Ha, 1992). The authorities should shed the fear that people (especially locals), left to their own devices, would destroy the forest resources.

With the Doimoi (Renovation Scheme) the Government has decided to allocate land to the cooperatives and individuals for farming, agro-forestry and other types of production. However, the policy is being implemented in a careless manner. The preliminary land registration booklets have been issued but not the land use certificate. There is no microplanning of land use and it is not based on local practices.

The trend nowadays is to look for the local practices or innovations in common property resources management for sustainable, low-cost approach for implementation of a project. The terms common

37 See Ly Van Trong, 1995
property and common property resources in Vietnam are understood quite differently. However, the outcome of this paper can provide some orientations for their management in some cases.

Vietnamese countryside is rich in tradition, diverse cultures, but with long periods of strife. Many of these practices may still be useful for developing the country in these days. The study has been conducted to bring about the changes, with the aim of meeting the goal mentioned above.

3. Objectives

1. To learn local practices and innovations in different ecological and socio-cultural backgrounds.
2. To identify the possible linkages between traditional values and formal regulations, law and their integration to project approaches of rural development.
3. To suggest initial methodology for learning the local practices, innovations based on PRA tools.

4. Scope Of Study and Methodology

4.1 Time

The study was targeted to probe a long historical period. Learning process was focused on three relatively separated periods: before 1954 (probably 1945-1954), 1954-1986 and 1987 up to now: the Renovation period.

The reason for focusing on the main periods mentioned above is due to the typical aspects characterized by socio-economic background which led to influencing local innovations.

4.2 Locations

Learning process was conducted mainly in Bac thai, Lang son, Cao bang provinces; for some components it has been extended to Vinh phu, Ha bac, Tuyen quang provinces.

- Ecological Diversity: Cao bang and Lang son are representative of northern and northeast highland area, while Vinh phu, Bac thai are for midland and highland.

- Socio-economic background: There are differences in ecological aspect, leading to diversity in economic context: Bac thai and Vinh phu are advanced compared to Cao bang and Lang son.
• Ethnic Group Composition Orientation: It is difficult to show ethnic variations in a region, nevertheless, Cao bang and Lang son are dominated by Tay and Nung, the others are Kinh (the majority in Vietnam) Bac thai is rather a mixture of almost all nearby regions.

4.3 Area of local practices, innovations

The study has identified some subject areas as follows:

• Socio cultural aspects are related to religious basis and ethnic custom.

• Technological Innovations like farming methods among local people in agroforestry, use of non-wood forest products and the changes they brought about.

4.4 Conducting the process of learning

Team Member Composition: Researchers from the University of Agriculture and Forestry, Bac thai, had been grouped into two: every three member group had one Kinh, one Tay and one Nung, each group had one female member.

Rapid Rural Appraisal method was adopted, as it was an interdisciplinary study of technical and socio-cultural background.

The team had a primary search for materials like books, newsletters, newspapers, etc. The most important source of material was informal information written or oral stories transmitted from one generation to the next.

Each group visited the targeted sites. The visit at first was to same institution like Department or Office of Culture and Communication and Department or Office of Agriculture and Rural Development in the Provinces and Districts. It was a preliminary step before collecting detailed information.

Communes, villages or even scattered hamlets and cottages turned out to be the desirable venues. Survey methods consisted mostly of in-depth interview and observation under the topics prepared in advance.

5. Findings
5.1 Socio-cultural Field

The cong (Tho ty) - A Customary Regulation of Tay, Nung ethnic groups.

The Tay, Nung and Kinh ethnic groups have their settlements in valleys closely linked to forests. They have developed appropriate mechanisms for protecting and exploiting their natural environment to find resources for survival. The protection of crops, animal, water sources and forests is the concern of both individual households and the whole community.

Many villages have traditionally regulated the use of natural resources. There is also coordination among villages with legal intervention from local authorities. Regulations are possible only when the whole community is involved.

The cong (Tho ty) has existed for a long time and was clearly recognized during 1930-1954 and is currently known in other ways. “Tho cong” was called in Ba be, Ngan son, Thong nong Districts (Cao bang province) and Bach thong, Cho don Districts (Bac thai province), while “Tho ty” was called in Loc binh, Chi lang, That khe Districts (Lang son province) or in some other places.

Tho cong or Tho ty in Tay Nung people’s concept was the God protecting the life of the people, animals and crops in a certain living area. The concept differed from place to place and a little from Tay to Nung group, but the idea is the same.

Tho cong could have the same topographical position. Each village or a group of villages might have a single place of worship for people living in the same area. There could be several places for people living in different places (in Thong nong, for example). Dense trees and a small temple with a joss-stick pot (sometimes it could be three pots, in Ba be for instance) served as a shrines. It was considered a holy grove and no one was allowed to cut trees, collect firewood or graze cattle. Tay people call it “Dong shan” (“Forest of God”).

Anybody violating the sanctity of the place would make the God angry leading to destruction of crops and livestock and other calamities. The violator could fall victim to accident or disease. Such sentiments have been handed down from generation to generation.

The religion belief in Tho cong has been playing an important position in the spiritual life of Tay, Nung people. They considered Tho cong had power that could help the family become prosperous or punished those who displeased him.
For whole village: The worship of Tho cong started from first day’s afternoon every year. Offerings of chicken and various kinds of cake were offered. The priest, often the religious head was selected by families at the same Tho cong because of his prestige and knowledge of tradition. Sometimes he was also the headman or the head of one group of families. In his praying he read the name of individual family with its members, all the same time “reported” about those who died, those who were newly migrated or settled in the year. After sermon, everybody sat around the place of worship and ate cakes and drank wine. The chicken was taken for the family, a small piece was kept with the joss-stick burning. While eating people discussed regulations, commitments from village or a group of families having the same Tho cong.

For individual family: Each family could also worship in their houses. However, their worship “corner” should belong to the common place where whole village prayed. Individual could sometimes pray in his or her “corner” then they brought some parts of Joss-stick to the common place pot as a signal of thing to be reported.

In most of cases, the regulations consisted of the following:

- Maintaining order and security
- Protection of production, particularly forest, land, irrigation, sharing natural resources.
- Mutual help (Pang).

The main contents were not of similar importance everywhere. During the survey it was found that in Ba be district (Caoband Province) the regulations were mostly on crops and livestock protection and mutual support, while in Bach thong district (Bac thai Province) protection of production and irrigation were more important.

Protection of production and irrigation: The families which were having fields near to each other should set up fences to prevent cattle encroachment. In some places in Ba be district grazing areas were set apart where grazing was allowed round the year except during cropping season. Goats and other domestic animals had to be kept in sheds or fenced areas. In case of damage by animals talks were held to minimize damage.

The damage was made good in kind: In some cases, compensation was done through replanting the damaged crop or paying by seedlings of the same species. Sometimes the crop was fertilized if it was make or paddy to restore growth rate.

Natural resources sharing in the use of forest, land, and water source.
Choice of site: Shifting cultivation was the prevailing practice in highlands.

In early spring, the heads of families scoured the area for suitable sites. It depended mostly on topography, kind of crop like upland rice, maize, cassava, bean and cotton. Women generally decided the size of plot because they could plan better taking into account available labour and time.

Marking off Territory: Once the size was decided, markers were put a long stick with some papers or leaves on top indicated the ownership. The Tay people in Bach thong, Ba be it could be done by folding the leaves or shrubs, climbers. This is called “Mai” or “New” and generally used for marking rice fields.

Putting a ‘mai’ or ‘neo’ symbol on a tree would signify the marker was the first to find it. This symbolism could extent to honey bee hive.

Community Affair: The farming activity was a community affair despite individual ownership of plots. Mutual help was the keyword. The steps taken to protect farms extended.

From chasing monkeys in Chu Huong, Yen Duong - Babe district to hunting, the whole community participated once the animal was killed, the meat was shared, irrespective of whether all participated in the hunt or not. Those who hunted the animal got more than the normal share given to all. If a person killed a deer, he would get a head and one of the four legs apart from the common share, and if the animal was a wild boar, he would get additional meat of the shoulder of the wild boar.

Natural resources/Forest Protection: Before 1945, forest protection was influenced by French government regulations. Then each district was under a forest officer - the Ranger - Qual Luc Lam in Tay and Nung. This was normally held by the French Ly truong (commune head) was responsible for natural forest in his locality. The French banned logging of precious species as Lim (Pettephorum tonkinesis Pierre), Nghien (Parapentaca tonkinensis Gagnep), Sen (Madhuca, Par Guiesia). However they could use some limit for house building.

Those who wanted to build had to submit a paper to commune head and ranger for a certificate. In Sy binh - Bach thong, for example, the French allowed local people to extract some timber after specifying the quantity. The French allowed hunting with civilian guns only. Those who use army weapons faced jail both for ecological and security reasons.
Irrigation and drinking water utilization: Irrigation was the responsibility of village heads in some places. Te Nam (water staff) elected by villagers assisted him. Families jointly constructed irrigation system. Contribution could be in labour or in kind. At cropping time or sunny period, the village head would inform the families and re-schedule water supply to the paddy fields. Under instructions from him, the water staff would open the dam.

Mutual help: Mutual help or support was evident mostly at weddings or funerals among Tay and Nung. In Chon don, Ba be districts it is called “Pang”. It has existed through all regimes since early days. The help is sought among the relatives or close friends. Every household keeps a booklet - “Song Pang” which is transferred from generation to generation. When someone has to meet a wedding expense (in Cho don for a wedding about 800 USD is spent), the friends or relatives may bring not only money but also rice, wine, pig.... The help is entered in “So Pang” and the help is reciprocated later. In farming, the villagers use a similar way in labour exchange. The help is reckoned in man/woman days and even buffalo days. The labour exchange disappeared during the period of Agriculture Cooperative (1954-1985) because labour at that time was considered something common or collective. All production activities were themselves common and planned from the Management Board. From 1984-1986 the agriculture Cooperative were demobilized. Since then the Renovation stage appeared. Market Economy took over. From 1985 upto present the policies of the Communist Party and government have directly impacted on forest and natural resources protection in the study area as policy “Khoan 10” (Contract 10) which seeks to re-establish village-level authority. Some traditional regulations have survived, not in the same old fashion. Of course, now there are no forest Gods but the content of Government Programme 327 recently and other programmes or projects related to forest protection, integrated rural development have created an encouragement of traditional regulations. In Ban Cuon, Cho don District, for example, the water supply to the village follows some old regulations. In Phu luong, Bac thai some agreements on water source and forest protection are based on Tay, Nung, groups regulation. The research team has conducted a learning survey in Yen do, Phu ly Communes, Phu luong and found that some households, very often the relatives, are living on the hill sides and sharing the common forest what was left from their parents or grand-parents for providing regularly fronds for the roofs. As the houses use bricks and tiles, fronds may not be needed. This way they protect common forest.

5.2 Technological Area:

“Gio” paper king in cho don needs to be mentioned. In Bam Cuon the Dao people make paper from Gio shrub which is normally used for worship. The villagers said that the God appreciate not the fragrance of Gio paper; it does not pollute the atmosphere.
In Phu luong, Bac thai researchers found simple method for Agro-forestry extension based on local practices to enable farmers and extension workers to learn indigenous knowledge; to evolve a data keeping system and to sum up experiences into specific steps.

The teachers from University of Agriculture and Forestry and Extensionists in Phu luong have come to the conclusion that most Agroforestry models initiated by farmers in PHu ly, Yen do, On luogn Communes, Phu luong district were evolved from 1979-1980, when the cooperatives were being demobilised (In Dong cho, On luong in 1979, in Phu ly, Yen do in 1980...).

As 30 years of cooperative experience was found to be inadequate, the villagers felt the need to find for themselves the techniques appropriate for them based on their experiences of nearby practices.

In Phu ly, Yen do Communes forest land, hill-side were occupied for growing wood and fuelwood for family consumption or income generation and for raising up-land rice cassava, maize, etc. Later cash crops like sugarcane and tea appeared. Sugar and tea processing require firewood that could be got from forests or home gardens. Most were agroforestry models in terms of ecological and economic interactions. The process of establishment was contrary to the popularized Taungia as it was started not from crop but from forest component. It should be understood as a three-phase process: Forest - Forest and Crops - Forest, of course, present forest may differ form “previous” forest. The phase of crops and forest or only crops was a transition phase, temporary for food. The starting point might be the same for all models, but the present views are different: some of them are considered phase 2, some may be said to be phase 3 and some need to be done Taungia again.

The study revealed three steps or phases

**Step 1**: Identification of good farmer practices through community meetings:
**Step 2**: Survey of good farming system and Systematic data keeping
**Step 3**: Presentation and discussion of practices with community
**Step 4**: Documenting collected data in Data Keeping Systems

**Trees in Tea**

Trees in teas was a follow-up exercise after training course on PRA and Rural System Analysis held in Suranaree Institute of Technology, Thailand by four members from University of Agriculture and Forestry (UAF) Bac thai and UAF Thu duc. The study was carried out in Bac thai, Vinh phu, Tuyen quang Provinces for Northern Vietnam to identify species and origin of trees in Tea plantations in Northern and Southern Provinces of Vietnam and learn how farmers manage the trees.
Tea plantations belonged to state enterprises or cooperatives during the period of Agriculture Cooperatives. Smaller plantations are managed by farmers’ families, not only at present, but for a long time in the past.

The conversion of common forest or hills into farmers’ tea gardens was similar to that of homegardens or homesteads. The study showed that people had no idea if any tree was need on a tree plantation. Interviews in Phy ly and On luong - Bac thai showed that the villagers preserved or voluntarily planted trees in their tea gardens not for the purpose of tea management during the time of tea harvesting, weeding or firewood for tea processing. In places Tuyen quang, Bac thai and Vinh phu jackfruit trees, litchi or longan are common trees. In Cay khe - Bac thai for example, newly planted trees in tea gardens is Acasia Audiculiformis.

Species and Origin of trees: The way tea is grown is nearly the same in northern Vietnam at the household level. Young tea plants have to have shade for the first three years. In Phu luong - Bac thai natural tree species preserved or planted in study sites are Thoi ba (*Alagium chinensis*), Xoan (*Melia azaderach*), Trau (*Aleurites fordii*). These are native species and provide appropriate canopy for the tea plant.

In Vinh phu, Tuyen quang or other Northwestern Provinces the native tree species are Bo de (*Styrax tonkinensis*), Muong den (*Cassia siamea*), Co (*Livistona saribus*). The survey mentioned some main sources of trees. The planted trees were got from mother trees in homestead or from seedlings in local markets or through exchange. Sometimes the extension centre gave them.

A farmer in Yen son district Tuyen quang said he had propagated plant the plant material himself while farmers in Tuc tranh Village, Phu luong Bac thai said they got seedlings from a household which specialized in seedling production.

**Harvesting and Processing Technologies in Wood and non-wood materials**

The researchers have also conducted a case of learning local farming property management of people in Cho don District - Bac thai province.

One of the objectives of study was to investigate existing local technologies of harvesting and processing wood and non-wood materials such as bamboo, rattan... at small scale in community condition. In mountainous area labour-intensive methods had less harmful impact on ecology.
The main reason for waste is lack of skills and knowledge. High stumps and inappropriate cross-cutting or felling trees with axes instead of using of a bow saw or cross-cut saws led to avoidable waste.

*Existing Technologies*: Villages mainly bounded by the secondary natural forests show tree felling, debranching and cross-cutting is manually done with local made axes, wooden framed two-man cross cut saws, etc.

Processing of wood products is almost zero apart from manual chipping of timber boards by axes, etc. Horizontal band sawing was the method most practised. The team was very interested in this point, because normally people in other plain places use vertical band saws. The explanation was horizontal sawing was preferable due to the local conditions and manpower limitation. One reason given was it is difficult to manage one end of the sawing process in vertical sawing because one end of the log should be put on the ground. The existing machines are locally manufactured, simple to use and manually operated.

*Fuelwood harvesting, transportation and processing*: People collect fuelwood from forests in their free time, often from December - February. They cut trees with locally made handtools. Sometimes cross-cutting of bigger diameter logs were also done with wooden framed bow saws and two man cross cut saws.

Transportation of small amount smaller size of firewood for the household uses were implemented by carrying them all the way from forest to home. Processing of firewood normally is done at home by simple way and with tools such as knives, axes, wedges.

6. **Conclusion and Recommendation**

6.1 **Socio-cultural field of local practices and innovations**

Some traditional customs regarding protection of natural common resources and domestic animals, planted trees have been created, developed and maintained over time.

It also has been changing adaptable to each stage of socio-economic development and environment changes.

The cong (Tho ty) was one of the typical tradition of Tay and Nung people which was organized and respected by villagers for a long time. It at present should be discussed and improved at the
Grassroots focused on natural common property management. It could also be considered as one of the promising approaches for implementation of rural development projects, especially in the areas where Tay and Nung people are living.

Common property sharing and mutual help/support of Tay people including “Pang” and labour exchange indicate very clear interrelation among the members of community. It also can be seen as a mixture of long time tradition and some aspects introduced by legislation way during the cooperatives time and as well as present. It should be applied by the people in many community development projects, particularly in revolving fund, food security activities at village level.

6.2 Technological Area of Local Practices and Innovations

- “Gio” paper making in Cho don district may be considered either a cultural or a technological innovation or a mixture of them. It presently needs to be studied a little more in detail for further suggestions.

- Agroforestry models spontaneously established by local people are existing in many places. It also is useful not only for farmers to follow but also for scientists, and especially extensionists, to learn the practical knowledge and to transfer them.

- Trees in Tea plantation or gardens are not different so much from place to place. However it can be seen that trees in tea management depends on market demand or extension, propagandation activities much more.

- Sawing method by horizontal band sawing, observed in Cho don district, shows that local specific conditions of nature and socio economic background are the determinants. It should be learnt for more validation.

6.3 Learning method

To learn the local practices and innovations, there are a number of methods. Some common aspects or steps could be:

- Elder men and women are the most important informants regarding tradition and culture.

- Remote areas are thought to be promising places to get lessons, but it needs more time and sources for conducting the study.
6.4 Limitation of Study

Due to the source and time constraints, the study has been conducted in a limited number of sites only.

Some initial results of the study of Gio paper locally making and horizontal band sawing in Cho don should be studied extensively before recommending them.
References


Introduction

According to the latest anthropological evidence, man evolved about eight million years ago and for over 95 per cent the period of his existence, he has depended on the forests for his existence, as a hunter and food-gatherer. The forests have provided man his essential needs of food and shelter. Civilisation, as we are experiencing it, has dawned late for man and only in the last 50,000 years has man begun to domesticate plants and animals, use metals and harness energy sources other than human/animal power.

Today, many tribal communities continue their life of isolation in the forests. For thousands of years, they have lived of in forests without damaging the forests, used wood and fuel, hunted animals and exploited minor forest produce for sustenance and medicine. Their culture is replete with ideas concerning forests. Forests have not only provided food and shelter but have also amply satisfied their ethos and sentiments. This intimate association with forests have evolved into a symbiotic relationship for the tribals.

About 21 per cent of the population of Orissa are tribal, spread over various districts (see Annexure). With their communal inter-dependence and non-monetised economy, tribals have evolved the barter system and assisted each other. But with the advent of the commercial exploitation of forests for the last 200 years, there have been tremendous changes in the tribal life and economy. All tribes have not responded equally to challenges faced by them. Today, there are three types of tribal communities in the country. The first type is of those who have been assimilated into modern settlements and who depend on mines/factories for a living. In all major mines and factories in the entire Chhota Nagpur

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38 Chief General Manager, National Bank for Agriculture and Rural Development (NABARD), Inspection Department, Hyderabad
belt, many tribals have found employment and do not lead a communal existence (e.g., Hos, Mundas, Bhuiyas, etc.).

The second type of tribals has been exposed to modern life but continue to lead a communal existence but with significant changes. Tribal lands have been parcelled off and land rights have come into existence. These tribals are exposed to the market economy and enjoy the benefits of both the tribal way of life and access to modern goods and ways of life. They have acquired necessary skills to adjust to the survival needs (e.g., Saurus, Santhals, Gondas, etc.).

The third type of tribals has retreated to inhospitable and inaccessible areas to avoid modernising influences and they lead a lonely existence, safe and secure away from a lifestyle they cannot comprehend. These primitive tribes have developed primitive skills that allow them to survive in their remote areas. Many avoid contact with modern man as a deliberate choice. Not much is known of their innovations because of their secretive lifestyle (e.g., Hill Marias, Juangs, Baigas etc.).

The effect of various innovations which tribals have introduced and some introduced by others (especially on the second type of tribals) and changes induced in their lifestyles are discussed here.

**Innovations that help tribals**

The tribal way of life has evolved over ages and is attuned to the local environment. It would be a mistake to think that the tribals share a common way of life. Their simple way of life, subtly shaped by the environment and external influences, and all minute changes in the tribal way of life are innovations, which have been accepted and imbibed in their way of life. With the caution of an oppressed people who have been exploited and who have seen their world of forests ever-shrinking, innovations are treated with due caution and are accepted only if they are perceived to be an improvement over existing practices. To look for quantum jumps in technologies for the tribals would be a mistake. The tribal people will not be able to assimilate technologies that are not an improvement over the existing practices. To that extent, most of the innovations thrusts upon them by various government-sponsored programmes turn out to be failures.
Under various credit-linked programmes, tribal people have been financed for wells and milch cattle, for which they have very little use. They do not easily assimilate well-meaning interventions for the tribals. However, the tribal people are not averse to innovations. As long as these innovations do not alter their lifestyle and as long as they signify a better method of doing something they have been accustomed to, they have a chance of acceptance. Other significant factors are the tribal taboos and beliefs that may hinder acceptance of innovative ideas. Thus, innovations in the tribal context appear to be “one step at a time”. The tribal will not be pushed into innovative thinking and processes on hearsay. He has to see it and believe it and then only can he consider any innovation. It must be emphasised that tribal innovations are an essentially slow process if the ideas are implanted from extraneous sources and acceptance will be faster if they are linked to the tribal ethos and way of life. A few examples of various innovations, which have had an effect on tribal life in Orissa, are discussed in the paper by way of examples of innovations and their effect on tribal development.

1. **Shifting cultivation among the Juangs- Keonjhar district**

Swidden cultivation or 'Pongar-chas' or 'Podu-chas' are the terms used for slash and jhum cultivation practised by tribals who are in the stage of development and who may have taboos for plough cultivation. Shifting cultivation has been in existence since Neolithic times and can be defined as continuing agricultural systems in which temporary clearings are cropped in the forests for short periods. The problem is that the cropping gap, which was in excess of 22 years, has been reduced to less than four years, due to disappearance of forests and population pressure as also food needs.

The Juangs depend on paddy obtained from shifting cultivation, which is a way of life, as it is established in tribal mythology that superior beings had taught these methods. Mango trees and jackfruit trees are never cut as mango kernel (crushed, roasted and made into paste) and jackfruit seeds are a supplementary source of food apart from jungle roots and tubers, which are collected by women. However, during the monsoons (3-4 months) food is in short supply and unless food is stored, starvation is rampant. In spite of hard work and constant supervision against depredation of wild animals, Juangs raise only insufficient amount of crops for sustenance. Where cultivation under
wells is possible, it is resorted to, but there is little irrigated land available in the inhospitable hillsides where the Juangs have been driven by cultivators belonging to other communities.

To prevent further forest cover destruction, wetland farming of valley bottoms may be encouraged and land up to three per cent slope be brought under permanent cultivation by giving land rights and title deeds to the Juang farmers. The various innovative methods used by the Juangs to harness hill streams to irrigate lands under permanent cultivation and to have perennial water source in the villages, are worth mentioning. Second year ‘taila’ on the same land should be banned as it destroys soil fertility. Instead, the ‘taungiya’ system of horticulture should be encouraged in lands between 12 per cent and 20 per cent slope and after five years it should be gradually brought down to between eight per cent and 12 per cent. In the first taila year, niger seeds are sown in July and after sowing is over, mango, jackfruit, papaya and banana trees can be planted before the end of monsoon, along the ridges so that they do not interfere with the cash crops but prevent further soil erosion.

Thus, after five years, farming will be restricted to eight per cent to 12 per cent slope lands only. Terraced fields can be developed between three per cent to eight per cent slope and should be reserved for grazing. Hill top cultivation should be banned. These innovative techniques can help wean away the Juang farmers from destroying their forest heritage and ensure that scientific land management principles are adhered to. These ideas have yet to take root because of the costs and time involved.

Some innovative methods, which have helped Juangs, are the creation of minor irrigation facilities such as dams and diversion weirs as also water harvesting structures, which have transformed barren lands into paddy land with private ownership. Sabai grass (*Eulabopsis binate*) brought from the Terai regions of the Himalayas has been planted in large areas of Mayurbhanj and Keonjhar districts since the 1930s to stop further erosion in already badly eroded lands. The sabai grass is grown at virtually no expense, is hardy and besides, it stops soil erosion and can be woven into beautiful ropes which are used for decorative articles, mats, furniture, etc. The grass clumps have an economic life of over 20 years and its introduction by the Maharaja of Mayurbhanj has been a boon for the tribals.

2. **Terrace cultivation of the Lanjia Saoras -Gajapathi district**
Of the Saoras, the Lanjia Saoras, though the most primitive, have mastered cultivation. They have small gardens on their homestead lands, and have developed terraced fields but for additional income. They also resort to swiddens on hill-slopes and hilltops. The terraced fields in which water flows throughout the year are reserved for paddy cultivation while the upper terrace, which are dry, are used for cultivating beans, pulses and minor millets.

The engineering skills of the Lanjia Saoras are to be admired especially when it comes to designing the cultivable terraces. The terraces are build right up to the beds of the hill streams and extend many hundreds of feet down to the valleys from the hill slopes and hilltops. The platform of each terrace is flat throughout and the fall of each terrace is stone-packed. The terraces are so constructed that no soil is carried down with the water that trickles down from the higher terraces to the lower. These innovative engineering skills deserve admiration, as do the water management skills. Water flow from one terrace to the other is controlled by channels and waterways, which are provided in the ridges up the terraces. There is another way of facilitating water flow from the higher terraces to the lower ones. Two or three pits are dug at the lower side of the upper terrace and these pits are packed with boulders. The water management is skilful; it avoids flooding of the terrace fields. In many places, water trickles level to level through stone facing and ultimately flows to lands in the plains. Neither is the soil carried over with the water from the terraced fields nor any damage caused to the stonewalls.

These terraced fields, developed with considerable engineering ingenuity, are privately owned and handed down as valuable assets from father to son and are even mortgaged to local money/paddy lenders in times of need, but not sold. Another interesting innovation is that all agricultural activities are done on a co-operative basis called 'Ansir', whereby villagers work on other’s land on the basis of reciprocity and the person provides mutuality of obligation but food to the workers on whose land they work. But this system is dying out and is being replaced by cash wages. Cattle are used as draught and also for payment of 'bride price’ and hence are 'movable assets'. Swidden cultivation is being continued more as a habit or as a source of additional income.
3. **Orange Plantations of the Saoras- Mahendragiri Hills, Gajapathi district**

One of the most pleasing sights to a horticulturist is the lovely Mahendragiri Hills in southern Orissa covered with Orange trees. The initiator was a Saora tribal who had worked in Burma and Khasi Hills and came back with a handful of orange seeds over 60 years ago. These were carefully cultivated and the orange trees grew, bore fruits and seeds were distributed free to other tribals who wanted to plant them. About 40 years ago, the Department of Agriculture also set up orchards and seed farms to propagate orange cultivation. Some of the innovative techniques used by the farmers are given below.

Fifteen feet spacing is to be maintained between trees, which should be planed at the edge of the stone-packed walls of the terrace so that decomposed matter and litter flowing from the higher side of the slope, could be deposited at the base of the plants for compost creation. Soil on the slope is not disturbed and shade trees present in the slope are not to be cut. No manure except the accumulated humus at the plant base is applied.

Ginger and turmeric are grown as inter-crops for adding to soil fertility as do minor millets. For preparation of seedlings, seeds are extracted from well-ripened fruits in December and dried in the sun. When the reddish coat vanishes, the seeds are ready for dibbling. The seedbed is to be prepared close to a hill stream and dried manure and water sprinkled over the bed. When seedlings attain full growth (one ft. height), they are removed from the seedbed and planted in the hill slope. As for the fruit-borer pests, a pot of water is mixed with molasses and kept in different places in the orchard. The insects are attracted, and they fall into the water.

However, today’s farmers have no knowledge of the traditional practices and lack even basic knowledge of important practices such as: (1) site selection, (2) selection of plants and raising in seedlings, (3) planting and after-care, (4) plant protection measures, (5) manuring and orchard maintenance. The Dombs (SC community) purchase the entire orchard by auction, much before ripening of fruits and the farmers do not get much for their labour. Due to the poor management practices, yields have reduced significantly and farmers spend time on other crops and ‘jhum’
cultivation and the average productivity has reduced. Farmers are also not using improved plants due to bias against new ideas - 'As a foreigner cannot thrive in our village, plants brought up under different conditions cannot survive in the local conditions and become sickly and die when planted in the hills'.

4. **Income Generation and Self-help among Tribals- Samanwita, Phulbani district**

Samanwita is probably an unique institution, the NGO set up by the State Bank of India to meet the needs of the tribals at G. Udayagrir. Set up in an isolated part of Phulbani district with the assistance of the district administration, the original scheme was to introduce sericulture (mulberry) among the tribal farmers and also to set up a cattle rearing and upgrading farm with assistance from Bharatiya Agro Industries Foundation (BAIF). Neither of the schemes ever took off. However, SBI continued to support Samanwita which took up health care, welfare, medical activities along with income-generation activities such as selling spices (cardamom, turmeric processing, pepper, aonla, etc.) and manufacture of sisal mats and ropes.

The stress has been on income generation and agro-processing activities and since 1994, the stress is on creation of self-help groups (with assistance from NABARD) using tribal facilitators who are from the villages in which the SHGs are located. Of the 60 SHGs set up, 13 have been linked up with banks and income-generation activities have been initiated. The creation of SHGs in tribal areas has given a shot in the arm to the SHG movement, especially in view of earlier failures by other NGOs to successfully promote SHGs in tribal areas. Replication of SHGs in tribal areas is now being taken up only in areas where aid/subsidies have not reduced tribal people to the status of dole seekers. Samanwita and other NGOs who have built up the SHGs in tribal areas are replicating the SHG concept in other areas/villages. The innovative idea of building up SHGs with income-generating activities with the help of trained local facilitators residing in the target villages has been sought to be replicated in other tribal areas and villages.

5. **Medicinal use of Animals- All Tribal Districts**
A study by the Zoological Survey of India (Joseph et. al.) in 1988, conducted in MP and Orissa led the fact that tribals had discovered.

i) 156 applications of mammals and products
ii) 33 applications of birds
iii) 30 applications of reptiles
iv) 10 applications of fishes

The blood and meat of pigeons are used in Orissa for treatment of paralysis. Derivatives of bar, tiger, wild board, cows urine, goats liver, hen eggs, honey, snake fat, earthworm flesh, elephant bones have been widely used but the exact scientific value of these medicines is not known, but a large number of cures have been affected. More work needs to be done to find out the efficiency of these animal product cures.

6. **Medicinal uses herbs and plants - Simlipal Hills**

Another study in Bihar, Orissa and West Bengal identifies 120 herbal medicines. The tribal people are rather secretive about their customs and beliefs and their tribal medicines. A study conducted by the RRL, Bhubaneswar in 1988, revealed that 70 species in the Similipal hills are available for commercial exploitation and are being used by a number of pharmacies manufacturing a number of ayurvedic/ pharmaceutical medicines, tinctures and extracts. In addition, there were additional 67 uses of vascular plants that had not been recorded in published literature before. The existence of such a large number of plants with medicinal uses in a small portion of Orissa (i.e., Simlipal Hills) raises the prospects of the existence of many more species that would be of benefit to mankind. A detailed study needs to be carried out regarding the medicinal properties of these plants. An interesting point to be remembered is that among some tribes no plant is removed entirely with its roots unless another one is planted in its place. This ensures that rare medicinal plants are not lost to posterity. A cure for cancer or AIDS may emerge from this research. Another rich area for medicinal herbs is the Gandhamardan Hills in Sambalpur district.

**Innovations that harm tribals**
1. **Tasar Silkworm and Lac Worm Rearing- Keonjhar district**

   Tasar has had extensive success in Orissa as Tasar silkworms are exclusively reared by the tribals on arjun, sal and asan trees that are leased out by the Forest Department to the tribals. In the case of tasar, the tribals are increasingly cultivating mulberry as it is being promoted as part of the Integrated Rural Development Programme (IRDP). But the gradual deforestation and the wholesale cutting of the host trees by tribals for monetary gains of non-tribals is rampant and for the last five years tussar production has been dwindling. Also, as these are exclusively tribal products that have modern alternatives available, not much is being done to focus the problems of the tribal tasar/ lac worm rearers. One of the main reasons for the setback to tasar production in the State has been partly on the inability on the part of officials and researchers to find solutions.

   For tasar, two to three crops in a year are possible. A tasar rearer takes the tasar worms and shifts residence to his 'adda', far from his home, situated in the leased portion of the forest for rearing them on the branches of asan, arjun and sal leaves. He has to live a life of a hermit, following self-imposed religious restrictions and obligations as per customs and formalities. Having placed the worms on the tree leaves, he and other members of the family, sit under the trees with bows and arrows to scare off birds and other enemies, which eat up the silkworms. However, the problem is that tribal youngsters, who are more aware of their talents and job opportunities, do not want to work as tasar reapers with poor income levels. They believe that it leads to a life of physical and economic hardship due to the small economic margins available for the growers.

   In lac too, the closure of the broad lac farm of the State Government has resulted in total dependence on broad lac procured from Ranchi. Further, the survival rate of the brood lac is now only 20 per cent and hence lac production has been dwindling in recent years. Inadequate attention to backward and forward linkages and innovative alternatives has succeeded in killing these tribal rearing skills and income avenues. These are two major areas of tribal income opportunities where emerging alternatives and changing lifestyles of tribals are becoming a threat.

2. **Denudation of forests- Cuttack and Khurda districts**
During the third Five Year Plan, an ambitious programme was set up by the state government to plant cashew trees in areas which were once sal forests and which had been logged to such an extent that now only degraded scrub remained. It was decided to plant cashew trees on a massive scale to reduce soil erosion and to enable better utilisation of the scrub forests. Targets were given but, as in the case with ‘top-down’ planning efforts, targets went haywire and officialdom topsy-turvey. Securing opportunity or possibly just to achieve targets, fresh huge sal trees were cut and replaced by bad quality cashew plants procured in a hurry.

Another innovation, which continues to cause misery, is the humble bicycle. Every day, one can witness long lines of cyclists returning in the evenings to Cuttack with loads of wood from the Athgarh forests. The wood will fetch them Rs.100 daily in the market. Also, every morning one can also see a line of cyclists merging from Chandaka forests enroute to Bhubaneswar. The humble bicycle is now adding to denudation of forests.

3. **Grain Golas versus PACS- Koraput district**

In the early 1950s, after the Rural Credit Survey Report was released, the central/ state governments wanted to strengthen the Primary Cooperative Credit Societies (PACS). In the western districts (Koraput, Kalahandi and Bolangir), revenue records reveal that 150 years ago, there was multiple cropping due to plentiful rains and vast forest areas. Today, forest cover has been destroyed and these districts face drought in the non-monsoon months and lack of drinking water at times.

To stall the recurrence of droughts and starvation deaths, the tribal communities had resorted to communal grain *golas* (or stores) in which excess paddy was stored by the tribal people during harvest times. These grain *golas* provided food security and sustenance in times of non-availability of food. People did not die of hunger, starvation, or malnutrition. But this food security aspect was seen to come in the way of the formation of the Primary Agricultural Credit Societies as people kept their savings, not in the form of deposits in PACS, but in the form of paddy in the grain *golas*. To promote the PACS, the grain *golas* were dismantled. Today, we have starvation deaths in plenty and selling of young children, as their parents are unable to provide them food while the PACS/ LAMPS, which
were supposed to help the tribals, have ended up as yet another instrument of exploitation. Another innovation, which went sour!

4. **Traditional Irrigation Systems versus Water Harvesting Structures- Kalahandi district**

In the drought-prone Kalahandi district, under DPAP/ ADAPT Programmes, the Soil Conservation Department undertook to create 588 water-harvesting structures (WHS) costing Rs.85.70 million and benefitting 60,00 hectares. Without consulting the local people, the setting up of WHSs caused misery in a few places due to reduction of water availability. As Sangadi, Khariar block, two perennial streams provided irrigation to 37 acres of land belonging to small and marginal farmers while the WHS subsequently created has hardly 3-4 feet depth of water and the natural sources are silted up due to the WHS construction.

To compound the misery, the Forest Department dug a trench just below the WHS which drained out whatever water passed through the seepage. Normally the land is at a higher level than the WHS and the water level does not reach the sluice level. Hence, there is no water for irrigation. At Dab, Boden block, the WHS. Clearly obstructed a single natural source, the innovative WHS succeeded in bringing misery and not water for irrigation in a drought prone-district!

5. **Mixed Orchards - Gumma, Gajapati district**

In view of the natural farming abilities of the Saoras, the Department of Horticulture decided to raise mixed orchards comprising mango, cashew, guava, bet, etc., with funds from ITDA/ District Rural Development Agency (DRDA) / Jawahar Rojagar Yojana (JRY) and after nursing plants for three years, handed the half grown plants to the Saoras who promptly cut down all plants except mango and cashew and did gap filling on their own with the same species. This was because the other fruit trees bear fruit and are harvested during the seasonal agricultural operations when the farmers work in the fields as causal labourers and hence they would not be able to protect the trees and their fruits during harvest time. When mango/ cashews are harvested in April/ May, they could afford to watch their trees. Further, cashew could also be stored for long periods after harvest to fetch better prices.
Hence their terrible logic was to use only those fruit bearing trees, which would fit into their scheme of things.

Conclusions

• The 11 case studies carried out earlier reveal that innovations can do both good and harm to the tribal people. If tribal people are involved in the innovative change being introduced, they will be able to comprehend, participate in decision-making, and help in implementation. But if 'top-down' planning is resorted on the basis that government knows best, the result is failure or misery. The tribals do not need charity but rather a sympathetic understanding of the tribal way of life. Innovations should meet the tribal expectations and fit into their subsistence level economy. Food products, which can be dried and stored for difficult days, are preferred. Sustainable and low cost technologies are also preferred. For a tribal 'doing is believing' and this is the dictum for any innovation. The simple nature and low level expectations of tribals are unable to cope up with risky investments. Another important factor is that a steady daily income is more important than an income, which will bring results after 4-5 months of labour, and, hence, tribals are today themselves engaged in cutting down forests on behalf of others. The animal husbandry skills of the tribals are excellent in view of the good health of the scrub cattle they posses and the herbal remedies to, in case of disease. But due to cost of maintenance of crossbred and heavier milch cattle, they persist with scrub cattle for manure and meat but not for milch purposes.

• If innovative technologies are to be introduced, it would be better to understand the present level technologies of the tribals and improve upon them gradually rather than introduce a brand new concept without linkages to the existing technologies. The compulsion should be theirs not that of the introducer. The tribal people can assimilate new technologies and in fact many modern mines and construction sites involving machines, are run by tribals. New technologies should not be thrust upon tribal people on the basis that `se know best what they need'. Awareness creation and building up a demand for the innovations is a must, if the process is to be assimilated. One should not try to force the process of change. Compassion and not compulsion is the watch ward
for innovations as far as tribal people are concerned. However, there is a bonanza waiting for those who would care to study and to research in tribal and herbal medicines. For sustainable development, it is we who have to learn from the tribal communities the art of harmonious coexistence the Nature, without disturbing the finelytuned ecological balance.

References

Swidden Cultivation Among Two Tribes in Orissa, CENDERET, XIM, Bhubaneswar, 1993.
### Annexure

**Major Tribes and Areas of Habitation in Orissa**

<table>
<thead>
<tr>
<th>Name of the Tribe</th>
<th>Total population (1981 Census)</th>
<th>Main places/ districts or habitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathudi</td>
<td>147967</td>
<td>Panchpir (Karanjia) and Kaptipada sub-divisions of Mayurbhanj Champua and KJR Sadar divisions of KJR Nilgiri sub-divisions of Balasore</td>
</tr>
<tr>
<td>Bhottada</td>
<td>247709</td>
<td>Nowrangapur sub-division of Korapur, Koksra and Jayapatna PS of Kalahandi district</td>
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<tr>
<td>Bhuyan</td>
<td>207792</td>
<td>Bandpal block (KJR) and adjoining areas of Bonai and Pallahara sub-division</td>
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<tr>
<td>Bhumia</td>
<td>75221</td>
<td>Nowarangapur sub-division</td>
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<td>Bhumij</td>
<td>157614</td>
<td>Mayurbhanj, Sundergarh, Keonjhar and Balasore</td>
</tr>
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<td>Bhunjia</td>
<td>9075</td>
<td>Bolangir and Sambalpur</td>
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<tr>
<td>Binjhal</td>
<td>98631</td>
<td>Keonjhar and Sundargarh</td>
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<td>8042</td>
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<td>Dal</td>
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<td>Gadaba</td>
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<td>Gond</td>
<td>602749</td>
<td>Sundargarh, Sambalpur, Bolangir and part of Kalahandi</td>
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<td>44497</td>
<td>Mayurbhanj</td>
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<td>Holva</td>
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<td>Koraput and Kalahandi</td>
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<td>Juangpir in Keonjhar and Dhenkanal</td>
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<td>Mayurbhanj and Sundargarh</td>
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<td>Omanatya</td>
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<td>North of Jeypore and Nowrangpur of Koraput</td>
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<td>Pentia</td>
<td>7909</td>
<td>Koraput, Mayurbhanj and Keonjhar</td>
</tr>
<tr>
<td>Santal</td>
<td>530776</td>
<td>Mayurbhanj, Balasore and Keonjhar</td>
</tr>
<tr>
<td>Saora</td>
<td>370061</td>
<td>Ganjam and Korapu</td>
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<tr>
<td>Shabar</td>
<td>329207</td>
<td>Ganjam and Korapur</td>
</tr>
<tr>
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Use of Indigenous Knowledge System in Natural Resource Management: Studies from Nagaland

Archana Godbole, Aparna Watve, A. Yaden & Vizonyu Liezie

Introduction

Indigenous societies have developed Natural Resource Management systems based on experiences accumulated over generations. Such systems can be seen in areas rich in biological and cultural diversity.

The Northeastern region of India has over 200 different tribes living as socially and culturally distinct units. Natural Resource Management system forms a part of culture of these tribes. Understanding these systems will help in planning strategies for sustainable resource use and community development.

Area

Eighteen major tribes and five to six sub-tribes inhabit Nagaland, which has remained geographically as well as politically isolated for a long time. The language barrier further added to the problem in communication and free exchange of information within the area. The state government owns two per cent of the land; the rest is owned individually or communally. Shifting cultivation is the main source of subsistence for all the tribes. This is supplemented by managing diverse ecological situations ranging from shifting cultivation fallows to forest ecosystem.

Objectives
The objectives of the Applied Environmental Research Foundation, a Pune-based NGO are:

- To understand and document Indigenous Knowledge System (IKS) regarding Natural Resource Management;
- To study the role of community organizations in preservation of IKS;
- To develop models of Sustainable Resource Management and community development based on the IKS.

**Methodology**

Structured and semi-structured interviews were used for collecting information, besides informal training programmes for villages. Home gardens have been surveyed to understand the management in the house. Informal discussions with villagers both at home and market place helped in the interpretation of the data.

**Review of traditional methods of Natural Resource Management**

The pattern of resource use varies from tribe to tribe. The diversity reflects the diversity of the ecological situations of the community. Shifting cultivation is the main source of subsistence in most districts. In Kohima and Phek, land is available for terracing and permanent cultivation. A variety of natural products are needed everyday. These include plants and animals that are used as food, fuel wood, timber for construction, etc. These are obtained from the resource area surrounding the villages. The IKS ensures a continuous supply of the products. This explains the poor marketing system. The markets are to be found only in towns or district places that are not self-sufficient. A survey of market in Kohima revealed the wide range of products used by different tribes and the varied ecological situations from which they are available. (Table 1).

**Table 1: Results of the survey of Kohima market**
The resource areas of the village can be divided into cultivated land (shifting cultivation/permanent cultivation/both); Shifting cultivation fallows; home gardens; private forests; and community forests.

The family is the smallest unit in land ownership. Each family has a patch of cultivated land and private forest. Each household maintains home gardens. Private forests provide for timber, fuel wood and other needs. Products from these areas can be traded. The family can independently take decisions about land under its control but care is taken that such a decision does not violate the framework set up by the IKS of the community.

A short study of resource area of a village Khejhakhenoma of the Chakesang tribe was conducted. The village is divided into three settlements (khels), each having its separate resource area. Community forests are common to all khels. Wood for community needs is taken from the community forest. Results of a preliminary study of resource use conducted in this village are shown in table 2. More than 600 products of plant origin and 107 products of animal origin are seen to be in regular use among the village. Angami tribe practices a peculiar agro-ecosystem management. Selective felling is traditionally practiced. The stumps of *Alnus nepalensis* (Alder) are kept in the jhum field. These coppice and give a large number of poles after completion of one jhum cycle.

**Table 2: Use of Biodiversity by Chakhesang community**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>No.</th>
<th>Category</th>
<th>No. of plant/ animal species used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Food</td>
<td></td>
</tr>
<tr>
<td>a</td>
<td></td>
<td>Vegetables</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>---</td>
<td>----</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>b</td>
<td>Fruits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c</td>
<td>Mushrooms</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Firewood</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Fibres</td>
<td></td>
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<tr>
<td>4</td>
<td></td>
<td>Construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a</td>
<td>Thatch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>Poles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c</td>
<td>Beams</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d</td>
<td>Roof</td>
<td></td>
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<tr>
<td></td>
<td>e</td>
<td>Ropes</td>
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<tr>
<td></td>
<td>f</td>
<td>Decorative wood</td>
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<tr>
<td>5</td>
<td></td>
<td>Tools</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a</td>
<td>Weaving tools</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>Utensils</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c</td>
<td>Agricultural implements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d</td>
<td>Basket/ drums</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e</td>
<td>Weapons</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Medicinal plants</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Poisonous plants</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Gums and resins</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Bamboo</td>
<td>6 (14 varities)</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Soaps</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Ornamentation and decoration</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>Others</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>Animals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a</td>
<td>Insects</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>Fishes/ aquatic animals/ amphibians</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c</td>
<td>Wild animals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d</td>
<td>Birds</td>
<td></td>
</tr>
</tbody>
</table>

Customary law also controls utilisation of wild animals. In Konyak Nagas, hunting of slender loris was a taboo. If such a thing happened accidentally, all villages had to stop work for a day.

**Discussion**

In the past, a committee of village elders called gaonburas who represented of all the clans governed all the villages. They selected areas for jhuming. Their decisions were based on experience and
indigenous knowledge of the tribe. Village elders punished any transgression of the traditional system. The Konyaks from northern Nagaland differ from other Naga tribes in having a king. Autocratic chiefs, the Angs, rule them. The Ang has a council of advisers. This is equivalent to the council of Village Elders in other communities. The decisions about jhumming are taken only with Ang’s consent. Fishing in the river is community activity in the Konyaks. Various tasks like putting nets and preparing fish poisons are allotted to various groups. This gives an identity to individual as a part of the community. The accent is on sharing the available resources. Overexploitation is avoided.

The traditional system of resource management is now changing as tribal communities are getting accustomed to new processes of development, the trends being incorporated into the traditional systems. The villages now have well-organized Village Development Board (VDB) with equal representation for various clans, women and village elders. Commercial logging is now allowed to a certain extent from private lands with prior permission of VDB. But extraction from community land is prohibited.

Population rise impedes sustainable harvesting. Shifting cultivation and increase in the land under it intensifies pressure on natural resources. The jhum cycle, which was around 12-15 years in the past, is now reduced to 8-10 years. The shortening of fallow period results in a low yield. There may be a break in the transfer of traditional system of indigenous knowledge in future. It exists as an oral tradition. The formal education system does not incorporate the traditional knowledge. Previously traditional institutions like the Morung (a social club for boys and girls) existed where children learned informally from elders about history, arts, skills, (like warfare) and about biodiversity in the surrounding area. This system is not functioning nowadays. But it can be revived and simultaneous efforts should be made to exchange of information with other communities.

The models promoted by government were not designed with the idea to bring about the participation of the communities as they were based on experiences from socio-cultural, ecological and situations, which were radically different from those existing in Nagaland. Nagaland is connected to main markets like Gauhati by road but communication remains poor due to climate and condition
of roads. The main market is two days by road. That adds to the cost of production. The project of growing crops like *Citronella*, cardamom, and ginger in the shifting cultivation fallows are examples of failure due to insufficient understanding of the ground realities. The absence of processing facilities for ginger and cardamom and poor marketing facilities led to the failure of these projects and the farmers did not receive any benefits. This led to distrust of any government promoted activities. The risks are high in converting a completely independent economy into a market-based economy.

The alternative approach is to have projects that will provide for the present needs of community. This model should consider the ground realities and should be flexible enough to fit into diverse ecological and socio-cultural situation. People’s participation is essential for its success.

The Government of Nagaland has undertaken a project, Nagaland Environmental Protection and Economic Development through People’s Action (NEPED) which is aimed at improving shifting cultivation methods by making them more productive and profitable. Members of the community with the help of village elders collected data on biodiversity use in local dialect from more than 200 villages, covering all tribes and regions of the state,. Outsiders’ help was taken in preparing formats. Short training programmes for local communities are conducted by NEPED. Suggestions by villagers help in adapting the NEPED model to suit local situation. The village level planning and implementation of the project is looked after by VDBs that helps in achieving community participation.

Research on indigenous knowledge and biodiversity is also being carried out as a part of this project. Applied Environmental Research Foundation (AERF) is involved in carrying out small regional studies like ethno botanical surveys, documentation of resource use patterns, biodiversity assessment. The research findings will be useful in designing management strategies for shifting cultivation. It may help in identifying certain natural products of commercial potential.

**Ethical issues**
While collecting data on Indigenous Knowledge Systems (IKS) we have faced problems concerning ethical issues. These findings will be useful for policy-making framework as well as improvements and modifications in the existing IKS. The local community’s attitude towards such activities is still that of observers. It is very difficult to carry on research activities with understanding of the culture and ethics of society. We may agree to disseminate the research results in local dialects but in many cases local interpreters are not available. A lot of training and extension work is necessary.

Conclusions

In conclusion, it may be said that

- Indigenous societies have established their own IKS for using and managing natural resources. The effectiveness of Natural Resource Management depends on the strength of community organization.

- It is necessary to create awareness about IKS in the younger generation through traditional methods of knowledge transfer like *Morung*.

- Natural Resource Management systems are changing due to various reasons like acculturation, population pressure, etc. The traditional system can be revived with certain modifications for the benefit of local people.
Figure: Resource use pattern of Khezakhenoma village
References


Knowledge Creation in Central India: Rethinking the Indigenous Knowledge Debate

Sonja Brodt

Introduction

A lot of writers and researchers focus attention on scientific knowledge of western concept and traditional knowledge that has not been systematized and does not depend on laboratories. A farmer does not make a distinction between modern knowledge and traditional knowledge that has been handled down from generation by word of mouth.

A scientist deals with systematized knowledge that he wants to spread. He tests in a laboratory with the aid of equipment. He is paid a salary irrespective of the application of the corpus of the knowledge at his disposal. A farmer, on the other hand, is not interested in management practices. He wants to increase the yield of his crop or the tree. The nearest he ever comes to western, modern knowledge is through extension workers. He is interested in results.

Ancient India had its own brand of science. Chanakya’s Arthasastra, written in 4th century BC mentions some agricultural practices. Ayurveda provided medicare to people till the advent of Europeans. Charaka left treatises and practices that are dated between 4th century BC and 4th century AD

Some compare and contrast “Western Scientific” knowledge with indigenous knowledge and stress their separateness (Chambers, 1983, p.83). Some have critically analyzed this, while some others say that the two can be combined for development.

This paper deals with tree management in central India to show that the dichotomy is meaningless at grassroots level although the two are not comparable.

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Distinctions between Indigenous and Western Scientific Knowledge

Indigenous knowledge is ethno-scientific knowledge, the “stock of knowledge” as well as “systems of concepts, beliefs, and ways of learning” (Chambers, 1983, p.83) held by culture groups. It is distinguished from scientific knowledge that has been systematically produced in research institutes and universities by professionally trained scientists and publicized in written documents (Meehan, 1980).

Indigenous knowledge is considered held mostly in the memories of people and transmitted orally as opposed to being maintained in written record (Browder, 1995). In a comprehensive literature review, Agrawal (1995) distilled three major themes used to separate indigenous knowledge and scientific knowledge. These comprise substantive issues (differences in subject matter), methodological issues (differences in methods of investigation and worldviews), and contextual issues (differences in the degree of incorporation of contextual elements such as culture in the knowledge systems).

Substantive and contextual issues stem from the idea that people in direct contact with their physical environment produce indigenous knowledge. It is mostly “concrete” knowledge (Howes and Chambers, 1980), about everyday realities of life in a certain place, rather than abstract ideas that can be applied universally Kloppenburg (1991). Many other scholars also describe indigenous knowledge as being closely connected to particular ecological systems and sites (Clarke, 1994; IDS Workshop, 1989; Sikana, 1994). Browder (1995) maintains that because indigenous knowledge systems are more locally rooted, they are “spatially and culturally pluralistic, polymorphic, and polychronous” while scientific knowledge “seeks convergence, progression, homogeneity and universality” (p.20). Heyd (1996) describes knowledge produced by professional scientists as “the result of focusing on certain discipline-internal questions within their subculture and micro-environment, and is largely independent of the broader culture and background of the practitioner” (p. 12), again in contrast to the local “rootedness” of indigenous knowledge.
Some scholars consider indigenous systems to be more holistic than Western science as they encompass not only technical knowledge but also cultural traditions, norms, values and insights that are tied to mystical or religious beliefs (Browder, 1995; Clarke, 1994; Thrupp, 1989).

“In indigenous knowledge obviates subject/object dichotomies that permeate western scientific rationalism” by reflecting “a cosmology in which the human self is embedded in community and nature” (Browder, 1995, pp. 20-21).

As for methodological differences, Browder (1995) writes of the finiteness of knowledge for some indigenous societies, in which knowledge has a divine origin, while modern science seems infinite, each particular piece of knowledge “born to be short-lived, awaiting to be disproved and replaced” by continuously expanding new knowledge (p.20). Howes and Chambers (1980) similarly consider the practitioners of academic science to be more open to “revolutionary change”, or the possibility of alternative paradigms, whereas indigenous knowledge is a closed system characterized by a lack of awareness that there may be alternative worldviews (p.330). The also consider indigenous knowledge to be more exclusively reliant on “intuition” and evidence directly available to the senses, whereas “the scientific mode of thought is characterized by a greater ability to break down data presented to the senses and to reassemble it in different ways” (p.330). Kloppenburg (1991) also describes scientific thought as involving much more reductionism, abstraction to “immutable” concepts, and objectification of the natural world than local knowledge (p.530).

**Critiques of the Indigenous and Western Science Dichotomy**

Agrawal refutes the theory of differences between Western and traditional knowledge by pointing out that the West too has different disciplines that differ from one another. Western science is problem-oriented with strong application base. The intuition-based Eastern methods are supposed to be divorced from day-to-day problems. It is difficult to distinguish these things. Agrawal maintains that even eminent philosophers of science have not been able to distinguish scientific methodologies from non-scientific ones.
Knowledge Blending

Den Biggelaar (1991) proposes a model for the integration of scientific and indigenous knowledge in agricultural research and development methodologies, suggesting that indigenous processes of acquiring and absorbing technical knowledge can enter into a comprehensive dialogue with exogenous scientific processes. The implication of this theoretical and apparently untested model is that any differences between the two can be overcome in combining them in a joint development effort.

An empirically tested computer program for storing and processing indigenous knowledge about agro-forestry techniques was found useful by Walker et al. (1995a, 1995b) in filling gaps in scientific knowledge.

They maintain that, especially in the case of agro-forestry (which is young as a “scientific” field), farmers have long possessed much detailed knowledge of local circumstances and species which is complementary to existing scientific knowledge and can thus be useful in research and planning.

Meehan (1980) takes a slightly different approach, using the term “ethno-science” to refer to a “set of concepts, propositions, and theories unique to each particular culture group in the world.” He asserts, “Western science is one of a number of types of ethno-science of culture groups throughout the world” (p 385).

Rhoades (1989), on the other hand, says that farmers themselves do not distinguish between traditional and modern, or native and improved, which would arise if they perceived an indigenous/scientific dichotomy.

The Incomparability of Indigenous Knowledge and Western Science
These arguments for or against a dichotomy, although instructive, ultimately fail to address some key issues that limit the comparability of these knowledge systems in the first place, especially on methodological grounds. Writers generally mention “farmers”, “villagers”, “indigenous peoples”, of some proper name for particular groups when referring to those people who are the creators and possessors of ‘indigenous knowledge’. They use the terms ‘scientists’ and ‘extension workers’ to refer to those who purvey ‘Western scientific knowledge’. Those with indigenous knowledge, thus, are people involved in subsistence economies, operating on a practical level in a range of activities, with limited equipment resources, where any experimentation with knowledge is likely to entail immediate risks to one’s well-being. Those with Western Science, on the other hand, are people who have spent much time, often many years, in professional training and now spend the bulk of their time in the specialized tasks of creating, expanding and validating small, specific domains of knowledge. They are paid for this work with salaries, which in most cases are not directly tied to the practical outcome or success of the knowledge they generate. To compare the methodologies and even the content of their knowledge systems, thus, entails a comparison of completely disparate groups of people who are engaged in fundamentally different pursuits.

Finally, the dichotomy of indigenous scientific knowledge ignores the existence of other knowledge systems that are at once ‘indigenous’ and formally ‘scientific’, in that they are non-Western and are produced by professional specialists. In India, ayurvedic medicine is not only widely practiced to treat patients, but is also researched and taught at its own institutes. Moreover, the system of licensing of practitioners exists side by side with the licensing system for allopathic, or Western, medicine.

As for the fields of agriculture and horticulture, they are included as topics in many ancient texts suggesting that they were studied by educated people who were not themselves engaged in activities for subsistence purposes long before the advent of ‘Western science’. Kautilya’s Arthasastra, for instance, believed to have been written in the fourth century BC, includes a detailed description of agricultural practices as well as directions of the activities to be undertaken by the appointed Director of Agriculture, who should be “himself conversant with the practice of agriculture, water-divining and the science of rearing plants, or assisted by experts in these” (Kangle, 1972). In
addition, the two ancient Sanskrit medical texts, the Sushrutasamhita and the Charaksamhita, whose
dates of origin are estimated variously from the fourth century BC to the fourth century AD, give
complex systems of plant classification expounded by experts and clearly embedded in a particular,
non-Western cultural perspective (Hayes, 1945; Zimmerman, 1987). In a more contemporary vein,
indigenous centres in Uttar Pradesh (famous for the excellence of their grafted mango trees) were
known in the study area even during the era of British colonial rule. Thus, indigenous professional
knowledge production has been taking place long before Western-based scientific systems were
introduced, and in some fields it continues to flourish.

Scholars have often noted that rural people engage experimentation and innovation, and thus practice
‘science’ in their own right (Brosisu et al. 1986; Chambers 1983, 91-92; Cornwall et al., 1944;
Pottier, 1994; Thrupp, 1989), even if their primary goal is not purely knowledge production.

The Creation of Knowledge Systems in Central Indian Villages

A study conducted among residents of three villages in Madhya Pradesh shows that a strict division
of knowledge systems is meaningless at the grassroots level. People not only combine information
from a variety of sources, they evolve their own knowledge system and once integrated, it can no
longer be identified as “indigenous” or “scientific”.

The study of rural tree management practices was conducted for eight months in 1995-96. Hindus,
Muslims and Gond tribals are found in the three villages in Raisen district of Madhya Pradesh. The
largest village is located on a major long-distances bus route, but the other are by no means isolated.
On the other hand, many people have only limited or indirect contact with such outside influences.
For example, only the better-off farmers and a few of the middle-range farmers have direct contact
with the extension agent of the area. The result is a halfway situation with respect to access to outside
information sources, which is probably typical of many present-day villages in India and throughout
the Third World.
Some typical soil management practices are illustrated below to show the growth of indigenous knowledge system. Most farmers, except a few of the poorest, make some use of commercial, inorganic fertilizer, especially urea and many have experimented with it on the fruit trees in their home gardens. Cow dung is used as manure, often in combination with urea for crops, or by itself for trees. Some use fish as a nutritive soil amendment for trees while a few others apply buttermilk and ashes. These are used to balance hot/cold in plants. It is associated with potency or fertility and is responsible for the good green colour and growth of plants.

For example, the ashes and buttermilk are used primarily for balancing. Some practices have cooling as one of several functions, as is the case with cow dung manure, which is seen both as generally nutritive and specifically cooling. Urea on the other hand, is considered nutritive as well as hot.

This hot cold concept is found in Indian system of medicine, Ayurveda. In this system, drugs and foods all have *virya*, also described as potency, which can be either hot or cold (Dash and Junius 1983; Jolly, 1977). In addition to forming a part of agricultural folk knowledge, the concept is also widely accepted in urbane folk knowledge, since many urban and formally educated people think of foods as having heating or cooling effects on the body.

Villagers, however, did not consider other tree management practices part of this hot and cold paradigm. Fish, for example, could be described neither as heating nor as cooling, but simply as “fertilizer”, or something nutritive for plants. Some people also described aged, dried cow dung as good food for plants requiring certain types of “food” or nutrients is certainly a part of the global scientific agricultural paradigm, and is the prime motivation guiding the production of commercial fertilizers such as urea. At the same time, it fits easily into the human body analogies prevalent in folk knowledge in this area.

Even these limited examples of tree management practices illuminate the complex nature of knowledge used on a daily basis by villagers both rich and poor. On the one hand, villagers practices are informed by concepts stemming from (or arising simultaneously with) long established, formalized Indian scientific traditions, while other concepts are shared in common with, and perhaps
may have been strengthened by, global scientific traditions. Particular practices, moreover, can be subsumed under more than one conceptual paradigm. Such is the case with urea application, which clearly is a practice acquired form outside information sources but which is understood by villagers both in terms of their “nutritive food” concept and in terms of their hot/cold concept (see also Kurin, 1992).

Conclusion

These brief examples illustrates that clear comparisons and contrasts are difficult to make between local, folk knowledge systems and global, or western, scientific knowledge. Local people are likely to adopt information from a variety of available sources, which can include “Western-style” scientific knowledge disseminators, such as extension agents, formal Indian scientific knowledge, and other traditions developed by farmers themselves. Moreover, people not only adopt knowledge from various sources, but they then transform that knowledge, at both the technical level (practices) and the conceptual level (conceptual paradigms), in a complex evolutionary process that is both consistent with their pre-existing knowledge system while potentially also changing that system over time.

Finally, we must be reminded that, while knowledge production is evidently taking place, it is doing so within the context of most villagers’ primary goals, which are to grow productive trees right now within what are sometimes severe management constraints. They are, thus, not directly comparable to professional scientists, whose main aim is to further knowledge for some future benefit, and who, therefore, usually have more flexibility to vary management practices for purely experimental purposes. Therefore, while a dichotomy between “indigenous” and “scientific” knowledge may be invalid in most communities, the necessity still exists for development workers not only to increase their understanding of the current state of local knowledge, but also to realize that it is likely to evolve in response to new stimuli and may do so in unexpected directions.
References


A System of Self Reliance

Anita Mishra

“Where is my share of the last forty years of planned development? Am I to live in continued poverty throughout my life? Will I die leaving behind my children borrowing money and searching for wood to perform my last rites? Has my land become so wretched that it has lost its capacity to sustain my family and cattle?” These are some of the question that Nirotai, a poor tribal woman of Bhusariya village in Palamau district of Bihar, asked in 1987 while brooding over her grinding poverty.

The answer came from Shri P.R. Mishara’s ‘Chakriya Vikas Pranali’ or the System of Cyclic Development, which is a highly successful and innovative effort in managing the natural resources in an integrated manner and on a sustainable basis. Shri Mishara is well known for his pioneering efforts in protecting and developing the catchment of the Sukhna Lake in the Sukhomajri area of Haryana. In Sukhomajri village, the villagers themselves adopted an integrated approach to rural development, with the management of several common natural property resources. The experience there has shown that resources are better managed and incomes are sustained at a high level when the grassroots people are themselves involved in deciding about the strategy for rural development.

The System is an extension of the Sukhomajri model. It has been implemented around thirty villages in Palamau district. The System believes that all the components of the environment, namely, air, sun, water, land, plants, and human beings, are important and interdependent and hence the need for a integrated management of land and other natural resources. If the natural resources are used carefully and economically, with the involvement of the grassroots people of the villages who share the benefits equally, it is possible not only to make the villages self-reliant, but also to develop the degraded and eroded land and increase the production. The income can be recycled for further development.

41 Chakria Vikas Foundation
The main aim is to establish a cyclical system of investments for rural self-reliance. The system envisages a one-time capital investment in land to ensure jobs, intermediary benefits and final income to the villagers in a rotational cycle of 7-8 years. The system is called cyclical as the benefits from one investment cycle on sun, land, water, plants and people in a unit village ensure adequate biomass production and with the conversion of the same, become capital input for the linked cycle. One-third of the income, that is, 30 per cent of the village share after 7-8 years, gets re-invested in the land to complete the cycle and ensure continuous usufructs and perpetual income from the treated land to the rural people. This surplus can bring in dynamism in the village with growing investments, recycled resources and intensified environmental preservation. Thus, it is a viable alternative concept of social survival and regeneration utilizing the inherent human instinct of saving others in the process of saving oneself.

Living together and protecting one another at all costs is the essence of its philosophy. Constituting a village society is the first step towards collective comprehension, collective learning spirit and collective desire for collective participation. All families become members of the Village Society. The whole project becomes a school and every single person in the village becomes a student of such a land and rain-financed school, irrespective of his/her caste, creed, gender or age.

As the next step under the Pranali, the uncultivable sloping barren lands belonging to different owners are pooled together to constitute an economically viable unit of at least 8-12 hectares of land. Pooling of land into one block brings the rural population further close towards co-operation and partnership for better and integrated management of our natural resources.

The System believes that the key to management of land is conservation of water, especially rain water. Therefore, after pooling of land, various moisture-retention techniques like tie-riding, strip-riding, strip trenching, pit digging, creating small and deep ponds are put into practice. After this, multi-rooted, multi-layered plantation is undertaken on the pooled common land. The appropriate choice of species is most crucial for the success of the system. Since the Pranali envisages only a one-time capital investment on land through external resources, it is necessary to generate sufficient surplus in order to provide regular income to students and landowners and also to have adequate

219
reinvestible, self-sustaining surplus. This surplus mainly depends on the rotation period of species selected for plantation and their compatibility to one another. Therefore, the strategy adopted is to plant different compatible species in different layers that have different rotation cycles. For this purpose, each family in the village plants at least 3000 (300 plants of 10 different varieties) multi-rooted, multi-layered crops having at the top high-income giving fruit and timber plants along with a number of vegetables, root and grain crops. Thus, short-term, medium-term, and long-term plants are grown together. The enormous benefits from this cannot be quantified in monetary terms alone. The benefits should also be seen in terms of environmental improvement, increased biomass cover, soil conservation and increase in its moisture content.

The most important feature of the Chakariya Vikas Pranali, which works as an incentive and is also the binding force behind the success of the system, is the pattern of equitable distribution of economic gains benefitting both the landowners and the landless, who are called students. The system distribution of intermediary benefits and final income from the pooled land is as follows:

- 30 per cent for the landowner
- 30 per cent for Chakariya Vikas Pranali student.
- 30 per cent as reinvestible capital for developing village infrastructures.
- 10 per cent for the welfare Fund for initiating similar processes in other villages.

On an average, if 3000 plants/trees/fruits are sold after 7-8 years @ Rs.100/- per tree, then the total gain will be Rs.100 x 3000=Rs.3,00,000/-. Out of this money, 30 per cent or Rs.90,000/- will be the share of the landowner. Thirty per cent or Rs.90,000/- will be the share of the student. Thirty per cent or Rs.90,000/- will be the village fund. Ten per cent or Rs.30,000/- will be the Welfare Fund. The sharing system recognizes the equal contribution of one and all involved to the equitable and acceptable development process in a unique, innovative way. The sharing system ensures that each and every family gets economic returns that reduce poverty, migration and social conflicts.

The system is under an open accounting system, being run by the villagers themselves. This ensures a transparent and meaningful functioning of the system.
The results of the Pranali can be easily seen on the hilltop of Sukhomajri and in the village of Palamau district of Bihar. It is estimated by grassroots learners that the least 10,000 Khair trees above 24 inches girth are available in Sukhomajri for curing, capitalizing gain and sharing natural usufructs in the same ratio of 3:3:3:1. Assuming a gain of Rs.2 crore from the Khair trees (₹ Rs.2, 000/- per Khair tree), 60 lakhs will go to the landowner (in this case, the State Forest Department), 60 lakhs to the people who worked on it, 60 lakhs will become reinvestible capital while the remaining 20 lakhs will form the Welfare Fund for similar work in other villages. The success achieved by the Pranali in Palamau in bringing together big and small landowners and the landless in a caste-ridden society, that too in a Naxalite infested area and sustaining the system for 7-8 years is by any standards, remarkable. Chakariya Vikas Pranali, having in a span of 7-8 years, provided answers to the question of Nirotia and has taught her and many others like her to live with dignity, self-respect and to obtain fuel, food fruits, fibre and fodder from degraded land on a sustainable basis. The villagers in Palamau have been able to collectively protect the system in 30 villages and there is an increasing demand for extension of Chakriya Vikas Pranali to other villages. In fact, a cascading process has started initiating here since the unit growth centres have begun to self-sprout with internal resources generated at the growth centres making the system self-sustaining, self-perpetuating, self-motivating and self financing, thereby minimizing the need for any further input from outside the system.

The initial assistance obtained by the Pranali from various donor agencies can easily be returned from the ten per cent share that constitutes and Welfare Fund. The confidence of the villagers in the system and its potential to perpetually sustain itself can be judged from the fact that the Chakariya Vikas Pranali has already returned an amount of Rs.21, 000/- to the Ministry of Environment and Forests, Government of India, and has also undertaken this year to return from sale of timber the remaining amount of the assistance provided. It is probably the very first instance where financial assistance provided has been and is being returned by a voluntary agency.
Eroding Gene Pools of Tropical Fruit Crops: Present Position, the Causes and Possible Remedial Measures with Reference to Indigenous Mango Germplasm of Kerala

Jyothi, M.L., Parameswaran, N.K. & Rajeevan, P.K.

Introduction

The forests and wetlands that support most of earth’s non-human species and indirectly the humans are increasingly at risk. The capacity of natural habitats to sustain their myriad plants, animals, and microorganisms is being eroded so rapidly that biologists warn that we are on the brink of a mass extinction. Extinction is the eventual destiny of all species. When the local populations are wiped out, the genetic diversity within each species that provides the capacity to adapt to environmental changes is diminished. The intricate links between species, their biological and behaviour associations are lost.

Biotic impoverishment, a regional global consequence of human activities, can demand costly adjustments from humans trying to raise food in the midst of a biologically depleted landscape. Conservation of biological diversities has long been seen as a matter of creating parks and reserves free from human interference. UNESCO started the Man and Biosphere programme. British environmentalist Norman Meyers says that two million species out of five million species live in the rich mosaic of tropical forests that cover just seven per cent of earth’s land area. He says that one million out of a total of five million species are at risk of extinction by the end of this century.

The ongoing fragmentation and isolation of natural habitats and the prevalence of the living dead-species that temporarily persists in modified habitats in which they can no longer successfully reproduce shape the world’s biological future. Interaction among wild species in natural assemblages gives ecosystems their integrity.

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Genetic Erosion in Fruit Trees

The current state of genetic erosion in fruit trees is influenced by many factors, including the origin and distribution of the crop, its breeding system, the propagation method used, whether improved cultivars are available, whether the crop is in decline or expanding, and whether natural habitants of its wild ancestors and relatives are under threat.

Of these, the most important are the deforestation and urbanization. The money-based development often fails to neglect or accept the intricate balance in the natural systems.

Mango

The greatest diversity of mango cultivars is in India, with at least 1000 unique and several widely grown cultivars. Genetic erosion of these cultivars is serious in India. It was found that collection in South-East Asia mostly contained cultivars, which had been distributed to farmers as grafted seedlings, leading to the disappearance of less desirable, usually seed propagated cultivars.

Wild mangoes are reported from forests bordering India and Burma, eastern region of Orissa, the Andaman Islands and the Western Ghats.

Kerala is considered as a region of diversity in mango and the Western Ghats form the secondary centre for mangoes. Each of the homesteads had a wealth of mango known in local names like, Muvandan, Chakiriyan, Puliyan, Muttkudiyan and like wise. Mangoes are used in pickling and culinary purposes. Mango leathers were also prepared. Many of these were polyembryonic, sour and fibrous and tall mango trees are an asset of each household. But with the increasing pressure on land, with the popularization of desert types of other states, changes in consumer preferences and the timber value of the tree and shift of pickle making from the household to the industry, there has been a rapid fall in the popularity for local mangoes. Deforestation had its own contribution too. A state reached today is that wild mango trees can be located only on roadsides, in a few old households and in some temple yards. The rate of destruction (as could be collected from people engaged in the
mango business) was 10-20 per cent annually. It could be more. The plants on the roadside are old and for fear of accidents, trees are also being felled indiscriminately. A lot of mango germplasm with variation in leaf shape, size, orientation, colour, fruits of varied sizes, shapes, qualities, aroma etc. have vanished and records have no mention of them.

**Papaya**

The risk of genetic erosion in wild Carcia species may be low because the plants grow fast. In disturbed habitats, the plants often produce numerous seeds and have a breeding system favouring out crossing and occasional interspecific crossing.

**Mangosteen**

It is an unusual case in which there is narrow diversity in the cultivated species. There has been severe genetic erosion in mango steen in South-East Asia. There is no truly wild population of mango steen. These are typical of Southeast Asian rainforests, and are likely to be under considerable threat as this habitat continues to be destroyed.

**Avocado**

Deforestation in Central America, where wild Persea tree grows, is doubtless leading to loss of genetic resources. P. theobromifolia - a native of low and wet forest - but now only found in the Equador, is listed in the Red Data book as being in the endangered category. It is potentially important as a blight-resistant rootstock for the cultivated avocado.

**Bread-fruit**

Breadfruit cultivation is on the decline, especially in Polynesia. So genetic erosion resulting from reduced interest in the crop is possible. The ‘Pingelap’ disease, which has killed many trees, may
also be a cause of genetic erosion. Some loss of cultivated breadfruit is reported from Indonesia, Malaysia and Southern Vietnam. The importance of the breadfruit is localized and declining despite its food value.

Jackfruit

Erosion of germplasm is reported in jackfruit due to replacement of seedling by clonal cultivars and due to felling.

Pomegranate

There is a continuing loss of genetic variability of cultivated pomegranate because propagation is mostly clonal, though the plants naturalize easily. There is serious genetic erosion of pomegranate in USSR, and the plant is included in ‘The Red Book of the USSR’. *Punica protopunica* is listed in the endangered category by IUCN because of excessive grazing.

Jujube

Development of clonally propagated cultivars may be expected to lead to loss of genetic diversity in cultivated Indian Jujube.

In general the rates of forest clearance, urbanisation and changes in land utilisation patterns determine the status of the germplasm. A majority of them are under the threat of extinction.

Conservation

Genetic conservation programmes are directed towards the long-term preservation of genetic resources either *in situ* or *ex situ* so that the potential for continuing evaluation of improvement
would be sustained. Conservation is more inclusive than preservation, the latter provides only for preservation.

Conservation in-situ include
1) Protection of vast tracts to protect the entire biomass,
2) Wild species in natural communities,
3) Domesticates - land races in their areas of cultivation.

The importance of crop germplasm found in land races is well established, and a comprehensive international programme exists to conserve this resource ex-situ in gene banks and botanical gardens. Land races are still cultivated in regions of crop domestication and diversity. Factors that promote in situ conservation are the fragmentation of land holdings, marginal agricultural conditions associated with hill lands and heterogeneous soils, economic isolation, and cultural values and preference for diversity. Land races are likely to persist in patches and islands of farming systems in regions of crop domestication and diversity and these patches provide potential sites for conservation programmes. In situ conservation can preserve the biological and social processes of crop evolution. In situ conservation is important for a wider gene pool. Conservation of field gene banks is rarely adequate representative of the variability. Economics and degree of sophistication in breeding will determine success on conservation.

India and the South-East Asian region is particularly important for the origin of many cereals, legumes and fruit plants like mango, rambutan, banana, citrus, durian, breadfruit, mangosteen etc. The tribal population of these areas has important primitive germplasm.

**Status of Mangifera spp. (Mukherjee, 1985)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Endangered</th>
<th>Vulnerable</th>
<th>Rare</th>
<th>Endemic</th>
<th>Insufficiently known</th>
<th>Closely to M. indica</th>
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<td><em>M. caloneura</em></td>
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</table>

IBPGR (1983) has initiated a world survey on germplasm collection of tropical and sub-tropical fruit and tree nuts and a directory was published in 1984 (Mukherjee and Van Sloten, 1988).

**Major ex vitro collection of Mangifera germplasm**
<table>
<thead>
<tr>
<th>Country</th>
<th>No. of accessions</th>
<th>Other Species</th>
</tr>
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<tbody>
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<td>M. indica</td>
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<td>Brazil</td>
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<td>China</td>
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<td>India</td>
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<td>M. cochin chinensis (1)</td>
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<tr>
<td></td>
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<td>M. odorata (1)</td>
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<td>Columbia</td>
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<td>Cuba</td>
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<td>Nicaragua</td>
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<td>Nigeria</td>
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<td>Peru</td>
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<td>Philippines</td>
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<td>M. altissima (2)</td>
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<td>M. foetida (1)</td>
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<td></td>
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<td>M. odorata (4)</td>
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<td>Portugal</td>
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<td>Seychelles</td>
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<td>M. odorata</td>
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<tr>
<td>Thailand</td>
<td>174</td>
<td>11 Mangifera spp. (34)</td>
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<td>M. odorata (1)</td>
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<td>Preuto Rico</td>
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<tr>
<td>Venezuela</td>
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</table>

Conservation of Mango in Kerala
Kerala has a rich wealth of poly embryonic and wild types of mango, but earnest efforts are yet to evolve to account for the variability and its potentials. As an initial step a census of the wild types that exist in the forests as well as that of the land races has to be done which would be assigned to locally interested people. Creating an awareness of the value of the trees may help to motivate the people to preserve this gene pool before whatever remains is also lost. Supporting this, strict governmental policies are required to protect these heritages. Incentives in the form of support for cultivation, product diversification and finding out avenues for their market will take care of their maintenance in due course. Seeds and seedlings with vivid genetic makeup should be encouraged as planting material in avenues and waste lands instead of vegetative materials viz. grafts, that constitute more or less a uniform genetic makeup. All these could be implemented only through the active involvement of local people. In the present setup it would be easy if all the panchayats consider the wild types and land races as their ancestral wealth and take measures to protect them. Institution and research organizations could earmark this stock as breeding materials and protect them. Seedlings of local types could be pooled in government nurseries, multiplied and distributed without any very undue concern for the economic profitability of the venture.

In situ conservation of germplasm could now be located only in temples, government farms, in sacred groves and in some households where the older generation retains it for sentimental values. In Kerala, the anomalous spread of mono crop plantations especially rubber, which has been taking place during the last two decades, has done severe damage to the wild germ plasm and land races of our countryside. The future is bleak. However, there has been increasing awareness and spread of the theme of organic/natural farming among the masses. The value of wild germ plasm materials is also equally being taken into account in the proper perspective. Voluntary organizations and individuals for collection of wild types, propagating them and raising them in homesteads, avenues, sacred groves etc., are undertaking genuine efforts though the examples are few. It could be noted that the awareness has been generated and it is spreading faster among the younger generation, creative farmers and among those who still attach some values to life.
References


Indigenous Scented Rices: Farmers’ Perceptions and Commitment

R.K.Singh and U.S.Singh

Introduction

Aromatic rice occupies a prominent position in Indian society because of its quality and auspiciousness. Different varieties of highly regarded throughout Asia and are becoming popular in Europe (Berber and Hoff, 1986) and the USA (Brooks, 1989). The aromatic varieties are called Basmati (*bas* = aroma). Later its fine grain was also included to signify the type but aroma is still rated most important.

India had numerous varieties of scented rice. But lost a lot of them during the past three decades owing to green revolution (with its emphasis on yield rather than quality). As the farmers are attached to these varieties, a large number of them are still grown.

India was a major exporter of Basmati and its share in world market went up to 17.0 per cent during 1995 compared to 3.7 per cent during 1994. This was because of increased export of non-Basmati rice. Basmati export fell by 25.8 per cent during 1995 compared to 1994. The country is facing stiff competition from Pakistan and in future several other competitors including Australia may compete (Blakeney, 1992). Most of the rice growing countries are working on scented varieties as using Basmati as one of the base material.

Our long-term concern should be not only to maintain but also to expand the export of aromatic rice. This can be done either by cutting the price or producing better quality rice. The Government has

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already abolished Minimum Export Price (MEP) for Basmati, which will have a positive impact on export. However, this is only a temporary relief.

I The Concerns (Current Scenario)

The aroma is dependent on the environmental conditions. Each variety performs best in its own native area of cultivation. The areas are identified from hundreds of the years of experience of the farmers. The scientists have not realized this factor. The production aromatic rice is going up both in production and productivity. R. K. Singh and U. S. Singh undertook an extensive survey of the Basmati growing areas in the districts of Dehradun, Bijnore, Pauri, Nainital and Tehri of U.P. A detailed report will be published in the near future. However, we wish to share some of the observations from this survey.

Statistics from Dehradun shows that the Basmati area is going up (from 1000 ha in 1990, 1500 ha in 1996). However farmers in the Seora-Majra belt which includes the villages of Seola Kala, Majra, Pithuwala, Bamanwala, Niranjanpur and Seola Khurd said that almost 80 per cent of the prime Basmati growing area of this belt has gone to housing which fetches a higher price. The cultivators bought land on Dehra Dun - Delhi road, away from the city. But the Basmati grown there is of an inferior variety. But the valleys of Dudhai Khadar and Jagatpur situation are an exception. The Basmati exporters procure the rice at the villages itself. In surrounding villages, varieties like Kasturi, Pusa Basmati-1 and coarse grain varieties like Pant Dhan-4 and Chine-4 are fast replacing Dehradun Basmati because of higher superior yield. In Vikas Nagar sugarcane has supplanted Basmati. The story was almost the same in most of the native basmati growing pockets visited in the districts of Pauri, Bijnore, Nainital and Tehri. Here we wish to describe briefly the story of Tapovan, which used to grow the finest variety till a decade ago.

Tapovan is a small village at the top of the hilly ridge above Laksman Jhoola, Rishikesh. Terrace cultivation is practiced here. At Rishikesh a dealer from Punjab told us that till 10 years ago when the Tapovan rice was cooked at his house in Punjab its aroma was so strong that the entire village come to know about it. When we met the villagers and asked them for samples of Basmati rice, we had a
real shock. They had nothing to offer except stories of bygone days. The economic condition of the villagers was pathetic. Now they grow very little rice. When we collected a few of these samples, they were bad admixtures.

Earlier, as per the order of the King of Tehri, only Basmati rice was cultivated in the entire village for the consumption of only the royal family. Later, the ownership of land was shifted to Mahant of Bharat Mandir at Rishikesh and the entire stock of the village was used for the ‘bhog’ at the temple. When farmers became owners of these lands their financial problems forced them to shift from single to multiple cropping resulting in drastic reduction in fertility of land. Zinc deficiency in crops was widespread. In our assessment, loss of purity of Basmati seeds and poor fertility of the soil (owing to multiple cropping) are major factors for the near extinction of the famous Tapovan’s Lal Basmati. Some of the farmers said they tried to grow Dehra Dun and Pakistani Basmati but failed probably because of lower temperature (due to higher altitude).

Based on our survey of the cultivation of indigenous scented rices in some of their native areas of cultivation, we identify the following reasons:

• growing population and ever dividing land holding.
• Commercialization of agriculture.
• alternate cropping systems (like sugarcane).
• introduction of high yielding rice varieties.
• use of land for non-agricultural purposes like housing, etc.

There is total absence of seed production. Even in Basmati- growing belt of Dehradun, government agencies are supplying Pusa Basmati - 1, Govinda, Pant Dhan-4 and Pant Dha-II, thereby eliminating finest quality local Dehradun Basmati. There is also no research support to improve these varieties.

Steady decline in yield has been one of the major causes for lack of sustainability. There is a need to properly address sustainability factors for these cultivars. Some of these are;
• Scarce water resources
• Land degradation
• Varietal impurity
• Indiscriminate use of chemicals

Indigenous aromatic rice varieties are losing their bas (aroma). It was the unanimous opinion of the farmers we visited. Some of the factors affecting aroma formation, as perceived by the farmers, are listed in Table 1. Major factors contributing to the aroma crisis are:

• Varietal (Seed) Mixtures: For ages farmers have been using their own seed. As mentioned earlier there is no seed production/improvement programme for the indigenous scented rice.

• Use of chemical fertilizers: Majority of the indigenous scented rice varieties are tall and susceptible to lodging. Nitrogenous fertilizers exacerbate this problem. Farmers also feel that use of urea, adversely affects aroma formation.

• Soil factors: Soil factors do affect aroma formation but these are not yet defined. Leaching of minerals may result in decline in aroma.

• Cultivation practices: Farmers say that there is better aroma in direct sown rice crop than transplanted one particularly in Hansraj.

• Rising temperature: Both in scientific and farmer’s circles it is accepted that comparatively low temperature at the time of flowering enhances aroma content of the seeds.

Most importantly, in the absence of any conservation programme, we are fast losing valuable germplasm of scented rice. Even in our survey of small area we learnt that a number of high quality local rice germplasms like Anjana, Anjani, Ram Jawain, Rat Ki Rani, Durga Pasand, Mukhmalati
etc., which were in cultivation till a couple of decades ago, are now extinct from these areas. We had great difficulty in locating the variety like Bindli, which was grown commonly by the farmers of Bijnore and Pauri districts till five years ago. Nevertheless India is one of the major exporters of Basmati rice. Again, the stress is only on Basmati rice and non-Basmati varieties are more or less ignored. We are not giving any consideration to the fact that the full aromatic potential of these varieties is expressed in specific pockets only. There is little sense in comparing the aroma of Basmati rice by growing the varieties at Hyderabad. None of the research centres are located at prime scented rice growing areas.

II    Current Research Status

The Indian Council of Agricultural Research (ICAR) has already established 7 research centres to improve Basmati-type rice varieties regarding the yield and fine grain parameters. It places little emphasis on aroma.

We initiated another project with emphasis on non-Basmati type indigenous scented rice with scientists from IRRI and G. B. Pant University of Sericulture & Technology, Pantnagar with the following objectives:
1) Germplasm collection, purification, morpho-physiological, biochemical and molecular characterization.
2) Chemical characterization of aromatic compounds and development of a qualitative assay for the aroma.
3) Location and documentation of genes for aroma, other fine grain qualities and resistance against diseases and pests.
4) Structuring of the gene pool in distinct groups on the basis of aroma and further sub-structuring based on other characteristics.
5) Effect of organic manure, chemical fertilizers and micronutrients on aroma formation in Basmati and Kala Namak.
6) G x E studies on aroma.
7) Improvement of the Kala Namak, Lal Basmati and Dehradun Basmati by selection.
The major emphasis of this project is to study the indigenous scented rice varieties in their native areas of cultivation and give due importance to aroma. We have tried to avoid duplication of work with ICAR Research Network on Basmati Rice. Progress made so far is as follows:

**A: Database development**

As a first step for data base development R. K. Singh and U. S. Singh devised a questionnaire and sent it to all the agricultural universities and institutes with active research programme on rice. Most of them responded. Information obtained has been summarized in Table 2.

The information clearly shows that even among the scientists:
- Cultivars with widely different characteristics are given the same name at different places,
- Cultivars/land races with almost similar characteristics are called by different names, and
- Even for popular scented cultivars wide variation is reported in some of the important characteristics like aroma (poor to strong) and grain elongation on cooking apart from duration, yield, and plant height. This emphasizes the fact that area of cultivation has a great impact on aroma formation.

**B: Collection, purification, and evaluation of germplasm**

During the first year more than 150 germplasms were collected mainly from U.P. and cultivated at major aromatic rice growing areas like Seora-Majra (Dehra Dun), Nagina, and Sidharthnagar for their purification and study of different physio-morphological and agronomic characteristics with stress on aroma.

**III Need**

A: Research Support
India still has a wealth of scented rice germplasms/ land races with vast potential. However, aroma is dependent on undefined environmental and cultural conditions. Till such time we must try to study and improve these varieties in their natural habitat itself to exploit their full potential.

Research support is a vital need for collection; purification; agronomic, morpho-physiological and molecular characterization; evaluation, and maintenance of the indigenous scented rice germplasms. Even the All India Rice Exporters’ Association (AIREA) may take initiative by funding the project. With the help of Agricultural and Processed Food Products Export Development Authority (APEDA) of Government of India, AIREA is fighting the legal battle against Rice Tea Inc., USA for protecting the name ‘Basmati’ in international market. Safeguarding indigenous scented rice germplasms is far more important for the future.

Preservation of germplasms of indigenous scented rices cannot be overemphasized as free exchange of these material would be longer be possible. These germplasms should be preserved and multiplied in their native areas of cultivation. During our survey of the Pauri district one octogenarian visionary farmer, Mr. Rishal Singh of Kishanpur village, while describing the characteristics of some of the scented rice varieties which were in cultivation about a half century ago, commented that, “We inherited a wealth from our forefathers and destroyed them by our foolishness and lust for more profit”. If we can inculcate a similar type of feeling even in small section of the farmers we can achieve a lot with resect to in situ preservation of the germplasms.

Environmental, soil and nutritional factors affecting aroma formation in major cultivars of Basmati and non-basmati type scented rice must be characterized.

Perceived rice aroma is broadly classified into five major groups: (1) green, (2) fruity/floral, (3) roasty, (4) nutty, and (5) bitter (Widjaja et al., 1996). More than 100 volatile aroma compounds have been identified from the cooked rice (Tsugita, 1985-86). However, little scientific information is available on the relative importance of these compounds to total rice aroma. Compound with lowest scent thresholds include (E,E)-2,4-decadienal, (E)-2-nonenal and 2-acetyl-1-pyrroline (Buttery et
The most important compounds, which contribute to total aroma profile are alkanals, alka-2-enals, alka-2, 4-dienals, 2-pentyfuran, 2-acetyl-lpyrroline and 2-phenylethanol (Widjaja et al. 1996). A mixture of the compounds may be responsible for any observed cooked rice aroma. A mixture of the compounds in the correct proportions may be responsible for the cooked rice aroma (Widjaja et al., 1996). Major aroma compounds in some of the scented varieties of rice are listed in Table 3. The most commonly present compound in scented rice is 2-acetyl-1-pyrroline. It imparts popcorn-like smell.

Among Indian scented rice whatever information is available on chemical nature of aroma compounds is restricted to Basmati. Even type of Basmati is not defined. By simple sensory test two distinct categories of scents, other than Basmati, could be detected in some Indian aromatic rices. These are (1) Malagkit Sung Song Type, and (2) Badshah bhog type (Anonymous, 1990-93). Also considering the fact that many of these cultivars form aroma under agro climatic conditions different from Basmati, the nature of the major aroma compounds in these cultivars is likely to be different.

Too much emphasis is placed on grain length. There are small and medium grain-sized varieties, which are better than Basmati regarding fine grain qualities, like aroma, texture, elongation on cooking, etc. Many of these can be cultivated under conditions and in areas where Basmati will not flourish. Small-grain Bindli has better aroma than Basmati. It performs well under waterlogged conditions. Such varieties in different agro climatic conditions in different states should be promoted for export. Domestic market is no problem as many of these varieties are more popular than Basmati in their areas of cultivation. A few such potential candidates could be Kala Namak, Tilak, Sakkar-Chini and Dhania (U.P.), Ambemohor (Maharastra), Bedsabhog (Bihar and West Bengal), Madhumati and Mushkan (Himachal Pradesh), Kon Joha-1, Ranga Joha and Krishna Joha (Assam), Radhuni Pagal (West Bengal), Vishnu Bhog and Dhubraj (M.P.), and Katarni and Sonachur (Bihar).

Following observations of the farmers should be verified preferable through farm trials:

- Nitrogenous fertilizers vs. organic manure for aroma
- G x E (especially temperature) for aroma
• Soil factors including micronutrients on aroma

Basmati should be tested in non-Basmati but aromatic rice areas like Sidharthnagar. Similarly performance of Kala Namak should be propagated in Dehra Dun. Drying, milling and storage technologies should be standardized for major indigenous scented varieties.

Policies

In order to achieve the above goals not only more research is needed but also change in our policies.

• There should be price support to the farmers of native aromatic rice growing so that they do not shift to other cultivars of rice or to other crops. Some of the farmers from Dehra Dun told us that increase in Basmati prices by Rs.3 per kg may change the situation and make the Basmati cultivation more profitable than sugarcane.

• There should be incentives for on-farm conservation of germplasms.

• There is need to improve rather than to replace these varieties. Government and university extension services should be more pragmatic in their approach. Their aim should be to conserve rather than destroy local varieties/germplasms.

• Organize seed production and distribution programs for local scented rice cultivars. AIERA may also help in this direction.

• Restricting sale of land for non-agricultural use in prime Basmati growing areas.

• Exploring/developing the international market for small/medium-sized grain, non-Basmati type-high quality scented rice. This should be primary job of the AIREA and APEDA.
References


Annexures

Table 1a: Factors favouring aroma formation in rice as perceived by farmers*

<table>
<thead>
<tr>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>low temperature (22-27 °C) during flowering and grain development</td>
</tr>
<tr>
<td>farm yard manure</td>
</tr>
<tr>
<td>good soil fertility</td>
</tr>
<tr>
<td>irrigation</td>
</tr>
<tr>
<td>direct sowing</td>
</tr>
<tr>
<td>lighter soil and upland conditions</td>
</tr>
<tr>
<td>change in field</td>
</tr>
<tr>
<td>quick threshing after harvesting</td>
</tr>
</tbody>
</table>

* Based on survey conducted by R.K. Singh and U.S. Singh of aromatic rices growing belts in districts Dehradun, Pauri and Bijnor of U.P.

Table 1b: Factors adversely affecting aroma formation in rice as perceived by farmers*

<table>
<thead>
<tr>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>higher temperature (&gt;27 °C) during flowering and grain development</td>
</tr>
<tr>
<td>nitrogenous fertilizers particularly urea</td>
</tr>
<tr>
<td>poor soil fertility</td>
</tr>
<tr>
<td>moisture stress</td>
</tr>
<tr>
<td>transplanting</td>
</tr>
</tbody>
</table>

* Based on survey conducted by R.K. Singh and U.S. Singh of aromatic rices growing belts in districts Dehradun, Pauri, Nainital and Bijnor of U.P.

Table 2: Major volatile compounds from cooked scented rices

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Origin</th>
<th>Compounds</th>
</tr>
</thead>
</table>
Table 3: Indigenous aromatic rice cultivars and land-races of India: some specific features

<table>
<thead>
<tr>
<th>Name</th>
<th>Duration (days)</th>
<th>Yield (t/ha)</th>
<th>Plant height (cm)</th>
<th>Grain Quality</th>
<th>Adapta-bility (for aroma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goolarah</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YRF9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jasmine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basmati</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Duration (days)</th>
<th>Yield (t/ha)</th>
<th>Plant height (cm)</th>
<th>Grain Quality</th>
<th>Adapta-bility (for aroma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adamchini</td>
<td>150-155</td>
<td>1.0-3.0</td>
<td>125</td>
<td>small</td>
<td>average</td>
</tr>
<tr>
<td>Ranga Joha - 1</td>
<td>150</td>
<td>1.5-2.3</td>
<td>142</td>
<td>small</td>
<td>average</td>
</tr>
<tr>
<td>Bindli</td>
<td>135</td>
<td>0.8-1.2</td>
<td>tall</td>
<td>small</td>
<td>v. strong</td>
</tr>
<tr>
<td>Dhania</td>
<td>150</td>
<td>0.8-1.5</td>
<td>tall</td>
<td>small</td>
<td>poor</td>
</tr>
<tr>
<td>Dehradun</td>
<td>140-145</td>
<td>2.0-3.0</td>
<td>140-145</td>
<td>long</td>
<td>strong</td>
</tr>
<tr>
<td>Basmati</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hansraj</td>
<td>135-140</td>
<td>2.5-3.0</td>
<td>135-140</td>
<td>long</td>
<td>average</td>
</tr>
<tr>
<td>Jeerabatti</td>
<td>150</td>
<td>0.6-1.2</td>
<td>150</td>
<td>small</td>
<td>poor</td>
</tr>
<tr>
<td>Kala Namak</td>
<td>150-160</td>
<td>1.5-3.0</td>
<td>150</td>
<td>mediu</td>
<td>strong</td>
</tr>
<tr>
<td>Katarni</td>
<td>160</td>
<td>1.0-1.5</td>
<td>130-175</td>
<td>small</td>
<td>strong</td>
</tr>
<tr>
<td>Ramj Jawain</td>
<td>150</td>
<td>2.0-2.5</td>
<td>tall</td>
<td>small</td>
<td>average</td>
</tr>
<tr>
<td>Randhuni Pagal</td>
<td>155-160</td>
<td>2.0-3.5</td>
<td>150</td>
<td>small</td>
<td>v. strong</td>
</tr>
<tr>
<td>T-9</td>
<td>150</td>
<td>1.0-2.5</td>
<td>tall</td>
<td>long</td>
<td>strong</td>
</tr>
<tr>
<td>Type 3</td>
<td>140-150</td>
<td>2.5-3.5</td>
<td>145-175</td>
<td>long</td>
<td>strong</td>
</tr>
<tr>
<td>Basmati 370</td>
<td>145-150</td>
<td>2.0-3.0</td>
<td>160</td>
<td>long</td>
<td>v. strong</td>
</tr>
<tr>
<td>Taraori</td>
<td>155</td>
<td>2.5-3.0</td>
<td>155</td>
<td>extra</td>
<td>average</td>
</tr>
<tr>
<td>Basmati*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(* ) Also known as Karnal Local

(**) Phool Patas has 300 grains/panicle

Elong = Elongation after cooking

Table continued on page 243.
Ethnomedicinal Plant Resources of Gujarat

by M.N. Reddy, Uma Devi, Dharmishtha Bhatt & Minoo Parabia

Introduction

With the advent of modern medicine, traditional medical practices with emphasis on plants, herbs, roots, fruits, etc. took a back seat. Our forests contain a number of plants that are of immense medicinal value. Their names have been mentioned in various nighantus. Panini’s Grammar (circa 5th Century BC) enumerates different plants, some of them of medicinal value. Tribals have become the repositories of indigenous medical lore. The Bapalal Vaidya Botanical Research Centre, South Gujarat University, is doing its bit to unearth the various medicinal plants and identity the diseases which could be cured with the aid of those plants and herbs. In this, various nighantus published at different times have been of some help. The lists of such publications have been provided. Some of the plants have become extinct and others are facing extinction. We cannot be too careful in preserving them. Changing lifestyles, deforestation, construction are some of the large factors for the loss of medicinal plants.

Shah (1978) has described about 2000 taxa in his flora of the Gujarat state. A scrutiny of the ancient as well as contemporary literature, ethnobotanical survey and personal interviews with the practitioners and healers of traditional medicine revealed about 750 taxa having medical uses, occurring in Gujarat (Umadevi, 1989). Umadevi et. al. (1989) classified these 750 taxa according to their use. The following are some of the ailments that could be cured with medicinal plants.

<table>
<thead>
<tr>
<th>SNo</th>
<th>Diseases</th>
<th>Taxa</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brain tonic, epilepsy, hysteria, neuralgic pain, paralysis, cephalalgia, ophthalmia, headache sciatica, CNS depressant, CNS stimulant, hemicrania, hypnotic epileptic fits, etc.</td>
<td>234</td>
</tr>
<tr>
<td>2</td>
<td>Bone fractures, sprains, arthritis, rheumatism, spondylitis, gout and stiff neck</td>
<td>181</td>
</tr>
<tr>
<td>3</td>
<td>Antiseptic</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>Wound healing</td>
<td>95</td>
</tr>
<tr>
<td>5</td>
<td>Blood impurity, anaemia, blood purifier and enricher</td>
<td>145</td>
</tr>
<tr>
<td>6</td>
<td>Pulmonary and bronchial diseases; expectorant, cough, pneumonia, bronchitis 294 pleurisy, pathosis, whooping cough, pharyngitis diphtheria demulcent, etc.</td>
<td>294</td>
</tr>
</tbody>
</table>

45 Shri Bapalal Vaidya Botanical Research Centre, South Gujarat University, Surat
Heart diseases: blood pressure, cardio tonic and cardialgia

Diseases of the alimentary canal, indigestion, ulcers, colitis, diarrhoea, dysentery, constipation, emetic, laxative, antihelmintic, dyspepsia, cholera, piles, spleen enlargement, polydipsia, antispasmodic, demulcent, gastritis, haemorrhages of bowel, flatulence, prolaps of the anus, etc.

Diseases of liver: jaundice, liver enlargement, derangement of liver and gall bladder, hepatic congestion liver tonic and hepatitis

Aphrodisiacs

Feminine ailments of reproductive system disorders: gonorrhoe, abortifacient, urethral discharges, leucorrhrea, amenorrhoea, emmenagogue, urethritis, menorrhagia dysmenorrhoea, general debility, galactagogue, sedative to uterus, fertility in obese women, blennorrhagia, ovaritis, venereal buboes vaginitis, prolapse vagina, mammary abscesses gravid uterus, expulsion of foetus etc.

Urinary troubles: Nephritis, prolapus uteri diuretic diuresis, micturition, dysuria urinary calculi cystitis, kidney stones, scalding urine, derangement of kidney urethritis etc.

Skin diseases: leprosy, itch, sores boils, skin eruptions, leucoderma, scabies erysipelas, herpes, eczema, antifungal, ringworm infections, warts, cracks of foot, blemishes maggot infested wounds, psoriasis, ozaena, pimples, oedema abscesses, dhobi-itch, small pox, pruiytis, etc

General tonic

Febrifuge: intermittent, fever, malaria, typhoid, eruptive fever, pneumonia

Hypoglycaemic

Problems and prospects:

Data collection:

The scrutiny of ancient literature presented us with jargon of synonyms and homonyms. The classics Nighantus (Materia medica) referred to are as follows:

<table>
<thead>
<tr>
<th>Name</th>
<th>Author</th>
<th>Approx. period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhanvantri Nighantu</td>
<td>Dhanvantri</td>
<td>10th Century</td>
</tr>
<tr>
<td>Nighantu Shesha</td>
<td>Hemchandra</td>
<td>11th Century</td>
</tr>
<tr>
<td>Sodhal Nighantu</td>
<td>Sodhal</td>
<td>12th Century</td>
</tr>
<tr>
<td>Madanpal Nighantu (Madan-Vinod)</td>
<td>Madanopal</td>
<td>14th Century</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------</td>
<td>--------------</td>
</tr>
<tr>
<td>Kaidev Nighantu</td>
<td>Kaidev</td>
<td>15th Century</td>
</tr>
<tr>
<td>Raj Nighantu</td>
<td>Narhari Pandit</td>
<td>15th Century</td>
</tr>
<tr>
<td>Todarmal Nighantu</td>
<td>Todarmal</td>
<td>16th Century</td>
</tr>
<tr>
<td>Bhavprakash Nighantu</td>
<td>Bhavimishra</td>
<td>16th Century</td>
</tr>
<tr>
<td>Shaligram Nighantu</td>
<td>Shaligram?</td>
<td>17th to 19th Century</td>
</tr>
<tr>
<td>Rajvallabha Nighantu</td>
<td>Rajvallabha</td>
<td>18th Century</td>
</tr>
<tr>
<td>Nighantu Ratnakar</td>
<td>Katobhatt</td>
<td>1850</td>
</tr>
<tr>
<td>Nighantu Bhusan</td>
<td>Shailgram</td>
<td>1896</td>
</tr>
<tr>
<td>Vanaspati Shastra</td>
<td>Jaikrishna Indraji</td>
<td>1910</td>
</tr>
<tr>
<td>Nighantu Adarsha</td>
<td>Bapalalji Vaidya</td>
<td>1927</td>
</tr>
<tr>
<td>Vanaushadhi Chandrodaya</td>
<td>Bhandari</td>
<td>1938</td>
</tr>
<tr>
<td>Dravyaguna Vignan</td>
<td>Jadvji Trikamji</td>
<td>1950</td>
</tr>
</tbody>
</table>

The literature sometimes exaggerates the curative properties. Bhat (1966) has enlisted 460 Sanskrit names, of them only 289 could be identified with modern equivalents, rest evaded their identity. Many are having controversial identity (Vaidya, 1982). Even to this date, we are not very sure about the correct botanical identity of many plants. The modern works (e.g. Shivrajana & Balachandran, 1994) too have regional impact about deciding the identity of plants.

Tribals, non-tribal rural sources, grandmas, traditional healers and even roadside quacks helped in compiling ethnic information. At times it was difficult to befriend a reticent person and at times an over enthusiast flooded us with nonsense information.

On referring to the brochures of current galenicals published by pharmacies revealed the list of about 150 taxa, of them quite a few do not occur in Gujarat. In short the taxa used for preparing ayurvedic medicines are very few. However, the total number of plants recorded by us as having medicinal value is 750 (Umadevi, et. al. 1987). These 750 taxa are broadly classified according to their utility as listed above.

The current status of resources: The taxa used medicinally occur in different ecoclimatic zones.

1. Forests  
   Trees  
   Climbers  
   Shrubs  
   Undergrowth  
   Herbs epiphytes and parasites
Open grounds
2. Road side vegetation
3. Hedges
4. Weeds along crop fields
5. Post harvest weeds
6. Door yard gardens and public gardens
7. Sea shores
8. River banks
9. Garden plants as ornamentals
10. Cultivars
11. Water sheds

These areas have varying degrees of vegetational diversity and magnitudes. It is not within the purview of this article to give list of taxa occurring in each of the aforelisted ecoclimatic zones. However, the factors affecting these repositories are briefly discussed.

The loss of habitat:

Changing lifestyles, industrialization, large dams, canals, roads, changing patterns of agriculture, weedicides, pesticides and fertilizers, reforestation, shifting cultivation, and agroforestry patterns cause loss of habitats. Forests are not only shrinking in size they are losing their diversity. Hedges used to provide a microclimate to harbour fairly diversified flora and fauna but the compound wall has put a stop to it. Canals are replacing village ponds. Weedicides destroy medicinal plants and the residual effects do not allow the growth of post-harvest weeds.

Modern Health Centres:

The primary health centres and modern medical aid have failed to recognize the value of traditional healing practices which are often rejected as witchcraft, unscientific and quackery. This has reduced the role of a tribal to that of a collector instead of a co-user. Such alienation leads to disregard in tribals and weeds are considered a nuisance despite their medicinal properties.

Destructive methods or collection and over exploitation:

Most of the herbs are used as whole, including roots, stem, leaves, flowers and fruits/seedes, if any. Certain medicines are made of wood, bark, roots, leaves, fruits or seeds also. The herb is collected before the seed setting, thus diminishing the chance of rejuvenation. Collection of vital parts like,
roots, bark and gum can kill the plant itself. Over-exploitation threatens the species. *Semecarpus anacardium*, *Asparagus* spp, *Chorophytum porivilianul*, *Sterculia urens*, *Pterocarpus* are such threatened taxa.

**Research needs:**

- Source recognition and publication of ethnic information on medicinal plants.
- Clinical and toxicological proving of ethnic information.
- Deciding botanical identity of classical drugs.
- Finding out substitutes.
- Clinical analysis of the constitutional profile.
- Methods of standardization and pharmacognostic studies.
- Methods of cultivation.
- Methods of storage.
- Identify role of NGOC in developing awareness for non-destructive collection methods, storage, processing and costing of drugs, marketing.
- Periodic “roll call” ensuring germplasm diversity and quantification of raw material.
- Developing dispensable products. Efficacy testing and preparing product monographs for ethnic formularies and single drug products.

**Present status of official exploitation:**

Official exploitation of medicinal plants is monitored by the Gujarat Forest Development Corporation (GFDC). The list includes 20 items. Quite a few items continue to be collected by the tribals and bought by a middleman and supplied to the business firms, exporters and pharmacies. Representative list of important products handled by GFDC is as follows:

<table>
<thead>
<tr>
<th>Species</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acacia nilotica</strong></td>
<td>Gum</td>
</tr>
<tr>
<td><em>Andrographis paniculata</em></td>
<td>Kalmegh</td>
</tr>
<tr>
<td><em>Anogeissus latifolia</em></td>
<td>Gum</td>
</tr>
<tr>
<td><em>Asparagus Spp.</em></td>
<td>Musli, Shatavari</td>
</tr>
<tr>
<td><em>Boswellia serrata</em></td>
<td>Gum</td>
</tr>
<tr>
<td><em>Chlorophytum</em></td>
<td>Musli</td>
</tr>
</tbody>
</table>
Still another official exploiter is the cooperative pharmacy at Ahwa.

The state council of Ayurveda and Siddha has a few gardens at Saputara, Gandhinagar, Rupavel, Antrasba, Junagadh, etc. and sell their own products to the users. Most forest products are available free of charge. The tribals are viewed as only collectors and not as rightful receiver of compensation as what a farmer or producer would receive. This particular matter renders any farming attempts on medicinal plants an economically non-viable project. Therefore, a moratorium or possibly a total ban on some of the products will be a welcome step towards conservation of biodiversity.

A representative list of plants in short supply or are threatened is as follows:

<table>
<thead>
<tr>
<th>Species</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia catechu</td>
<td>Katha</td>
</tr>
<tr>
<td>Asparagus adscendens</td>
<td>Dholi Musli</td>
</tr>
<tr>
<td>Boswellia serrata</td>
<td>Loban</td>
</tr>
<tr>
<td>Chlorophytum tuberosum</td>
<td>Dholi Musli</td>
</tr>
<tr>
<td>C. borivilianum</td>
<td>Dholi Musli</td>
</tr>
<tr>
<td>Commiphora wightiana</td>
<td>Dholi Musli</td>
</tr>
<tr>
<td>Diospiros melanoxylon</td>
<td>Timru</td>
</tr>
<tr>
<td>Gmelina arborea</td>
<td>Shivan</td>
</tr>
<tr>
<td>Hymenodictyon excelsum</td>
<td>Haimmar Chhal</td>
</tr>
<tr>
<td>Oroxylum indicum</td>
<td>Shyonak, Tetu</td>
</tr>
<tr>
<td>Pterocarpus marsupium</td>
<td>Biyo</td>
</tr>
<tr>
<td>Semecarpus anacardium</td>
<td>Bhilama</td>
</tr>
<tr>
<td>Sterculia urens</td>
<td>Kadaya</td>
</tr>
<tr>
<td>Terminalia arjuna</td>
<td>Arjun</td>
</tr>
</tbody>
</table>

Following are the plants (a representative list) which are in constant need and are used in large quantity, yet not qualified as endangered taxa due to their cosmopolitan nature and fast growth. However, under global perspective one gets impatient about their future welfare.
<table>
<thead>
<tr>
<th>Species</th>
<th>Local Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Abutilon spp.</em></td>
<td>Bala ati</td>
</tr>
<tr>
<td><em>Acacia nilotica</em></td>
<td>Babool</td>
</tr>
<tr>
<td><em>Achyranthus aspera</em></td>
<td>Aghedo</td>
</tr>
<tr>
<td><em>Agave spp.</em></td>
<td>Ketki</td>
</tr>
<tr>
<td><em>Aloe spp.</em></td>
<td>Kunvar patha</td>
</tr>
<tr>
<td><em>Andrographis paniculata</em></td>
<td>Kalmegh</td>
</tr>
<tr>
<td><em>Azadirachta indica</em></td>
<td>Neem, Limdo</td>
</tr>
<tr>
<td><em>Butea monosperma</em></td>
<td>Palash</td>
</tr>
<tr>
<td><em>Calotropis spp.</em></td>
<td>Ark, Akdo</td>
</tr>
<tr>
<td><em>Clerodendron phlomidis</em></td>
<td>Arani</td>
</tr>
<tr>
<td><em>Datura spp.</em></td>
<td>Dhatura</td>
</tr>
<tr>
<td><em>Echinops echinatus</em></td>
<td>Utkanto</td>
</tr>
<tr>
<td><em>Gymnema sylvestre</em></td>
<td>Madhunashini</td>
</tr>
<tr>
<td><em>Lawsonia inerme</em></td>
<td>Mehandi</td>
</tr>
<tr>
<td><em>Mucuna pruriens</em></td>
<td>Kauncha</td>
</tr>
<tr>
<td><em>Padalium murrex</em></td>
<td>Gokhru-boda</td>
</tr>
<tr>
<td><em>Psoralea coryllifolia</em></td>
<td>Bavchi</td>
</tr>
<tr>
<td><em>Sida spp.</em></td>
<td>Bala</td>
</tr>
<tr>
<td><em>Terminalia bellerica</em></td>
<td>Behda</td>
</tr>
<tr>
<td><em>T. chebula</em></td>
<td>Harda</td>
</tr>
<tr>
<td><em>Tinospora cordifolia</em></td>
<td>Golo</td>
</tr>
<tr>
<td><em>Tribulus terrestris</em></td>
<td>Gokhru-kantaly</td>
</tr>
<tr>
<td><em>Tylophora indica</em></td>
<td>Damvel</td>
</tr>
</tbody>
</table>

Strategy for a conservation of biodiversity and intellectual right of tribals or any other endemic source:

- Universities, surveyors should be urged to be conscious in publishing the information collected from endemic resources. They must document and acknowledge the source.

- Exploitation from nature be monitored and restricted. Threatened taxa must be banned as early as possible. For other taxa constant watch should be kept on their rejuvenation potential. If found depleting, moratorium be imposed.

- All the forest areas must have germplasm reservoir to be treated as sacred cow and be left unmolested so as this can serve as a future resource for dissemination.
• Pharmacies must be encouraged to produce their own raw material. Tax benefits could be granted to those who produce their own raw material.

• Studies on the cultivation of medicinal plants should be encouraged and the information should be disseminated freely to farmers.

• Owing to the limited number of buyers for medicinal raw material a farmer’s interest should be safeguarded against tricky businessmen.

• Small processing units could add value to the products, decrease volume and transportation overheads.

• Non-destructive methods of collection be taught to the collectors and should be enforced whenever necessary.
References


Community Forest Management for Fuel wood in Thai Highland Villages

Sinth Sarobol

Introduction

The study was conducted in five villages inhabited by Karen, Lisu, Hmong, and local Thai hill tribes, which were part of the UN/Thai Sam Mun Highland Development Project in Thailand. The research method used comprised triangulation techniques, interviews, direct measurement and rapid rural appraisal. The study aimed to determine the fuel wood system as well as community forest management system.

The findings showed that fuel wood was obtained mostly from hill evergreen forest and mixed deciduous forests. The major species were *Fagaceae* and *Pinaceae*. These were collected from the forest near the villages, farmlands, and woodlots. The hill tribes perceived that community forest management required the involvement of rural households or individuals in the production, management and use of fuel wood, trees, woodlots and forests. It also depended upon traditional practices, customary laws, culture patterns and lifestyles of people living in and dependent on forest resources. It also involved a set of activities: development of community forest resource management plan, allocation of benefit sharing, implementation and control, and recognition of user rights.

The rules and regulations for the use of forests were the main theme in community forest resource management in the study villages where the community had to protect and maintain all types of forests. In case of conflict in community forestry, project officers and the villagers had to sort out the problem. The project provided information, advice and support to resolve the conflict at the peoples’ forum. Conflicts among users were settled at a meeting of the community forest committee and the village. The role of women was found to be important in community forest management for fuel wood.

46 Director, Payap Research and Development Institute, Payap University, Chiang Mai, Thailand
Northern Thailand is a mountainous area with ridges rising to over 2500 metres above sea level. A slight imbalance between the total demand for wood resources and supply was usually met by over-cutting of the forest (National Economic and Social Development Board, 1985). A survey of fuel wood consumption in 1980 showed that 38.26 m$^3$ was consumed per household per year. The consumption would be around two million m$^3$ per year for the 50,000 households. This rate of consumption has a direct impact on highland watershed areas (Royal Forestry Department, 1980). Fuelwood continues to be the major source of energy in the rural areas. Studies from Royal Forest Department (1980), Eckholm et. al. (1984), Islam et. al. (1984), National Economics and Social Development Board (1985), UNDP/World Band (1985), Lovelace et. al. (1988), and other authors identified the forests nearby villages, trees outside designated forests, and trees form reserve forests as the primary sources of supply. Nevertheless, the village data base in 1990 for the Thailand Seventh National Economic and Social Development Plan (1992-1996) showed that more than two-third per cent of the villages in the North was suffering from deficit fuelwood supply (Department of Community Development, 1991).

Arnold and Jongma (1978), Eckholm et. al. (1984), Munslow et. al. (1988), Gregersen et. al. (1989), and Mehl (1990) mentioned that deforestation and degradation results from fuel wood demand and crises and were closely linked although they were not identical. Various international organizations were established to solve the fuelwood problem in northern Thailand through a social approach to forestry development. One of these is the UN/THAI Sam Mun Highland Development Project (UNFDAC/SM-HDP 1990). Most studies on social and community forest programmes had shown an attempt at striking a balance between villagers’ needs for agricultural land and fuel wood without destroying the forest (Mehl, 1990).

Deforestation and population growth are linked to fuel wood consumption. This can be solved through community forestry programme. In 1987, the Royal Thai Government and United Nations for Drug Abuse Control established the UN/THAI Sam Mun Highland Development Project to protect, conserve, control the National Forest Area and narcotic crop cultivation, and to help villagers meet their fuelwood needs from community forestry.
The paper compares the forest management between five highland villages of northern Thailand and Nagaoka-Ku, Ina city, Nagano, Japan. The study aims at strengthening people’s ecological knowledge of community forest.

**General physical characteristics of the study villages**

Table 1 gives a profile of the villages in the Nam Sa sub watershed according to rainfall, forest type, sub watershed location, and slope. The annual average rainfall is 1000-1500 mm per year. The villages are divided by sub watershed according to topography and mountain ranges. Ban Lisu Mae Muang Luang and Ban Mae Muang Luang Nua (Karen) are located in Huai Mae Muang Luang sub watershed while Ban Khun Sa Nok and Ban Khun Sa Nai are in the Huai Pong sub watershed. Only Ban Huai Rai is situated within Pong Sa sub watershed.

**Table 1. Physical characteristics of the study villages**

<table>
<thead>
<tr>
<th>Village</th>
<th>Rainfall (mm/year)</th>
<th>Forest Type</th>
<th>Subwatershed</th>
<th>Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ban Lisu Mae Muang Luang</td>
<td>1000 - 1500</td>
<td>74.6% Hill Evergreen Forest and 25.4% Mixed Deciduous Forest</td>
<td>Huai Mae Muang Luang</td>
<td>36-50%</td>
</tr>
<tr>
<td>Ban Mae Muang Luang Nua</td>
<td>1000 - 1500</td>
<td>74.6% Hill Evergreen Forest and 25.4% Mixed Deciduous Forest</td>
<td>Huai Mae Muang Luang</td>
<td>36-50%</td>
</tr>
<tr>
<td>Ban Khun Sa Nok</td>
<td>1000 - 1500</td>
<td>50.4% Mixed Deciduous Forest and 49.6% Hill Evergreen Forest</td>
<td>Huai Pong</td>
<td>13-15%</td>
</tr>
<tr>
<td>Ban Huai Rai</td>
<td>1000 - 1500</td>
<td>50.4% Mixed Deciduous Forest and 49.6% Hill Evergreen Forest</td>
<td>Pong Sa</td>
<td>0-12%</td>
</tr>
<tr>
<td>Ban Khun Sa Nai</td>
<td>1000 - 1500</td>
<td>93.5% Hill Evergreen Forest and 6.5% Mixed Deciduous Forest</td>
<td>Huai Pong</td>
<td>13-15%</td>
</tr>
</tbody>
</table>
The village settlement varies according to the slope of the mountain ranges and foothills. Both Ban Lisu Mae Mae Muang Luang and Ban Mae Maung Luang Nua are located approximately in 36-50 degree slope, while Ban Huai Rai, between 0-12 per cent slope. Ban Khun Sa Nok and Ban Khun Sa Nai are located in the same elevation at approximately 13-15 per cent slope. The data from the Geographic Information System of SM-HDP showed that Ban Lisu Mae Muang Luang and Ban Mae Muang Luang Nua has 74.6 per cent hill evergreen forest and 25.4 per cent mixed deciduous forest cover. On the other hand, mixed deciduous forest is greater than hill evergreen forest cover in Ban Khun Sa Nok and Ban Huai Rai. Only Ban Khun Sa Nai has a large area (93.5) covered with hill evergreen forest and only 6.5 per cent mixed deciduous forest.

**Village-level Agroecosystems**

The Rapid Rural Appraisal techniques (RRA) and the overall village-level agroecosystem data in the five villages consist of components like habitation area, reserve forest, woodlots forest, hill evergreen and mixed deciduous upland cultivation, paddy, and fruit trees. A transect was used to describe the biophysical features of the villages studied.

The dominant features of village-level agroecosystem of Ban Lisu Mae Muang Luang is shown in the transect (Figure 1). The settlement sites are normally found in a cleared area adjacent to sloping land. The upland rice fields are mostly around and near the village, and along the road to the Thung Cho Watershed Management Unit. The nearest rice fields are about 20-minutes walk from the village, and the farthest, about one-and-a-half hours. Paddy and maize are the main crops; previously opium too was grown. Mangoes, lichees and coffee are the fruit crops around the village. Fuelwood comes from woodlots on the south of the village and also from dead trees along the road to the Thung Cho Watershed Management Unit.
The transect of Ban Mae Muang Luang Nua (Figure 2) show that Karen hill tribe is situated in a flat area surrounded by forest, fruit trees, and paddies. The nearest paddy field is a 15-minutes walk from the village and the farthest can be reached in about an hour. Mangoes, bananas, coffee, jackfruits and lichees are fruit crops planted around the village and home gardens. Branches and stumps from dead trees serve as fuelwood. These are gathered from woodlots, communal forest and natural forest around the village.

**Figure 1: Agroecosystem transact of Ban Lisu Mae muang luang**

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Figure 3: Agro ecosystem transect of Ban Huai Rai

The agro ecosystem transect of Ban Khun Sa Nai (Figure 4) show the settlement in the central cleared part of the slope. Most of the farmlands and upland rice fields are located in slopes ranging from 13 to 35 per cent, encircled by natural forest. Reserve communal forests are located in the southern portion of the village. The distance from settlements to farmlands is at a distance of 30 minutes to one and half hours walk. The farmlands were formerly used for paddy cultivation. Fuel wood is generally obtained from farm lands and woodlots.

Community Forest Resource Management and Operation

In Northern Thailand, a community forest implies the involvement of rural communities, households, or individuals in the production, management and use of fuel wood, trees, woodlots and forests. This also covers the traditional practices, customary laws, culture patterns, and life-styles of people living in and depending on forest resources, according to the type of forest as classified by the local people (reserve forest, watershed forest, woodlots, farm land forest and communal forest).
Figure 3.1: Agro ecosystem transect of Ban Khun Sa Nok

Figure 4: Agroecosystem transect of Ban Khun Sa Nai
Community forest resource management, however, faced the problem of how to coordinate individual users so as to attain an optimal rate of production or consumption for the whole community. This is also concerned with community control and management of productive forest resources.

“Networking” was established to bring about cooperation between villagers and various government agencies. This was done as most ecological and forest problems faced by the communities were similar. Within the project area, villages are located near rivers. The project area was divided into sub watersheds based on the topography and mountain ridges. Some villagers in a sub watershed informally organized themselves into committees, the representatives of committee served as the core group to help the other villagers analyze the problem and regulate the use of community forest resources.

On December 8, 1991, the SM_HDP project management held a seminar on resources management and land use planning in the watershed area to introduce the concept of resource management and land use planning, get the co-operation of the villagers in the watershed area, and set guidelines for networking. The seminar also aimed at setting up a Nam Sa watershed executive committee for the purpose. The project officer served both as an observer and adviser. The villagers identified the following general problems and solutions affecting the watershed (Limchoowong 1994):

<table>
<thead>
<tr>
<th>Problems</th>
<th>Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Soil erosion, low crop yield, poor water quality, and lower water yield</td>
<td>a) Shifting cultivation because villagers had never learned other management practices</td>
</tr>
<tr>
<td>b) Destruction of crops because of forest fires</td>
<td>b) Illegal hunting by outsiders and accidental swidden fires</td>
</tr>
<tr>
<td>c) Health of down stream settlers affected by chemical contamination streams</td>
<td>c) Poor chemical utilization practices in cabbage field</td>
</tr>
<tr>
<td>d) Crop damage</td>
<td>d) Raising of cattle without fencing or other controls</td>
</tr>
</tbody>
</table>

The villagers suggested the following solutions:
1. Each sub-sub watershed should be divided into management zones fuel woodlots, agricultural land, and headwater conservation to enable the people to know the area of their responsibility.

2. A village committee to control land use.

3. Educating villagers on the impact of forest fires and the establishment of firebreaks around their fields to prevent fire from spreading to adjacent areas when forests are cleared.

4. Each village should protect its headwater forest to be monitored by the members of the committee.

5. Regulating/Controlling the use of chemicals by decreasing the quantity of chemicals used and prohibiting the washing of chemical containers in the stream. Used chemical containers must be burned and buried in the ground.

6. The use of terracing, alley cropping, and agro forestry systems in steep slopes as erosion control measures.

7. Cattle owners should secure their animals and fence their farms.

The inhabitants of ten villages in the Nam Sa sub watershed decided to establish their village committees to carry out community forest resources management project activities.

The villagers initiated the idea of a watershed network committee with support from the Royal Forest Department through the UN/Thai Sam Mun Highland development Project. It paved the way for the project to undertake forest resource management involving the following set of activities (Figure 5).
- Development of a community forest resource management plan
This consisted of classifying the forest for watershed protection according to their use; reserve forest, woodlots, communal forest, reforestation, watershed forest, and farm land forest. Thus, the forest became an area for exclusive communal purposes in terms of the legal and traditional physical boundaries providing access to its utilization.

- **Allocation and benefit sharing**

The local community was permitted by the village committee to share forest products such as mushrooms, bamboo shoots, rattan, fuelwood and lumber for construction. The benefit allocation and sharing was done by the overall supervision of forest management committee through the Nam Sa Subwater Network organisation and from the village forest management committees.

- **Implementation and control**

Allocation and sharing of benefits by the users’ group were done according to the rules and regulations laid down by the community. They were formulated on the basis of forest classification and forest plan established by the concerned agencies and village level organisations. The subwatershed committee and community forest management committee with the co-operation of users, imposed fines for violations of rules.

- **Recognition of rights of users**

Three levels of rights were recognized, namely (a) community rights; (b) community rights by the network; and (c) endorsing of these rights by the government.

Community rights provided the users the opportunity to enjoy the benefits by having the access to forest resources at the community level. This recognition was granted by the community forest committee at the village level based on the traditional and legal rights of a village member. Because the watershed area was divided into subwatersheds, the location of the village also affected the use of
Government recognition of forestry rights was granted to the users for utilizing forest resources for land cultivation, construction, fuel wood, and food among other users. The user groups were allowed to use the forest and share the benefits from the forest resources in the village within the boundaries established by the forest resource management committee, sub watershed network organization and the SM-DHP project.

People’s Ecological Knowledge for Establishment of the Community Forest Management Committee at sub watershed and Village Level

During the December 8, 1991 seminar, 54 participants from 18 villages participated. They included a sub-district headman (Kam Nan), village headman (Phu Yai Ban), village committee (Kha Na Kam Ma Karn Mu Ban), and villagers from the watersheds of Nam Sa, Mae Rak, and Mae Rao. The Nam Sa Watershed Network Committee was formed from among them. Eventually the committee was composed of 15 members selected from 10 villages.
The village committee and the village headman served as representatives of their village community forest resource management organizers. At the same time, they were responsible for disseminating to
the villagers, issues and information obtained from the Nam Sa sub watershed committee. The community forest committee was composed of 10 to 12 members selected by the village people (Figure 7).
The village network organization and the watershed committees were established to develop and increase people’s awareness of the forest resources problems of their sub watershed, and of related problems of neighbouring villages and the whole watershed area in general. The tasks of the community forest committee in every village were as follows (Limchoowong 1994):

- To identify problems and suggest solutions to set guidelines for using forest produce,
- To impose fines on violators,
- To co-ordinate with project officers and government agency,
- To plan and implement forest activities, and
- To spread information among villagers.

People’s Ecological Knowledge for Rules and Regulations in the Use of community Forest

Based on the SM-HDP project document, the village committee and Nam Sa subwatershed network committees held meetings on December 7-8, 1991, and on February 4-5, 1992 to determine the rules and regulations (Limchoowong, 1994) in the management of the community forest within the project areas.

The rules and regulations formulated were as follows:

1) **Opening land for agriculture and forest fire control**

   (a) Farmers are prohibited from opening agricultural land outside their sub-watershed. Violators will be fined 2,000 baht per rai of US$ 90 per hectare.
   (b) If the agricultural land is not used for two consecutive years, the committee shall issue a warning to the user and if it is still not used, the land will be allotted to another farmer who has no agricultural land.
   (c) A farmer must build a firebreak around his holding if fire spreads outside the area or farm, the owner will be fined 2,000 baht per rai.
2) **House construction**

The villagers should make a request to the village committee for wood and for house construction. If they sell the wood instead of using it for construction, the wood will be confiscated and the violator will be fined twice the price of the wood.

3) **Illegal hunting**

The following fines have been decided for illegal hunting and contamination of water sources:

(a) Jungle fowl and domestic fowl, 500 baht each (US$20)

(b) Wild pigs\* domestic pigs, 2,000 baht each (US$90) and

(c) Cattle, 10,000 baht each (US$400)

4) **Protection of reservoir and use of chemicals**

To protect the reservoir as source of water supply, farmers are required to adhere to the following regulations:

(a) Improper disposal of chemical containers around the village shall be subject to a fine of 500 baht per container of chemicals.

(b) Farmers have been asked to grow pigeon pea or other trees across the slope as barrier to reduce chemical seepage into the source of water supply.

The committees have been made responsible to enforce the regulations. The money collected from the fines will be credited to village development fund. Defaulters who fail to pay the fines have to be sent to the district office to face proper action.

**Cases of People’s Ecological Knowledge involving Rules and Regulations of Community Forest Management**
The following cases illustrate how the rules and regulation of Nam Sa subwatershed network organization were adopted during the meetings conducted on December 7-8, 1991 and February 4-5, 1992 by the village community forest committee.

• The community forest committee of Ban Huai Rai and Ban Khun Sa Noka

The community forest committee of Ban Huai Rai and Ban Khun Sa Noka had 10 members consisting of representatives from nine local Thai tribes and one Karen tribe. The villagers of Ban Huai Rai and Ban Khun Sa Nok were allocated a reserve forest in the eastern part of village and a woodlot in the western part of the villages. The rules and regulations on the community forest agreed upon by Ban Huai Rai and Ban Khun sa Nok were:

1. The woodlot should be guarded against fire. Cutting of trees should have the prior approval of the Nam Sa sub watershed management committee.
2. Villagers are allowed to use woodlot for fuel wood and natural food. For house construction, the villagers should inform and make a formal request to the committee.
3. Villagers are allowed to gather dead wood and trees for fuel wood. Cutting of standing trees is prohibited and penalized with a fine according to the regulations set by the Nam Sa sub watershed management committee.
4. Users are required and maintain woodlots.

• Community Forest of Ban Mae Muang Luang Nua and Ban Lisu Mae Muang Luang.

The community forest was distributed among the villagers of Ban Mae Muang Luang Nua and Ban Lisu Mae Muang Luang. The community forest committee was composed of 10 members: representatives of nine Karen tribes and one Lisu tribe from the two villages.

The reserve forest had an area of 5000 rai located in the north of Ban Mae Muang Luang. The woodlot had a total area of 300 rai situated in the southern part of BanMae Muang Luang. Both villages shared the benefits from the forest products coming from the shared forest resource.
The rules and regulations in the utilization and management of the community forest adopted by the village committee members were:

1. Villagers have equal access to fuel wood and should request permission from the community forest committee for house construction before cutting trees.
2. Villagers may gather only dead wood for fuel wood.
3. Sale of wood for house construction is prohibited. It will be seized and a fine twice the price of the wood will be imposed on the violator.
4. The regulations set by the community forest members will be enforced with the cooperation of villagers and users.
References


Centralized vs. Decentralized Forest Management

Sakari Virtanen

Introduction

We Finns are inseparable from our forests. The intensely cold climate endows the forests with pine and spruce. When a Finn goes into the forest, it is like going home. This is a national tradition, which has been handed down from generation to generation since time immemorial. Now that Finland has become a vibrant democracy constantly striving for a welfare state, the tradition has been reinforced. There have no doubt been some variations. As a result of growing unemployment which has risen from five per cent to 25 per cent the highest in Western Europe next only to Spain. The country is sparsely populated. There are only five million people in a country that is a quarter larger than Great Britain that has a population of 60 million.

I have lived all my life in the eastern province of Kainnu that has 95,000 inhabitants in 24,000 square kilometres (four people per sq. km compared to 275 in India). The population is slowly diminishing. Forests take up more than 95 per cent of the land area. There was a time when timber had no price and could be had for the asking. Deforestation was never possible, as Finns have all along been so few in numbers.

Kainuu provides the key to Finnish attitude to life. The national epic, the ‘Kalevala’ was written here. The epic heroes are poets and singers and not warriors. He, who was the wisest and proved it by singing, was usually made the chief.

Once a forest policy was evolved which differed from the laissez-faire attitude of the earlier era, there arose a controversy as to what should be done with old trees, some of them planted hundreds of years ago. One school held that it was crime to cut these old trees. Others argued equally vehemently that they should be felled. Instead of solving the rising unemployment, it would add to it. Forest administrators are currently facing this dilemma.

A radical change in political philosophy has given a new dimension to the problem of modern vs. traditional methods of management. Political parties in the old days worked sincerely for a better world. Society still relies on the same political parties. Parties organize parliament, municipal councils, trade unions, and the administration of parishes of the Lutheran Church in the country.

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In a Spanish book “Modernidad, historia y politica” written by Agapito Maestre (1992), I have found an explanation as to why democracy is sick:

“For instance, the constitutional political powers meet the most serious limits in problems like environmental protection, interrelation of generations, civil obedience, fight for global human rights (unemployment/sv) etc. All the series of questions crosses the boundaries of the classical scheme of the Left and Right and has, so far, not attained the special attention of the parliaments and political parties.”

That is, according to Maestre, where the legislative and executive inability of western democracies is revealed. Maestre names the reason but I have two other men, Jorn Rusen and Richard B. Norgaard to point out what has happened. In his essay on the science of history between modernity and post modernity Rusen (1992) states the ideals of modernity that have, since the Enlightenment, been the guiding stars of the Western society.

The table below is not Rusen’s but has been inspired by his presentation of the ideals.

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“Crisis of Progress” declares lack of confidence in modernity. Norgaard (1994), again, speaks about modernity’s promises. The promises he lists tell that there has been, for several centuries, a lot of world unification in the spirit of western or westernized patterns of development. In spite of many positive signs during the centuries the promises are still only partly fulfilled.
Norgard argues:

“Modernism, and its more recent manifestation and development, have betrayed progress.”

According to him, at least three points of view can be presented:

1. While a few have attained material abundance, resource depletion and environmental degradation now endanger many and threaten the hopes of all to come;

2. The public sectors of all the countries are powerless. Even the democratic capitalist societies are having increasing difficulty providing education, health care, and housing for their poor and are stymied by a plethora of new interlined environmental problems and cultural contradictions;

3. An increasing number of people are declaring that modernism as culture is specious. The open resurgence of cultural, ethnic, and religious diversity after years of suppression, through brutal repression at worst to voluntary assimilation at best, is perhaps the most challenging exposure of the betrayal.

With all my heart, I hope Maestre’s vision about a new democracy inspired by new morale comes true. Indeed, there has recently been a lot of talk about ethics. Emilion Lledo (1994) reveals one of the central problems dealing with ethics and any other fields where communication is needed. He says that the tradition of western ethics has been obscured in transition from one language to another, developed along different spiritual and practical routes. Power and Ideology guided linguistic development. So, the central concepts of ethics as Justice, Beauty, and Love have different translations in different parts even of the western world and during different eras.

**Background**

After the latest ice age, 10,000 years ago, Finland has been constantly inhabited. We do not exactly know who these people were but most of our genetic heritage is from them. Our linguistic heritage is only a few thousand years old. Finnish language does not belong to the Indo-European family.

There was no nation or state called Finland before the Swedish Kingdom was formed in the early centuries of this millennium. Finland was part of Sweden or as we call it, Sweden-Finland, until 1809 when she became part of the Russian Empire. Finland declared independence in 1917.
Two years ago Finland became a full member of the European Union. Parliament and the bureaucracy in Helsinki are no longer the sole centres of power. There is Brussels, the capital of EU, and below are regions and citizens, the grassroots; all gaining additional importance. A new democracy has emerged as a result of this.

**Province of Kainuu**

Now let us revert to my place. The Gross National Product (GNP) per capita in Kainuu is three quarters of the national level, and two thirds of the European (EU) GNP per capita. Kainuu was settled in the early 16th century. Finns used to roam and the Russian traders travelled from the White Sea to the Gulf of Bothnia. In 1595, a Peace Treaty between Sweden and Russian Novgorod was concluded in Taysina. Among other things, the Finnish colonization of what we today know as Kainuu was established. The new borderline was one of the first ones in Europe drawn across land through wilds where people had used to wander freely. These particular 260 kilometres long stretch in Kainuu is one of the oldest untouched on-land borderlines in Europe.

The approach to the history of Finnish forest management is made through the example of Kainuu:-

**Historical Survey: The Finns and the Forest**

**Material value**

The period of the permanent settlement of Kainuu equals ten generations. The period consists of three to four tree generations. The life cycle of coniferous species at the Kainuu latitude is about 110 years. The oldest living trees located in the Kainuu Old Growth reserves were seeded in the 14th century.

Radical changes have occurred in exploiting forests during the last four centuries. In the beginning, the main source of livelihood was hunting but in the 16th century swidden cultivation became the most important one. Tar burning from pine started during mid 18th century. This became the next main source. In the late 19th century, Kainuu, together with Russian Archangel, was the leading European producer of tar. From the 1860s onward the forest industry became the most important user of timber of the Finnish forests. The progress of a backward Russian Grand Duchy of the 19th century located in the European periphery to an independent welfare state of the late 20th century can, from the economic point of view, be told as a success story about “the Rise by Timber into Better Days”. In the inter-war period, in the 1920s and 1930s, the forest industry made over 80 per cent of the total export. Today the share is about 40 per cent. “Finland has wooden legs” is very much true today as it has always been. Today there is more wood in Finnish forests than there used to
be a century ago although the forest industry has increased its consumption of timber from 8 million cubic metres in 1900 to 47 million in 1989.

Forest served as a “farmer’s bank”, especially in the post-war period. A timber delivery made up primary capital for investments of the farmer’s households because all the farmers in Kainuu are also forest owners. Today, the connection between agriculture and forestry is no more that close since great numbers of forest owners have given up agriculture and moved to urban professions, and the farmers have got other financial sources.

Non-material value

The idea of the beauty of nature is comparatively new. Finnish, painters, poets and composers became conscious of it in the 19th century, not so much later than their colleagues elsewhere in Europe. The National Romantic Movement of Arts round the turn of the country equated the nature of Finland with the best features of the national character. Those were the heavy years of oppression under the Russian regime. National romantic works using metaphors from nature were to strengthen the striving for independence (Reitala, 1987).

The impact of the Romantic Movement was soon seen, for instance, in the views over the villages where trees and ornamental shrubs became accepted into the traditionally treeless yards and squares. Forest has also many profound metaphysical meanings in the mind of present-day Finns.

Forest is a place for recreation. The common right of access assures practically all the forest free for citizens to wander to pick berries or to encamp. After reading Ramchandra Guha’s “The Unique Woods, Ecological Change and Peasant Resistance in the Himalaya”, I have been looking for a Finnish tradition of “ecological sanctification”, as I call it. Nothing comparable to the Himalayan holy woods has come to me. The reason is most obvious: As the Finns always were so few they never were able to threaten the existence of forest, however exploitative their usage might have been.

Forest as itself

Till the late 19th century, timber had no value. Thereafter, in a faithful modernist manner, the attitudes towards the forest have turned more and more positive - testifying in favour of the ideology of modernism or liberalism.

Commercial forestry has resulted in many positive consequences in the Finnish society. Nevertheless, because the time of commercially rational circulation in the Kainuu forests is 110 years old, scientific
forestry started in the early 20th century in Finland has not yet been capable to reveal, to say nothing about solving, all the problems involved in attempts to manage Nature. One of the problems was caused by the extremely promising results from large-scale experiments in silvicultural methods in the 1930s, climatically most favourable. The climate in the 1950s and 1960s was most unfavourable and the results were bad.

In the last few decades forest has made one of the main subjects of the Finnish dispute on the environment. Commercial forestry has increased the volume of the forests. The forests but did not look like an original forest. Open cutting dominated forestry. The monoculture pinewoods were lacked other species. Were the scientific methods the best in the long run? There were concerns for the health of the forest and for the genetic heritage on which the forest has survived so far in our harsh climate.

Open cuttings and other highly commercial methods of forestry, came to be criticized in 1960s and 70s. They were the first environmentalists in Finland. The result is silviculture today is more ecological than a few decades ago.

The hot issues today are the biodiversity and the low growth forests. The last boreal coniferous old growth in Western Europe can be seen in Finland, in Kainuu and its neighbourhood. After a dispute, the government decided to protect some 60,000 hectares of the state owned old forests. Actual borders, compensation for lost jobs, the actual acreage are still matters of dispute.

**Historical Survey: Decision Levels**

**Private**

The first regulations in forestry by the government were imposed in Sweden-Finland in the 16th century to help mining industry against the sawmill industry, swidden cultivation, etc. These curbs had no impact on remote parts as Kainuu. Forests continued to be burnt for swidden cultivation even at a distance of 80 kilometres from the home estate. All the lands suited for swidden cultivation were burnt in Kainuu at least once a century in the period from the 16th to the late 19th century.

Swidden culture altered the species. The suitable land was simply identified by rich spruce (or broadleaf) habitat. After one to three crops the area was left by itself and the natural afforestation began. The first tree species to enter were broadleaf and then pine that liked the ashferous soil. In the course of a few tree generations, spruce (being the most vigorous species) was able to regain its dominating status – as if there was no human activity.
Vast spruce dominated forests in Kainuu after the era of tar. The original balance was forced back by modern forestry in the 20th century but soon turned over in favour of pine because it seemed, in the industrial sense, more profitable than spruce. As the forest science has developed it has, once again, changed the assortment of species towards their natural balance; even the broadleaf trees have today their duties in the Finnish forests. The local people made decisions according to their knowledge of traditions as long as the forests were common property (until the general parcelling of land in the mid 18th century)

**Authorities**

An epoch-making change took place during the last decade of the 19th century. At first, in the 1850s the Government (Senate of Finland) began to realize the value of the forest. The industrial policy was liberated and the first steam driven saw mills were permitted. From the 1860s onward no privilege was any more needed for the amount of timber and further in a negative attitude towards the traditional forest uses. One of the results was intensified management of the state owned forests.

A German style authority, National Board of Forestry was established in the late 1850s for the management of the Crown’s forests. Free burning of tar or swidden cultivation in the Crown’s forests was no longer allowed for peasants. The education of professional foresters started in the 1860s. Academic education started in the early 20th century. A layman’s ability to take care of his own forest was not respected. In 1928 the Private Forest Law as made to oblige the forest owners to manage their forest as authorities saw it to be good forestry. A network of regional boards (Regional Forest Centres) was constructed for the private forest owner’s control and guidance.

**Obedient Finns**

The Finns are generally obedient to a centralized administrative system. When Finland became a democracy this attitude of the people turned out to be an asset. The concept of forestry has undergone a change with the tree acquiring a commercial value instead of purely a utilitarian one.

With the collapse of the ancient rural economy the possibility to make money from forests was realized in two ways:

1. Around the turn of the century thousands of farmers sold their forests to the forest industrial companies. There were communities where every third estate became a company property. This
was seen as an alarming social phenomenon and an act to very strictly control the companies’
right to own land was enacted in 1915 after a decade of stormy dispute;

2. Companies gave the terms of timber trade. People who had never got accustomed to handle
money were satisfied with any price. It was also usual to make deals as concessions for
harvesting were given by the company upto 10 years in normal cases but in utmost cases even 40
years.

As the first national forest inventory in 1923 proved that the private forests were in the worst
condition compared with the state and company owned forest the reason was most obvious.: People
who had in the ancient rural economy given Nature time enough to patch the holes man had made in
the forest did not have any traditional knowledge about how to behave. People had never learned to
work for the forest. On one hand, there always were new stands for swidden cultivation and on the
other the recently burnt area was naturally reforested, the burning being the best way to prepare the
substrate and to uncover mineral soil covered by thick turf. Nothing was needed to help Nature.

Ethics

Because of rising unemployment the question arose whether forests should be preserved even when
people were facing economic difficulties. Two opposing points of view emerged in Kainuu, both
basing their arguments on high moral ground. One argued that it is immoral to protect forests
because it results in unemployment. Another says that it is immoral to destroy the old growths
because they are the only we have left to leave to our children and grandchildren. The old growths are
in the communities that suffer severe unemployment (30%) and where every unemployed lumberman
has a name.

Citizens Heard

A decennial plan for the state owned forests of the Forest and Park Service’s Kainuu Region has been
evolved. The plan is called Regional Natural Resources Plan. Public Participation, a revolutionary
turn in the Finnish tradition of forest management, is an inherent part of the plan. Organized interest
groups, laymen and others were asked beforehand how they would like the state owned forests to be
used.

Citizen’s first reactions were rather suspicious as to how their comments would affect the plan. But,
as the planning proceeded, attitudes became more positive and participation activated. The first
round left a lot of questions unsolved, e.g., dealing with the reliability, validity and overage of the articulated layman’s will.

A feedback survey (Loikkanen 1996) was done to find out laymen’s comments on:

1. How the planning process was perceived;
2. How the participation feedback on forest attitudes compares with the whole population’s attitudes; and
3. How their opinions were actually taken into account.

The purpose of the survey is to develop the methods of Public Participation to fit better in the Finnish culture and to serve the landscape ecological planning.

The survey was administered to thousand inhabitants of the planning region. Response rate was 53 per cent. Only every seventh respondent knew how to participate and only two per cent really participated. Two thirds of the respondents believe that Forest and Park Service (FPS) manages well the forests. Two thirds of those who participated believed that the FPS pays attention to their opinion. According to a unanimous opinion people value biodiversity, but at the same time they see no need for additional protection areas. The common right of access is one of the most important citizen rights in Finland, with forests being a natural part of everyday life. The aspect of employment should be carefully taken account. The most difficult problems revealed by the survey should be carefully taken account. The most difficult problems revealed by the survey were twofold. On one hand, the utmost protection (of the old growths) was seen as a threat and on the other hand, the methods of the Hard Forestry were disliked too.

**Citizens made to decide**

The brand new Private Forest Law included ever stricter duty to take care of the ecological diversity. At the same time the Government has reduced the financial support to the national organizations (the Regional Forest Centres (RFC)) for the control and guidance of the owners of the private forest. This leaves the forest owner alone with the heavier responsibility.

**Conclusions**

There are, thus, today in Finland at least vague signs of a tendency towards a new grassroots democracy. I cannot help being a little bit suspicious concerning the whole society’s management.
There are current examples of authorities that do not give up their domineering ways. There is a tussle between the old modernist structure’s defense against a new worldview and new democracy. There is also the cultural polarization between the elite and the people.

While the Ministers in the Government are speaking of banks they are speaking of men and women they know and with whom they have involved a variety of affairs. For citizens these people belong to gray elite.

The last generations have learned to know Finland as a Happy Isle, safe and isolated. True, we live in peace and our representative democracy functions as well as anywhere. The social system still takes care of everyone. Remembering the history of Finland and comparing the current standard of living with that of the grandparent’s everything seems to be well, now, in our country.

The example of forestry tells that even if modern science has produced five achievements, it now and then has met its limits in unpredictable reactions of Nature (Crisis of Progress!). A lot of these reactions could have been found in the memory of people’s tradition, but not read because we believed that we got a New World to live. I have also seen many of the problems of forestry explained in the reports of the old professionals who made the decennial regional plans for the state owned forests in the beginning of our country. Their observations were just forgotten because of the promising results of the 1930s told above. As we know from medicine, grassroots tradition is worth learning in forestry, too.

It may sound like a paradox, but while the welfare society has reached its limits and turned downwards, the citizen’s independence in relationship with the authorities has turned upwards. How long it will take to learn to exercise the legitimate power one has and not leave everything to someone else?

There is room for science and grassroots knowledge, for centralized and decentralized management. The future I am interested in as an enlargement of what we do know today (in Finland).
References


Innovative institutions for the management of natural resources comprise an important component of creativity at the grassroots level. At times, such institutional change is initiated input from outside the village economy. In the arid and semi-arid region of Rajasthan, a number of NGOs have been instrumental in initiating such institutional change. This paper examines the impact of such innovative institutions on population from the region.

Primary data from six villages in Udaipur district are used to examine the postulated linkages. It is found that newly set up institutions does have an impact on the magnitude of migration. In the systems approach, it is found that the relative income from the source and the destination points of migration varies. Better access to income from common property from clearly specified institutions results in changed labour force allocation decisions. In other words, a creative approach to the interface between people and resources results in a larger number of people being supported by the same resources.

I Introduction

An institution is a codified set of rules, which by convention or by law mediates the nature of the relationship between people and resources. It creates the structure within which economic transactions take place in the short run and resource management takes place in the medium and long runs. Institutions are also distinguishable on the basis of the level of decentralization required for smooth functioning. Some institutions such as the state or the market are identified at the national level, others such as collectives are confined to the regional levels. Some kinds of institutions exhibit a fair degree of stability and have existed for some length of time e.g. the state and the market. The form of an institution may, however, need to change with time as the transaction costs associated with keeping it alive increase. This calls for institutional innovation. Innovatory institutions emerge, either as a consequence of evolution from within the community/ society or with a degree of imposition from outside. The absence of such innovation results in both efficiency and distribution-related losses.

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Specific tasks that institutions for natural resource management need to address are:
(a) Finding a method of rationing scarce resources in situations where the nature of the good preempts the existence of a market;
(b) Building in a system of inter-temporal allocation that overrides possible preferences of individuals for the present; and
(c) Ensuring sustainable use of the resources.

Institutional innovation can be visualized as a process that replaces the earlier structures with newer, more efficient ones. It is a dynamic process in which the interface of the society with the rest of the world plays an important role. In rural India of the eighties and nineties for instance, the village community can no longer be viewed as a self-reliant entity. It has strengthened its contacts with the city both through population movements and through the introduction of new kinds of goods and services. Increasing contact with village society has also meant that people from cities have been exposed to the changes taking place in the countryside, both of a beneficial and a not-so-beneficial nature. One outcome of such two-way contact has been the attempt by some individuals to understand and participate in the functioning of village institutions, especially those in the area of natural resource management.

On account of this, a large array of non-governmental interventions in the area of natural resource management has its origins in urban India. Such intervention, even when it is the outcome of participatory action research can be termed as induced by institutional innovation. It stands in contrast to the slowly evolving institutions of rural society. Such induced innovatory experiments have, however, an important role to play. They have an impact on productivity and hence on the links between population and environmental degradation through the creation of well-specified property rights and methods of implementing their enforcement. An analysis of this role is significant in the context of migration and the questions being asked about the links between population and environmental degradation.\(^{49}\)

In this paper, it is being hypothesized that the link between population and environmental degradation is not a simple arithmetic one, but is mediated by the institutional framework within which it takes place.

II Determinants of Rural-Urban Migration: A Hypothesis

\(^{49}\) See, among other, Srinivasan (1993) in the wider context of India’s population policy.
The literature on internal rural-urban migration in developing countries has viewed the problem from a number of different angles.\textsuperscript{50} In the early phases, rural urban migration was considered desirable as it helped the growth of the industrial sector. Over a time, it was found that migration far exceeded the rate of employment creation.

A number of analytical as well as quantitative studies focused on the micro economic foundations of the behaviour of individuals in the process of deciding to migrate. The Todaro hypothesis that migration proceeds in response to rural urban differences in expected rather than actual earnings comprised one major explanation. Further, it was the probability of getting a job that determined the decision to migrate or not. The overwhelming conclusion of most studies seemed to be that people migrate for economic reasons. Greenwood’s study for India found that migration was related positively and significantly to destination wage and negatively to origin wage.\textsuperscript{51}

In the same vein, some studies examined the genesis of the expected income differentials between rural and urban areas. The existence of trade unions and other institutional factors that increased this wage differential was recognized. The effect of migration on the differences between source and destination areas also attracted attention. Keeping in view the impact of an increasing population on the urban environment, it was recognized that rural-urban migration was not necessarily desirable. It was also found in some studies that internal migration may affect adversely the welfare of the source areas\textsuperscript{52} while contributing little to expanded social welfare in urban areas.

Some factors affecting micro economic behaviour of migrants have however received little attention. One of these is the changing institution in the rural sector, which impact migrant behaviour basically through their effect on the rural-urban income differential. Incomes in the rural economy are typically the sum of those obtained from private property resources and those received from common property resources. A strengthening of common property rights over resources increases expected incomes from them, thereby tending to reduce the propensity to migrate. In other words, the increased capacity of the resources to sustain populations works as a disincentive to migrate.

The following kinds of interrelationships between population levels and changes and inter-spatial movements in population can be identified:

- increases in population result in pressures on land and water in rural environments;
- environmental degradation of the above kind results in stress out-migration from rural tracts;

\textsuperscript{50} See Todaro in Easterlin (Ed.) (1980) for a survey of the earlier literature on internal migration in developing countries.
\textsuperscript{51} See Greenwood (1971a) and (1971b).
\textsuperscript{52} See, for example, Lipton (1976) and Connell \textit{et al.} (1975).
• the introduction of new institutions resulting in changing property rights in land and in common property resources can limit, or even end, stress-out migration from the rural tracts;
• parallel stream of “developments” migration occurs as a consequence of employment opportunities in the urban non-agricultural sectors of the economy;
• both kinds of migration have their own impact on urban environments as well.

It is hypothesized that the better attenuation of property rights following from the creation of new institutions is related in different ways to population movements:

Firstly, migration, whether of the stress or the pull variety, reduces the labour availability in a household, thereby affecting its decision to participate in common property management which is often labour-intensive. Availability of an alternative source of income from remittance also reduces its dependence on common property resources. This further influences its decision regarding participation.

Alternately, and perhaps over a longer period of time, the creation of a well attenuated system of property rights increases the productivity of common land and decreases the need for stress migration. It is to be noted, however, that this will not affect pull migration.

### III The Region and the Selected Villages

The above hypothesis is examined in the context of a region in Rajasthan’s Udaipur district known to have experienced a large magnitude of stress migration. The district has a development index of 53 as compared to 69 for Rajasthan as a whole. The literacy rate is 34.38 per cent as compared with 38.55 per cent for the state. Male literacy at 49.27 per cent is somewhat higher than the state average. Udaipur is one of Rajasthan’s more forested districts with 40 per cent of the geographical area being under forests as compared to only six per cent for the state. It also has a higher proportion of sown area as irrigated. Agriculture occupies about 70 per cent of the population, which is around the same as for Rajasthan.

Mining and quarrying is however the main occupation of 2.2 per cent of the district population, as against 1.1 per cent for the state as a whole. This is the sector that absorbs a considerable proportion of the stress migrants. It can be said that Udaipur has more dependence on forests and quarrying than many other districts in the state.

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53 See Table 1 in the appendix for a comparative picture
Some parts of Udaipur district have witnessed considerable activity in terms of institution creation and the understanding of the nature of common property rights in land and communal responsibilities going with them. It has, since the sixties, been home to a number of different kinds of NGOs. In 1995, an estimated 15 major organizations had headquarters in Udaipur.\(^{54}\)

The evolution of NGO activity in the district has taken place in two phases - the first in the sixties and the second in the eighties. Correspondingly, the non-government organizations can be grounded in two parts:

(a) Those formed in the sixties or seventies, have been concentrating on extension work defined as imparting educational training related to environmental degradation, other non-formal education and bringing awareness about the upliftment of the poor. This was partly the outcome of the then prevalent view with regard to mobilization in the countryside.

(b) The NGOs formed in the eighties and nineties, have focused more on conservation of environment through programmes of wasteland development, water and soil conservation and the like. Organizations seem to have become far more focused by this time. Ubeshwar Vikas Mandal (UVM) belongs to this group. In terms of size and focus of activities, it is smaller than Sewa Mandir, one of the better known NGOs of Udaipur.

Together the two organizations, Sewa Mandir and Ubeshwar Vikas Mandal, committed to the promotion of community management of eco-cultural regeneration in the rural areas of Udaipur, represent the broad features of the NGO movement in Udaipur. Both organizations actively involve people at the grassroots level for the protection and management of natural resources and upliftment of their socio-economic status. The focus of UVM has been on natural resources from the outset.

All non-government institutions in the region are the outcome of an interface between the urban and the rural parts of the district. They cannot be said to have evolved in rural areas. A number of them, typically the ones that were set up in the earlier phase had a philosophy of “educating, training or doing extension work” in villages.

Over a time, however, this approach changed to creating institutions with roots in local traditions. It is this second set of institutions that can be conceived of as experiments in innovatory institution building. The UVM for instance made use of existing institutions such as those of “adsi-padsi” in bringing the people together to regenerate the natural environment. Our study focuses on this second

\(^{54}\) See Appendix Tables 3 and 4 for their names, years of initiation and area of activity. The information is from WWF (1994).
category which it refers to as “institutional innovations”, originating in urban areas but built around the concept of using existing rural traditions to create norms and mores for natural resource management.

Six villages, in some of which UVM work has been going on for more than a decade, were selected for a study of the process of institutional change - Dhar, Gahaloton Ka Vas, Bunadia, Patia, Majjam and Bagdaunda.

All these are located to the West and North-West of Udaipur town at distances varying from 20 to 70 kilometres. Patia, Majjam and Bagdaunda are in the North and North-East in Gogunda tehsil at a relatively greater distance, whereas Dhar and Gahaloton Ka Vas are relatively closer towards the West. The revenue villages of Dhar, Gahaloton Ka Vas and Bunadia are located in Girwa tehsil in the upper middle valley of Ubeshwar nala in a watershed 15-25 kilometres from Udaipur city. All the villages fall within Udaipur district. The attached map of Udaipur district and the two tehsils in Appendix 4, 5, and 6, give the location of the study villages.

The villages are different in terms of their accessibility. They also illustrate considerable differences in size. Whereas Dhar, Bagdaunda and Bunadia are smaller villages with 50 to 75 households, Patia and Majjam are bigger with populations of 1500 to 2000 divided into 200 to 250 households. This region is mainly the homeland of the Bhils. The caste break up shows that Gamatis and Meghwals constitute the majority of the households with a fair sprinkling of Gujjars, Rajputs and Brahmins in some villages.

All villages except Gahaloton Ka Vas have primary schools, with Bagdaunda having two. Dhar and Bagdaunda also have higher secondary schools. The average level of literacy is about 1.48 years of school. However, all children seem to be sent to primary school now.

Health infrastructure is uniformly underdeveloped in all the six villages. No hospitals or primary health centres are to be found. Traditional medical practitioners are the only source of treatment for day to day ailments: for problems of a more serious nature, people have to travel to the nearest town. The nearest medical store, except for Majjam, (where it is about five kilometres away), is at a distance of 15 to 25 kilometres. The low level of development of health infrastructure is reflected in the immunization levels of the children. Only nine per cent of the children are fully immunized against DPT, 12 per cent against polio and 17 per cent against BCG. Further, of the six villages, only three, i.e. Dhar, Bagdaunda and Majjam, are connected by an all weather road and, hence, by bus.
Livelihoods in this region depend mainly on land and livestock with casual and regular labour on nearby construction and other works forming an important supplementary source of income. With regard to land ownership, a clear perception seemed to exist with regard to the difference between private land including private pasture (“beeda”), community pasture (“charnot”) and forest land (“junglat”). The first two categories are often interchangeable. Private land ownership seemed to exist, with 166 of the 186 households (or about 87 per cent) owning some land. Average agricultural land owned however exhibited variation from 2.87 bighas in Bagdaunda to 6.47 bighas in Bunadia. Cropping pattern on private land is dominated by wheat, mustard and gram in rabi, and maize, and bajra usually in the semi arid parts of northern and western India. Further, wheat is normally grown on the better quality and irrigated land.

Access to forest land for grazing did exist as in many parts of India. Dhar and Bagdaunda residents maintained this access, both for grazing and for fuelwood collection. In fact these two seem to be the major uses to which forest land is put by villagers of this region. It was stated often that forests were too degraded for medicinal plants to grow.

Gum was sometimes extracted. Fuelwood, on the other hand, was collected by 124 of the 186 households surveyed in the six villages. Further, 174 of the 186 households used fuelwood as a source of fuel. Leaves and small timber were insignificant in comparison.

Dependence on land seemed to follow the traditional pattern in which each family has some land in the low lying areas which is cultivated or kept as private pasture. Beyond these, usually in the uplands are the common pastures, and further up the forests, up to the ridge boundaries common to other villages. This was the clearly defined econiche of each community, sometimes in one watershed but at others as part of a larger watershed with numerous tributaries flowing down the Aravallis.

Water is scarce in this region, though the extent varies as between villages. Seasonal irrigation from rivers is available in all villages. A number of other sources of irrigation also exist with community and private ownership predominating. Tanks exist in all six villages and are used for both irrigation and drinking water extraction. Like anicuts, they are both privately owned and commonly owned.

Government owned tanks are found only in Bunadia. Privately-owned bawaris, on the other hand, exist in all villages. Private wells too augment the supply of drinking water in Gahaloton Ka Vas, Bagdaunda and Patia. The number of wells seems smaller in Dhar, Bunadia and Majjam. However, here hand pumps supplement them. Tapped supply of drinking water exists only in Gahaloton ka Vas. Ground water is of good quality uniformly in all villages and in Dhar, Bagdaunda, Patia and Majjam,
there is evidence of an increase in the level of ground water. A perception seems to exist that this increase is due in part to field bundings, check dams, anicuts and plantations. During discussions in the course of fieldwork, it was stated clearly that upto 1988, wells did not provide water even for animals. In spite of these changes, scarcity of water for irrigation persists; the irrigated land area is not more than eight to ten per cent of the total privately owned arable land.

Ownership of other assets such as cattle is widespread, with cows, buffaloes, goats and camels comprising the stock of animals owned. Of the 186 households surveyed, a majority owned livestock of one kind or the other.

Villages do not seem to differ much in terms of average level of ownership of cattle, which is between one to two standard units across all villages.

In addition to income from land and livestock ownership, a considerable amount of income also accrues from casual labour, both in and near villages, villages industry and from trading. Again, average levels differed considerably across villages, with Majjam and Gahaloton Ka Vas having about half the level of income from these sources than the three villages of Bagdaunda, Bunadia and Patia. Dhar falls somewhere in between with an income of about Rs.1,078/- per month.

Out-migration from the villages is significant with 44 out of 186 households or about 25 per cent reporting migration. With the total number of outmigrants being 56, the general pattern seems to be of one member from each household migrating. The distribution of this outmigration across village is uneven with the most accessible village showing the lowest levels of migration. This seemed counter intuitive and we tried to investigate whether this was because daily commutation had taken the place of permanent migration.

Daily commutation is significant with about 220 adults out of a total population of 900 odd commuting to neighbouring towns for work. The maximum number of commuters is from towns that are connected by bus. It is not distance but accessibility in terms of time spent in commuting that seems to determine its magnitude, other things being the same. Further, it is interesting to note that the extent of commuting decreases in drought years. It was stated in the course of field investigation that this was because of the start of relief works near villages. This intervention did away with the need for commuting or migrating.

The migration is predominantly male migration with 99 per cent of the migrants being male. Further, 42 of 44 migrants gave “work” as the reason for migration, with only 2 stating that they migrated for
study. Average age of outmigrants, which was about 25 years, confirmed this. Occupation of outmigrants also turned out to be service and labour.

Remuneration of the outmigrants showed a considerable degree of variation from Rs.300 to Rs.12,000/- per month, with the average being about Rs.1,545.22. The pattern of migration is also revealing. About 67 per cent of the total migration seem to have taken place in 1989 the year in or following the drought of 1988-89.

IV Evolution of Institutional Innovation in Villages

The first intervention in eco-restoration in these villages was made in the form of protection of a 20 hectare private pasture area in the Dhar region for natural regeneration. This was in 1985 and even with the scanty rainfall of those years, it was successful and was able to meet the community’s needs for a considerable part of the year. The following year saw their expansion of activity to 600 hectares, and also saw the forest department’s active involvement in it. This was followed by the initiation of the concept of planning on a watershed ecosystem basis. A micro watershed regeneration project was extended to the four revenue villages in the area. It included soil and water conservation, improved animal husbandry and agricultural practices.

In the village of Bagdaunda, the social organization process started with,

(a) setting up of a large community based pasture in 1986 and an open well based lift irrigation facility in 1990;
(b) natural aid in labour for land improvement; and
(c) women’s saving group for self help.

Initial interest in Kheda, a hamlet to the east of Bagdaunda, was in pasture protection. Here, the panchayat was made partly responsible for protection with the help of a locally appointed guard and village contribution for the salary of the guard.

Later, the sustenance of interest once again seemed to be centred on the community well-lift irrigation scheme. Work could be started only after some conflict between two groups was resolved in 1990. Free contributory labour was made available for this well. Autonomy of judgement, action and resources was the hallmark of the process by which this was made operational. In the

\footnote{For details, see Saint, K…1}
Bagdaunda-Kheda area, the two tasks of pasture protection and irrigation development were carried out with the successful interaction of village, voluntary agency and government cooperation.

Patia has seen another kind of cooperation. Here the stress has been on field bunding and cooperation on private land. As early as 1989, they have been working on the protection of each other’s private land, treating it as an extension of a traditional institution called “adsi-padsri”.

It is seen, therefore, that the process of institution creation followed different routes in each village. The starting point could be protection of a private pasture or a common pasture, the building of a common irrigation source or just the initiation of self-help groups. It was necessary to have a technically sound plan in each case and to enthuse the village residents through the establishment of links with traditionally existing institutions.

V Capturing the Impact of Institutional Innovation: Methodology

Two schedules, the village level schedule, and the household level schedule were canvassed in the six villages selected so as to represent different levels of institutional intervention. The three categories stated below are used to distinguish between levels of institution creation:

(a) The reference villages were those in which no institution creation had at all been attempted, and where, as often stated by the NGOs, “work had just been initiated”. These were Majjam and Bagdaunda.
(b) Villages in which some degree of institutional work had existed for some time. These were Bunadia and Patha.
(c) The villages of Dhar and Gahloton Ka Vas which had seen the extensive involvement of two well-established institutions (UVM and Seva Mandir for the past decade or more).

Dummy variables in the form of intercept dummies simulate the time series effect of being at different stages in the process of creation of common property rights. This procedure was adopted to reflect, in the behavioural pattern of individuals, those aspects of institution creation that changed the nature of the village environment in which they took decisions regarding migration and participation.

At a later stage in the analysis, slope dummies corresponding to specific explanatory variables were also introduced in order to simulate the time series effect of those village level changes that affect individual behaviour through an impact on the respective slopes.
From the data collected from a cross section of six villages, two sets of variables were generated from information collected in the household and village schedules canvassed: households level, which were defined for each of the 186 households and village level, which referred to the infrastructural and institutional aspects best defined at that level of aggregation. Some of these variables are quantitative in nature while others are of the yes/no variety. A set of important variables used in the analysis is given below:

**Household Level Variables**

**Migration Related:**

- **ROMAG:** Ratio of migrants to adult members above the age of fourteen.
- **RCOMDAM:** Ratio of daily commuters to adult members of the family.
- **REMHH:** Remuneration per household migrating into urban areas.
- **RPM:** Remittances sent per month to households in village.

**Asset and Income Related Variables:**

- **PALO:** Private agricultural land owned
- **SCUO:** Standard cattle units owned: The number of cattle owned are converted into standard units on the basis of ICAR norms.
- **FAMI:** Family income from sources other than agriculture
- **TCA:** Total cultivable land owned.
- **PII:** Private investment in irrigation.
- **CGSCU:** No of days of common land grazing by cattle: an index of dependence on common land.
- **FGSCU:** Forest grazing
- **FUELW:** collection of fuelwood from forest and common land

It is to be noted that though an office existed within the bounds of Bagdaunda, people attending meetings and work done was more in Bunadia and Patia.

**Variables Relating To Institutions Creation:**
EPCIS: Decision whether or not to participate in irrigation related institutions (has a “yes-no” value)
EPCLR: Decision whether or not to participate in land related institutions (has a “yes-no” value)
NLDSP: Number of labour days spent (paid and unpaid) in working on water related institutions.
NLDSL: Number of labour days spent (paid and unpaid) in working on land related institutions.
SSFC: Adopted of stall feeding as an indirect indicator of participation in institution creation.

Village Level Variables

Asset And Infrastructure Related Variables:

CL: Village level common land
FL: Village level forest land
DT: Distance travelled by migrants to reach city?? Is this not a household level variable?
CB: Whether or not the village is connected by bus.
CR: Whether or not the village is connected by road.
ASFIV: Availability of schooling facility in village.

The methodology followed to test the hypothesis stated above consists of formulation of multiple regressional specifications and simultaneous structural systems and thereby estimating the parameters by both single equation and systems methods. Further, depending on the nature of the question being asked on specific response variables, a mixture of OLS and logit regressional estimational techniques are utilized. The migration related variables are analyzed using OLS and the institutional participation using logit methods.

The logit regressional analytical technique is used to analyze the variables EPCWR and EPCLR. It facilitates in eliciting the effects of several predictor variables, which may be quantitative, categorical or a mixture of the two, on the dichotomous response variable which depicts decisions like buying or not buying a car, or participation or non-participation in any collective action or basically yes/no kind of decisions on the part of the respondents.
A brief presentation of the functional form of the logit model for the present study follows. The basic form of the multivariate logistic function with Z as the predictor variables, which itself is a combination of several predictor variables (X_k) as

\[ Z = b_o + b_1 \cdot X_1 + b_2 \cdot X_2 + \ldots + b_k \cdot X_k \]

and thus the functional form of the model becomes

\[ P = \frac{1}{1+\exp(-b_0+\sum E X_i)} \]

or alternatively the logit form of the model as follows:

\[ \log \Omega = Z \]

where the odds of participation (\( \Omega \)) becomes

\[ \Omega = \frac{P}{1-P} \]

in which P is the probability of participation in any collective action or commons such as common-land resources (EPCLR) or common-land resources (EPCWR) in the present study and thus \( \Omega \) depicts odds of the participation. Obviously, the reference category in the present model is non-participation in the commons and thus P provides the probability of participation in the commons.

The Maximum Likelihood (ML) estimational procedure is adopted for eliciting parametric estimates of the structural coefficients (b_j) of the model. Retherford provides detailed exposition of mathematical details of the ML estimational procedure, cautions interpretation of the estimated parameters, multiple classification analysis (MCA) based on the elicited parametric estimates etc. in the logit regresional analytical technique (Retherford and Minja, 1993). The estimated structural coefficients (B_j) by the Maximum Likelihood estimational procedure and their mean values are in turn utilized to elicit the estimates of probabilities of participation or non-participation in the commons as follows.

\[ Z = \exp(b_o + \sum b_i \cdot X_i) \]

where the summations range from j=1 to j=k. Thereby the estimated values of odds (\( \Omega \)) and probabilities (P) of participation in the commons are elicited.
The MCA table for adjusted values of $P$ is constructed by substituting appropriate combinations of ones, zeros, and mean values for the predictor variables ($X_j$) in the above mentioned estimated equations. The adjusted values are based on elicited parametric estimates for the complete model including all the predictors simultaneously. Alternatively, all the predictor variables are controlled at their mean values except the one whose effect is to be elicited at its particular level. The Multiple Classification Analysis (MCA) Tables for the purpose are also presented in the study.

VI Analysis of Results

It was postulated that individual decisions to migrate depend on variables relating to

(a) asset ownership which is the primary determinant of expected income from private property;
(b) infrastructural situation in the village; and
(c) nature of institutional build-up in the village which determines the nature of rights in common property and therefore the expected income from common property.

In other words, the nature of the source and the destination points for migration together determines the household decision regarding the division of the total labour available to them between work on assets within the village and for obtaining income from outside.

In these areas, daily commutation to a nearby town is a good alternative to distance migration, since it achieves the kind of division of total family labour between the two. Therefore, both ROMAG and RCOMDAM are taken as the dependent variables. In the first set of results given in Table 1, intercept dummies defined as above are intended to capture the impact of institution creation at the village level.

VI.1. Distance Migration Process (ROMAG)

The parametric estimates of the distance migration variable (ROMAG) are presented in the following Table 1.

| Table I: OLS Estimates of the Model with ROMAG as the Response Variable |
|----------------------|-----------------|-----------------|
| Variables            | $b$              | t-value         |
| Institutional Build-up| 21.227           | 1.723           |
Interestingly we find that the variable representing institutional build up for a longer duration (D2) stalls distance migration significantly. The ownership of cattle (SCUO) also has significant and negative effect on distance migration. As expected, the remittances sent home (RPM) depicts positive and significant impact on distance migration.

The other variables, such as distance from town (DT) and connectivity by bus (CB), though insignificant, depict expected directions of effects.

**VI.2 Daily Commutation Phenomenon (RCOMDAM)**

Daily commutation is also an important manner in which households try to supplement their income by dividing their labour force between working on assets in the village and wage labour elsewhere. The OLS specification with respect to this variable also gives results on lines smaller to these of ROMAG.

**Table II: OLS Estimates of the Model with RCOMDAM as the Response Variable**
Perusal of Table 2 reveals that the impact of village level institution building on individual decision making emerging after these institutions have worked in the village for a period of around 10 years (as shown by the negative) and significant effect of D2 on RCOMDAM. Again, households owning large areas of land do not choose to commute for wage labour. Connection by bus promotes commutation to and from the base.

VI.3. Participation in Commons (EPCLR AND EPCWR)

The second behavioural decision of the household we consider is that of whether or not to participate in the different activities that lead to the creation of well attenuated rights in common property. This decision strengthens the institutions created with outside intervention and is a measure of the extent to which institutional innovation has been internalized. Two possible kinds of participation are identified; that in the creation of common irrigation assets and that in the creation of well spelt out rights in common land. In the case of irrigation structures, participation resulted in the creation of anicuts, tanks and other structures that led to a sure supply of irrigation water, both directly and indirectly through a rise in the level of ground water in the region.

The effective participation in common irrigation structures or water resources (EPCWR) states whether or not households decide to participate in this activity. The effective participation in common land resources (EPCLR) on the other hand states whether or not households participate in the creation of common property rights on land. This took the form of ensuring rotational grazing and protecting land from encroachment by outsiders and others who did not have a right to it.

VI.3.1. Logit results for EPCLR

The estimated coefficients of the Logit Regression Model outlined in the text for participation if commons, viz., common land resources (EPCLR) and common water resources (EPCWR), are presented in Tables III.1 and IV.1 respectively. The estimated structural coefficients and their
standard errors along with the levels of significance of different predictor variables for EPCLR are presented in the following Table III.1.

**Table III.1: Estimated Logit Regression Coefficients, Standard Errors, Levels of Significance and Effects on Participation in the Common Land Resources (EPCLR) in the Tribal Villages of Rajasthan for the Model: \( \log (\Omega) = K + \sum B_k X_k; k=1,12; \)** in the text

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>EPCLR</th>
<th>Effect (Odds-Ratio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1.9950</td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>.6704 .7758 .3875</td>
<td>2.9523</td>
</tr>
<tr>
<td>D2</td>
<td>1.0826 .5790 .0615</td>
<td>2.5462</td>
</tr>
<tr>
<td>EPCWR</td>
<td>.9346 .4724 .0479</td>
<td>1.0000</td>
</tr>
<tr>
<td>PII</td>
<td>.0000 .0001 .5101</td>
<td>1.0000</td>
</tr>
<tr>
<td>PALO</td>
<td>-.0354 .0322 .2718</td>
<td>.9652</td>
</tr>
<tr>
<td>FAMI</td>
<td>.0001 .0001 .7634</td>
<td>1.0000</td>
</tr>
<tr>
<td>SCUO</td>
<td>.3327 .1951 .0881</td>
<td>1.3948</td>
</tr>
<tr>
<td>CGSCU</td>
<td>.0034 .0018 .0578</td>
<td>1.0034</td>
</tr>
<tr>
<td>FGSCU</td>
<td>.0004 .0016 .8044</td>
<td>1.0004</td>
</tr>
<tr>
<td>SSHGO</td>
<td>-.3845 .3654 .2927</td>
<td>.6804</td>
</tr>
<tr>
<td>ROMAG</td>
<td>-.0104 .0150 .4848</td>
<td>.9896</td>
</tr>
<tr>
<td>CR</td>
<td>.2998 .5782 .6040</td>
<td>1.3497</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>-2.1051 .8137 .0097</td>
<td></td>
</tr>
</tbody>
</table>

Perusal of Table III.1 reveals that all the estimated structural coefficients pertaining to institutional build up more than ten years in the villages (D2), participation in commons like common-water resources (EPCWR), ownership of cattle (SCUO) and the extent of dependence of commons for cattle grazing (CGSCU) have turned out to be highly significant. Furthermore, the direction of effects of all the predictor variables have turned out to be consistent with general expectations.

Interestingly, longer and longer exposure of the villages to the institutional build-up, initiated from outside by NGOs, motivates people to participate in the commons. Furthermore, we find that participation in common-land resources is higher in villages that have been exposed to institutional build up for longer duration (D2) compared to lesser duration (D1) or absolutely no exposure (the reference category depicted by the Constant). People participating in commons like common-water
resources also participate more in common-land resources, could be because of complementary reasons.

Ownership of cattle (SCUO) also motivates persons to participate in the commons i.e. common-land resources like pasture lands, etc. basically because of greater accessibility to fodder for their cattle stock. The positive linkage between the amount of cattle stock and participation in the common-land resources also depicts more and more dependence on the commons for fodder, etc. This is also depicted by positive and significant association between decision to participate in common land-based activity and extent of cattle grazing in the commonland areas. (CGSCU). Interestingly the directions of effects of all the other predictor variables, though not significant, have turned out to be consistent with the general expectations.

Estimated probabilities of participation in the common-land resources are elicited through use of the estimated parameters in Table III.2 and mean values of predictor variables and parametric estimates of the Multivariate Logit Models and the Mean Values of predictor variables presented in the Appendix Tables. The values are depicted as adjusted as the values of the other predictors are kept at their mean values excepting the predictor variable whose effect is to be highlighted. The adjusted values of the odds (Ω) and the probabilities (P) of participation are presented in the following MCA Table III.2.

**Table III.2: MCA Table of Adjusted Values of the Odds of Participation (Ω) and Probability of Participation (P) in Common Land Resources (EPCLR) for the Significant Predictors in the Estimated Model in Table V.1.1.**

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Adjusted Value of Ω</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nil</td>
<td>.415</td>
<td>.293</td>
</tr>
<tr>
<td>Around 3-4 Yrs</td>
<td>.812</td>
<td>.448</td>
</tr>
<tr>
<td>Around 10+ Yrs</td>
<td>1.226</td>
<td>.550</td>
</tr>
<tr>
<td>Participation In Common Water Resources (EPCWR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>.619</td>
<td>.382</td>
</tr>
<tr>
<td>Yes</td>
<td>1.577</td>
<td>.612</td>
</tr>
<tr>
<td>Cattle Ownership (SCUO)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nil</td>
<td>.433</td>
<td>.302</td>
</tr>
<tr>
<td>1</td>
<td>.605</td>
<td>.377</td>
</tr>
</tbody>
</table>
Perusal of the Table III.2. reveals that the extent of participation in the common-land resources improves with longer exposure of villages to institutional build up. Interestingly, we find that the participation rate in villages in commons like common-land resources, which are not exposed to institutional built up is only around 29 percent whereas it improves significantly to around 45 and 55 percentages in villages which are exposed for 3-4 years and more than 10 years, respectively.

Similarly, those who are participating in the creation of common water resources (EPCWR) like building of anicuts, nullah bunding, or dug-wells, etc. are also participating more in management of common-land resources. Rather, the probability of participation goes up from almost 38 percent to 61 percent amongst villagers who don’t participate to those who participate in the management of common-water resources.

Interestingly, we find that villagers with more and more ownership of cattle (SCUO) participate more and more in the management of common-land resources. Rather the probability of participation improves from just around 10 percent to almost 70 percent amongst villagers who do not own any cattle to those who own five standard cattle units. Furthermore, those who depend more on the common-land resources for fodder for their cattle stock, obviously are supposed to be interested and participate more in the effective management and sustenance of common-land resources and thus participate more towards its management.

3.2. Logit Regression Results For Participation in Creation of Common Water Resources (EPCWR)

The estimated structural coefficients and their standard errors along with the levels of significance of different predictor variables are presented in the following Table IV.1.

<table>
<thead>
<tr>
<th>Cattle Grazing In Commons (CGSCU)</th>
<th>3</th>
<th>1.177</th>
<th>.541</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>2.290</td>
<td>.696</td>
</tr>
<tr>
<td>No</td>
<td>.596</td>
<td>.373</td>
<td></td>
</tr>
<tr>
<td>Average no. of Days</td>
<td>.753</td>
<td>.429</td>
<td></td>
</tr>
<tr>
<td>Full Year</td>
<td>2.062</td>
<td>.673</td>
<td></td>
</tr>
</tbody>
</table>

![Table IV.1](image-url)
Table IV.1: Estimated Logit Regression Coefficients, Standard Errors, Levels of Significance and Effects on Participation in the Common Water Resources in the Tribal Villages in Rajasthan for the Model: $\log(\Omega) = K + B_k \cdot X_k$; $k=1,11$; in the text

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>EPCWR</th>
<th>Coefficients</th>
<th>Standard Errors</th>
<th>Level Of Significance</th>
<th>Effect (Odds-Ratio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td></td>
<td>2.1587</td>
<td>1.2362</td>
<td>.0808</td>
<td>8.6596</td>
</tr>
<tr>
<td>D2</td>
<td></td>
<td>7.9562</td>
<td>19.2762</td>
<td>.0798</td>
<td>2853.1</td>
</tr>
<tr>
<td>PII</td>
<td></td>
<td>0.0000</td>
<td>0.0001</td>
<td>.0765</td>
<td>1.0000</td>
</tr>
<tr>
<td>PAUI</td>
<td></td>
<td>-.1260</td>
<td>.0071</td>
<td>.0765</td>
<td>.8816</td>
</tr>
<tr>
<td>PALO</td>
<td></td>
<td>.0181</td>
<td>.0390</td>
<td>.6424</td>
<td>1.0183</td>
</tr>
<tr>
<td>TCA</td>
<td></td>
<td>-.0056</td>
<td>.0126</td>
<td>.6552</td>
<td>.9944</td>
</tr>
<tr>
<td>SCUO</td>
<td></td>
<td>.0533</td>
<td>.2124</td>
<td>.8020</td>
<td>1.0547</td>
</tr>
<tr>
<td>FAMI</td>
<td></td>
<td>.0000</td>
<td>.0002</td>
<td>.9491</td>
<td>1.0000</td>
</tr>
<tr>
<td>ROMAG</td>
<td></td>
<td>-.0035</td>
<td>.0161</td>
<td>.8293</td>
<td>.9965</td>
</tr>
<tr>
<td>ASFIV</td>
<td></td>
<td>5.9502</td>
<td>19.2988</td>
<td>.7578</td>
<td>383.84</td>
</tr>
<tr>
<td>CR</td>
<td></td>
<td>-6.5928</td>
<td>19.3083</td>
<td>.7328</td>
<td>.0014</td>
</tr>
<tr>
<td>CONSTANT</td>
<td></td>
<td>-8.5376</td>
<td>19.2893</td>
<td>.6580</td>
<td></td>
</tr>
<tr>
<td>NT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of observations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>163</td>
</tr>
<tr>
<td>- 2 Log L1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>139.87</td>
</tr>
<tr>
<td>- 2 Log L0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>172.12</td>
</tr>
</tbody>
</table>

A perusal of Table IV.1 reveals that the exposure of villages to institutional build-up certainly helps in more and more participation in commons like common-water resources, viz., anicuts, nullah bunding and dug-wells. Both the dummies (Ds) depicting the exposure of villages to the phenomenon of institutional build-up depicts significant and positive impact on the participation of villages in the commons. Furthermore, the magnitude of the coefficients also reveals that the longer duration of exposure helps better participation of villagers in the commons.

The availability of irrigational facilities through private resources or alternatively private ownership of water resources deters them to participate in the common-water resources. The negative and significant association between privately owned agricultural area already under irrigation (PAUI) and participation in common-water resources (EPCWR) clearly depicts the phenomenon of lower
participation by villagers who have or can manage more of their agricultural land holdings under irrigation.

Interestingly, the direction of effects of other predictor variables, which do not depict significant association also turns out to be consistent with the general expectations. More and more availability of migrational avenues (ROMAG), and connectivity of village by road which certainly improves the mobility of villagers to avail employment opportunities in nearby or distant places, reduces the possibility of participation in the commons. Thus, most of the elicited parametric estimates depict the directions of effects to be consistent with the general expectations.

The estimated probabilities of participation in the common-land resources are elicited through the use of estimated parameters in Table IV.1 and mean values of predictor variables and parametric estimates of the Multivariate Logit Models and the Mean Values of predictor variables presented in the Appendix Tables. The values are depicted as the values of the other predictors kept at their mean values excepting the predictor variables whose effect is to be highlighted. The adjusted values of odds ($\Omega$) and the probabilities (P) of participation are presented in the following MCA Table IV.2.

Table IV.2: MCA Table of Adjusted Values of the Odds of Participation ($\Omega$) and Probability of Participation (P) in Common Land Resources (EPCLR) for the Significant Predictors in the Estimated Model in Table V.1.1.

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Adjusted Value of $\Omega$</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nil</td>
<td>.002</td>
<td>.002</td>
</tr>
<tr>
<td>Around 3-4 Yrs</td>
<td>.018</td>
<td>.017</td>
</tr>
<tr>
<td>Around 10+ Yrs</td>
<td>5.936</td>
<td>.856</td>
</tr>
<tr>
<td>Privately Owned Agricultural Land Under Irrigation (PAUI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nil</td>
<td>.099</td>
<td>.090</td>
</tr>
<tr>
<td>5 Bighas</td>
<td>.053</td>
<td>.051</td>
</tr>
<tr>
<td>10 Bighas</td>
<td>.028</td>
<td>.027</td>
</tr>
<tr>
<td>20 Bighas</td>
<td>.008</td>
<td>.007</td>
</tr>
</tbody>
</table>

The perusal of Table IV.2. reveals that the participation of villagers improve significantly along with the duration of exposure to the institutional build-up. Surprisingly, we find that the participation rate
goes up almost from nil in villages with no institutional build-up to almost 86 percent in villages which have been exposed to the build-up for more than 10 years. Thus, institutional build-up seems to be a very important consideration for motivating people to participate in commons.

As expected, we find that the villagers, who have private water resources or have more of their land under privately owned irrigation resources are less likely to participate in the management of common-water resources.

VII. **Extent of Participation in Commons**

Whereas the decision to participate or not is reflected by the variables EPCIS and EPCLR, the extent of participation is measured by the number of labour days spent in the two kinds of participatory activity, that relating to creation of water related assets (NLDSCWR) and that relating to common land (NLDSCLR). Another indicated measure could be the number of days of fodder collection through stall feeding (SSFC), one of the main modes of common land protection (as a substitute for grazing). The results, with respect to magnitude of participation as measured by NLDSL,P, NLDSP and SSFC are discussed below and given in Tables V, VI and VII respectively.

VIII.I. **Parametric Estimates of NLDSCLR**

The parametric estimates of the extent of participation in common-land resources (NLDSCLR) are presented in the following Table V:

**Table V: OLS estimates of the extent of participation In common land resources (NLDSCLR)**

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>NLDSCLR</th>
<th>Coefficient</th>
<th>t-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-11.533</td>
<td>-.734</td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>-26.417</td>
<td>-1.40</td>
<td></td>
</tr>
<tr>
<td>D2</td>
<td>10.868</td>
<td>.551</td>
<td></td>
</tr>
<tr>
<td>NLDSCWR</td>
<td>.44568</td>
<td>6.97</td>
<td></td>
</tr>
<tr>
<td>SCUO</td>
<td>.02692</td>
<td>.258</td>
<td></td>
</tr>
<tr>
<td>FAMI</td>
<td>.004854</td>
<td>7.46</td>
<td></td>
</tr>
<tr>
<td>ROMAG14</td>
<td>.08045</td>
<td>.156</td>
<td></td>
</tr>
<tr>
<td>RCOMDAM</td>
<td>.0155</td>
<td>.193</td>
<td></td>
</tr>
<tr>
<td>CGSCU</td>
<td>.080396</td>
<td>3.576</td>
<td></td>
</tr>
</tbody>
</table>
Interestingly, we find that participation in land-related activity is explained significantly by the extent of dependence on common land as measured by the number of days of grazing in common land (CGSCU).

It is also related positively to the participation in creation of common property in water (NLDSCWR). Since the latter came earlier in point of time, this variable reflects the change in the village level institutional infrastructure as well.

While cattle ownership (SCUO) does not turn out to be significant here, probably due to the inclusion of CGSCU, the direction of the relationship is positive. Households having a higher level of income from sources other than agriculture exhibit a larger extent of interest in participating in common water related structure.

**VII.2. Extent of participation in common water resources**

The estimated parameters for the extent of participation in common water resources (NLDSCWR) are presented in the following Table VI:

**Table VI: OLS estimates of the extent of participation in common water resources (NLDSCWR)**

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>NLDSCWR</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-10.448</td>
<td>.961</td>
</tr>
<tr>
<td>NLDSCLR</td>
<td>-49126</td>
<td>6.912</td>
</tr>
<tr>
<td>PALO</td>
<td>-.26961</td>
<td>-.262</td>
</tr>
<tr>
<td>FAMI</td>
<td>.000128</td>
<td>.140</td>
</tr>
<tr>
<td>PII</td>
<td>.000217</td>
<td>-.262</td>
</tr>
<tr>
<td>FUEW</td>
<td>-2.9114</td>
<td>-.570</td>
</tr>
</tbody>
</table>

When NLDSCWR is taken as the measure of magnitude of participation, the only variable that emerges as significant is NLDSCLR, illustrating once again the complementary aspect between the two kinds of participation.

**VII.3. Extent of participation as proxied by SSFC**
The estimated parameters for the structural relation with SSFC as response variable are presented in the following Table VII.

**Table VII: OLS estimates of stall feeding (SSFC)**

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>SSFC</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>t-ratio</td>
</tr>
<tr>
<td>Constant</td>
<td>.63987</td>
<td>5.892</td>
</tr>
<tr>
<td>D1</td>
<td>-.046702</td>
<td>-.358</td>
</tr>
<tr>
<td>D2</td>
<td>.19942</td>
<td>1.462</td>
</tr>
<tr>
<td>NLDSCWR</td>
<td>.003431</td>
<td>7.888</td>
</tr>
<tr>
<td>SCUO</td>
<td>-.000044659</td>
<td>-.062</td>
</tr>
<tr>
<td>FAMI</td>
<td>.000042458</td>
<td>9.438</td>
</tr>
<tr>
<td>ROMAG</td>
<td>.0027992</td>
<td>.787</td>
</tr>
<tr>
<td>RCOMDAM</td>
<td>.000066794</td>
<td>.120</td>
</tr>
<tr>
<td>CGSCU</td>
<td>.0004014</td>
<td>9.438</td>
</tr>
</tbody>
</table>

The extent of stall feeding as an indirect measure of participation with respect to land throws up some interesting results. This equation also has an explanatory power of about 57 per cent. Households with a higher level of income from nonagricultural sources (FAMI) having presumably lower agricultural assets also participate more. Participation is explained by the existence of a village level institutional structure and by dependence on common land for cattle grazing.

**VIII. Simultaneous structural system**

In the simultaneous system approach, the hypothesis is that in the presence of an innovative institution each individual has to decide whether to migrate (either permanently or on a daily commutation basis), or to strengthen the institution by participating in the building up of common property resources in the village economy. It is postulated that the two decisions are taken in an interdependent fashion in the manner explained as under.

The formulated simultaneous structural system depicting hypothesized linkages between decision-making processes of migration and participation in commons comprises three endogenous variables and ten exogenous variables. The three endogenous variables are distance migration (ROMAG), number of labour days spent in commonland (NLDSCLR) and common water resources (NLDSCWR). The nine exogenous variables are private ownership of agricultural land (PALO) and cattle stock (SCUO), private investments in irrigational sources (PII), family’s income from other
non-agricultural sources, (FAMI), remittances per month (RPM), extent of dependence on commonland for cattle grazing (CGSCU), availability of schooling facility in the village (ASFIV), connectivity of village by bus (CB), and distance from the city (DT).

The specifications of the structured system gets reflected in Tables VIII and IX. The functional form of all the three structural relations is assumed to be intrinsically linear i.e. in parameters. A perusal of the system reveals that all the structural relations are over-identified and thus a three stage least squares system estimational procedure (3SLS) is used for eliciting consistent estimates of the structural coefficients. Theoretically the original least squares (OLS) estimates of the structured system are not only biased but also inconsistent. Nevertheless, for estimational convenience and for obviating other problems like degrees of freedom etc. the OLS estimational procedure is also generally utilized. The estimates are discussed below.

VIII.1. OLS estimates of the structured system

A perusal of the parametric estimates for ROMAG in Table VIII reveals that the distress rural-urban migration process gets decelerated or stalled along with the process of institutional build up in the rural areas as reflected by downward movement in the magnitude of the intercept dummies i.e. from constant to D1 and D2. Also we find that remittances to the households depict significant and positive impact on the extent of outmigration in villages with no institutional build up and its significance and intensity of effect on outmigration gets reduced in villages with medium and longer duration of the institutional build-up. Thus, the process of distress migration from these villages gets stalled along with the process of institutional build up as the remittances lose their significance in the process.

Table VIII. OLS Estimates of Structural Parameters of Migrational and Participation Response Variables in the Models in the text.
A perusal of the estimated coefficients of participation in common-water resources (NLDSCWR) in Table VIII reveals that the participation is higher by households having more of agricultural land (PALO) and cattle-stock (SCUO) in these villages. Possibly leadership for initiation of participation is provided by large asset owners in the initial stages. However, we find the ownership of private irrigational sources as reflected by private investments in irrigation (DIIPII) hinders participation in creation of common water resources in the initial stages.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D2NLDSCWR</td>
<td>-0.01</td>
<td>0.039</td>
<td>-6.54</td>
<td>0.308</td>
</tr>
<tr>
<td>NLDSCLR</td>
<td>0.033</td>
<td>1.770</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1NLDSCLR</td>
<td>-0.05</td>
<td>1.135</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2NLDSCLR</td>
<td>-0.03</td>
<td>1.463</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PALO</td>
<td>-4.01</td>
<td>0.864</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1PALO</td>
<td>11.49</td>
<td>2.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2PALO</td>
<td>3.90</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PII</td>
<td>0.0008</td>
<td>1.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1PII</td>
<td>-0.0011</td>
<td>0.171</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2PII</td>
<td>-0.0003</td>
<td>0.111</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCUO</td>
<td>-25.45</td>
<td>2.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1SCUO</td>
<td>14.34</td>
<td>0.819</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2SCUO</td>
<td>22.82</td>
<td>1.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASFIIV</td>
<td>25.37</td>
<td>1.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAMI</td>
<td>0.003</td>
<td>0.375</td>
<td>0.0049</td>
<td>0.486</td>
</tr>
<tr>
<td>D1FAMI</td>
<td>-0.002</td>
<td>-0.241</td>
<td>-0.0034</td>
<td>-0.338</td>
</tr>
<tr>
<td>D2FAMI</td>
<td>0.007</td>
<td>0.849</td>
<td>-0.0055</td>
<td>-0.518</td>
</tr>
<tr>
<td>RPM</td>
<td>0.0092</td>
<td>6.287</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1RPM</td>
<td>-0.0061</td>
<td>-3.308</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2RPM</td>
<td>0.0084</td>
<td>1.125</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CGSCU</td>
<td>0.11</td>
<td>4.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1CGSCU</td>
<td>-2.73</td>
<td>0.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2CGSCU</td>
<td>-1.80</td>
<td>0.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RCOMDAM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1RCOMDAM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2RCOMDAM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CB</td>
<td>0.127</td>
<td>0.887</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DT</td>
<td>-0.084</td>
<td>-0.623</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statistics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-Square</td>
<td>0.348</td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of Obs.</td>
<td>186</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


The estimated coefficients of participation in common-land resources (NLDSCLR) reveals complementarity between participation in common-water and common-land resources. Alternatively, those who have participated more in creation of common-water resources also depict a tendency to participate more in creation of common-land resources. Interestingly, it is observed that participation in creation of common-land resources improves along with the duration of institutional build up i.e. the participation gets higher and higher in villages which are exposed to longer and longer duration of institutional build up as reflected by increasing magnitudes of the intercept dummies.

Furthermore, households which depend more in commonland for cattle grazing also participate more in creation of common-land resources as revealed by significant and positive coefficient of extent of grazing by cattle (CGSCU). The intensity of this linkage decreases over time as the institutional build-up takes place.

### VIII. 2. 3SLS estimates of the structured system

The estimated structural coefficients of the formulated simultaneous equations system by the system estimational procedure (3SLS) are presented in the following Table IX.

#### TABLE IX. 3SLS Estimates of Structural Parameters of Migrational and Participation Response Variables in the Models in the text.

<table>
<thead>
<tr>
<th>Var. Name</th>
<th>ROMAG</th>
<th>NLDSP</th>
<th>NLDSP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coeff.</td>
<td>t-value</td>
<td>Coeff.</td>
</tr>
<tr>
<td>Constant</td>
<td>10.50</td>
<td>1.19</td>
<td>-28.78</td>
</tr>
<tr>
<td>D1</td>
<td>3.28</td>
<td>1.18</td>
<td>14.87</td>
</tr>
<tr>
<td>D2</td>
<td>-8.82</td>
<td>-1.551</td>
<td>23.87</td>
</tr>
<tr>
<td>NLDSLP</td>
<td>-.0054</td>
<td>.078</td>
<td></td>
</tr>
<tr>
<td>NLDSP</td>
<td>.0015</td>
<td>-.414</td>
<td>.792</td>
</tr>
<tr>
<td>PALO</td>
<td></td>
<td>-1.76</td>
<td>-.436</td>
</tr>
<tr>
<td>D1PALO</td>
<td></td>
<td>10.14</td>
<td>2.37</td>
</tr>
<tr>
<td>D2PALO</td>
<td></td>
<td>1.69</td>
<td></td>
</tr>
<tr>
<td>PII</td>
<td></td>
<td>.0012</td>
<td></td>
</tr>
<tr>
<td>D1PII</td>
<td></td>
<td>-.0012</td>
<td>-.864</td>
</tr>
<tr>
<td>D2PII</td>
<td></td>
<td>-.00014</td>
<td>2.37</td>
</tr>
<tr>
<td>SCUO</td>
<td></td>
<td>-6.28</td>
<td>.792</td>
</tr>
<tr>
<td>D1SCUO</td>
<td></td>
<td>4.22</td>
<td>1.90</td>
</tr>
</tbody>
</table>
The estimated parameters of the formulated system of equations reveal strong interconnections and multiple influences among the three crucial endogenous variables. Alternatively, the dynamic process of interconnected decisions for migration and participation in commons gets reflected through significant estimated coefficients in the Table.

Juxtaposing the estimated parameters in Tables VIII and IX reveals that the magnitude of the estimated structural coefficients and their significance have generally improved from the OLS to the 3SLS estimational procedure and thus simultaneity bias to some extent has been accounted for by the consistent estimates provided in Table IX. Nevertheless, the directions of effects have remained the same and thus the interpretation of coefficients and the results arrived at remain the same.

The interconnections as revealed by the estimated parametric estimates turn out to be interesting. The dynamic process of decision making about migration and participation in commons gets clearly revealed by the estimated structural coefficients of the formulated system. The overall results reveal that to begin with the participation in creation of common-water resources is generally higher from households with more of private ownership of land and cattle-stock. However, the households with more of private sources of irrigation do not come forward for participation in creation of common-water resources. The complementarity between participation in creation of common-water and common land resources in the system also is revealed. Interestingly, the participation in the commons improves significantly along with the exposure of the villages to the institutional build up. The process of distress rural outmigration from the villages with no institutional build up gets decelerated.
or stalled where creation of common property rights appear. Simultaneously the significance of remittances gets reduced along with institutional build up in the villages.
References


Appendices

Table 1: Selected Indices for Udaipur and Rajasthan, 1991

<table>
<thead>
<tr>
<th>Relative index of development</th>
<th>Year</th>
<th>Unit</th>
<th>Udaipur</th>
<th>Rajasthan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>1991</td>
<td>sq. km</td>
<td>17279</td>
<td>69</td>
</tr>
<tr>
<td>Forest</td>
<td>1993</td>
<td></td>
<td>3228</td>
<td>13099</td>
</tr>
<tr>
<td>Net sown area</td>
<td></td>
<td></td>
<td>3464.62</td>
<td>-</td>
</tr>
<tr>
<td>Net irrigated area</td>
<td></td>
<td></td>
<td>1048.63</td>
<td></td>
</tr>
<tr>
<td>Forest area as %age of reporting area</td>
<td>1991</td>
<td>%age</td>
<td>40.57</td>
<td>6.41</td>
</tr>
<tr>
<td>Net sown area as %age of reporting area</td>
<td></td>
<td>%age</td>
<td>40.57</td>
<td>6.41</td>
</tr>
<tr>
<td>Gross irrigated area as %age of gross cropped area</td>
<td></td>
<td></td>
<td>26.83</td>
<td>21.3</td>
</tr>
<tr>
<td>Average size of holding</td>
<td></td>
<td>ha</td>
<td>1.75</td>
<td>4.34</td>
</tr>
<tr>
<td>Occupied households</td>
<td></td>
<td>thousand</td>
<td>562.34</td>
<td></td>
</tr>
<tr>
<td>Population</td>
<td></td>
<td>lacs</td>
<td>28.89</td>
<td>440.06</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td>14.70</td>
<td>230.43</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td>14.19</td>
<td>209.63</td>
</tr>
<tr>
<td>Urban</td>
<td></td>
<td></td>
<td>4.94</td>
<td>100.67</td>
</tr>
<tr>
<td>Rural</td>
<td></td>
<td></td>
<td>23.95</td>
<td>339.39</td>
</tr>
<tr>
<td>Population growth rate (per annum)</td>
<td></td>
<td>%age</td>
<td>2.04</td>
<td>2.5</td>
</tr>
<tr>
<td>Population density (person/sq.km)</td>
<td></td>
<td>nos.</td>
<td>167.21</td>
<td>128.58</td>
</tr>
<tr>
<td>Urbanisation</td>
<td></td>
<td>%age</td>
<td>17.10</td>
<td>22.88</td>
</tr>
<tr>
<td>Literacy</td>
<td></td>
<td>%age</td>
<td>34.38</td>
<td>38.55</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td>49.27</td>
<td>54.99</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td>19.00</td>
<td>20.44</td>
</tr>
<tr>
<td>Urban</td>
<td></td>
<td></td>
<td>74.44</td>
<td>65.33</td>
</tr>
<tr>
<td>Rural</td>
<td></td>
<td></td>
<td>25.81</td>
<td>30.37</td>
</tr>
<tr>
<td>Workers</td>
<td></td>
<td></td>
<td>12.51</td>
<td>138.62</td>
</tr>
<tr>
<td>Main workers</td>
<td></td>
<td></td>
<td>9.54</td>
<td></td>
</tr>
<tr>
<td>Workers as %age of Total</td>
<td></td>
<td>%age</td>
<td>43.28</td>
<td>38.87</td>
</tr>
<tr>
<td>Population</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture &amp; allied activities</td>
<td></td>
<td></td>
<td>70.84</td>
<td>70.60</td>
</tr>
<tr>
<td>Mining &amp; quarrying</td>
<td></td>
<td></td>
<td>2.2</td>
<td>1.03</td>
</tr>
<tr>
<td>Mfg &amp; non-HH industries</td>
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<td>5.6</td>
<td>5.45</td>
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<tr>
<td>HH Industries</td>
<td></td>
<td></td>
<td>1.62</td>
<td>2.00</td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td></td>
<td>2.21</td>
<td>2.42</td>
</tr>
<tr>
<td>Services</td>
<td></td>
<td></td>
<td></td>
<td>17.54</td>
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317
<table>
<thead>
<tr>
<th>Name</th>
<th>Year of commencement</th>
<th>Membership</th>
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<tr>
<td></td>
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<tr>
<td>1. Adult Education Institute</td>
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<td></td>
</tr>
<tr>
<td>2. Alok Nav Youvak Mandal</td>
<td>1969</td>
<td>8</td>
</tr>
<tr>
<td>3. Aravali Volunteers Society Rajasthan</td>
<td>1987</td>
<td>15</td>
</tr>
<tr>
<td>4. Bhawana Sansthan</td>
<td>1988</td>
<td>5</td>
</tr>
<tr>
<td>5. Environment Community Centre</td>
<td>1992</td>
<td>3</td>
</tr>
<tr>
<td>6. Gayatri Shiksha Sadan Sansthan</td>
<td>1986</td>
<td>16</td>
</tr>
<tr>
<td>7. Gram Vikas Samiti</td>
<td>1984</td>
<td>5</td>
</tr>
<tr>
<td>8. Gyan Bharati Trust</td>
<td>1985</td>
<td>8</td>
</tr>
<tr>
<td>10. Sajeev Seva Samiti</td>
<td>1981</td>
<td>8</td>
</tr>
<tr>
<td>11. Sewa Mandir</td>
<td>1966</td>
<td>202</td>
</tr>
<tr>
<td>12. The Ashoka Foundation</td>
<td>1982</td>
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</tr>
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<td>13. Ubheshwar Vikas Mandal</td>
<td>1983</td>
<td>15</td>
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<td>14. Udaipur Environmental Group</td>
<td>1976</td>
<td></td>
</tr>
<tr>
<td>15. World Wide Fund for Nature</td>
<td>1993</td>
<td>-</td>
</tr>
<tr>
<td>Name</td>
<td>Area of activity</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Adult Education Institute</td>
<td>Adult education, environmental education, improving village sanitation and use of alternative energy</td>
<td></td>
</tr>
<tr>
<td>Alok Nav Youvak Mandal</td>
<td>Environmental training for women, constructing anicuts, land bunding, plantation</td>
<td></td>
</tr>
<tr>
<td>Aravali Volunteers Society</td>
<td>Educate people about environment through camps, training on afforestation, soil and water conservation, wasteland development</td>
<td></td>
</tr>
<tr>
<td>Rajasthan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bhawana Sansthan</td>
<td>Promote water conservation, agro-forestry, wasteland development, soil-water conservation, encourage use of smokeless chullas and biomass</td>
<td></td>
</tr>
<tr>
<td>Environment Community Centre</td>
<td>Impart non-formal environmental education, eco-development camps for tribals, nursery raising and agro-forestry, encourage use of herbal medicines</td>
<td></td>
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<tr>
<td>Gayatri Shiksha Sadan Sansthan</td>
<td>Social forestry, wasteland development, environmental education and training</td>
<td></td>
</tr>
<tr>
<td>Gram Vikas Samiti</td>
<td>Wasteland development, afforestation, improving sanitation and environmental education</td>
<td></td>
</tr>
<tr>
<td>Gyan Bharati Trust</td>
<td>Propagation of medicinal plants, educational opportunities and life support protocols</td>
<td></td>
</tr>
<tr>
<td>Jagaran Jan Vikas Samiti</td>
<td>Work for upliftment of poor, promote tree planting, agriculture, nursery raising, community plantation, village sanitation, mud solar cookers, soil conservation</td>
<td></td>
</tr>
<tr>
<td>Sajeev Seva Samiti</td>
<td>Encourage community organisation, environmental awareness, tree plantation, wasteland development, soil and water conservation, nursery raising, biogas plants, solar cookers, training masons in building biogas plant</td>
<td></td>
</tr>
<tr>
<td>Sewa Mandir</td>
<td>Promoting local initiative in developmental issues, adult and non-formal education development of women, health, forestry, wasteland development, soil and water conservation, agricultural extension, conservation of biodiversity</td>
<td></td>
</tr>
<tr>
<td>The Ashoka Foundation</td>
<td>Highlighting environmental issues, providing advisory and financial support, network building and communication, consultancy services</td>
<td></td>
</tr>
<tr>
<td>Ubheshwar Vikas Mandal</td>
<td>Promote eco-cultural regeneration, upliftment of adivasis in Aravali, wasteland development, nursery raising, tree</td>
<td></td>
</tr>
<tr>
<td>Organisation</td>
<td>Activities</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Udaipur Environmental Group</td>
<td>Organising ecodevelopment camps, workshops, tree planting, organise studies in environmental conservation, publishing newsletter etc.</td>
<td></td>
</tr>
<tr>
<td>World Wide Fund for Nature</td>
<td>Promotion of nature conservation and protection through support to research, field projects, education, raise funds for conservation</td>
<td></td>
</tr>
</tbody>
</table>
Self Help Groups in Orissa: Some Conceptual Issues

Dr. K.G. Karmakar

I. Introduction

Unlike many countries, which have implemented Self Help Groups (SHGs) as a part of the formal credit delivery system, India has been experimenting with them since the 1960s. They are very flexible systems, giving a lot of freedom to the non-government organisations (NGOs) to set up SHGs based on various models. SHGs are mostly informal groups of people where members pool their savings and re-lend in the group on a rotational basis, depending upon the need for consumption, production, or investment. The SHGs have a common perception of need and improvise in collection decisions and actions. Many such groups are formed around specific production activities to promote savings among members and use the pooled common resources to meet emergent credit needs of members. The resources are supplemented by external resources, loaned/ donated and by NGOs, where fund generation is low in the initial phases (due to low savings capacities). Thus, SHGs have been able to provide rudimentary banking services to the members on a cost effective basis and meet urgent credit requirements in time which ensures almost 100% repayment of loans. Based on local requirements, SHGs have evolved their own characteristics of functioning as under:

(i) The groups usually create a common fund by contributing their small savings on a regular basis.
(ii) SHGs evolve flexible systems of working sometimes with the help of NGOs and manage common pooled resources in a democratic manner.
(iii) Groups consider loan requests in periodic meetings, with competing claims on limited resources being settled by consensus as regards greater need.
(iv) Loaning is mainly on trust with minimum documentation and without any security.
(v) The loan amounts are small, frequent and for short duration, and are for mainly unconventional purposes.
(vi) Rates of interest vary from group to group, depending upon the purpose of loan. It is higher than that of banks but lower than that of moneylenders.
(vii) At periodical meetings, besides collecting money, social and economic issues are also discussed.
(viii) Defaults are rare due to group pressures and intimate knowledge of the end-use of credit.

56 Chief General Manager, National Bank for Agriculture and Rural Development (NABARD), Inspection Department, Head Office, Hyderabad
SHGs in Orissa

India has about 1,50,000 credit outlets in the rural institutional sector including co-operatives. The disbursements made by the banks for agricultural purposes during 1994-95 amounted to US $6460 million. In spite of this, rural people depend on moneylenders for all consumption purposes. Even for production credit requirements, it is estimated that rural credit institutions supply only 12-13 % of the actual credit requirements, with the remaining being met from their own sources, friends and relatives, traders, moneylenders and landlords. With land reforms being a forgotten issue, gross capital formation in agriculture has also been falling. Banks are unable to meet rural credit requirements owing to various organisational inadequacies. The really poor persons (estimated at around 65 crores) have little or no access to rural credit due to the following reasons:

(i) Attitude of bankers in view of rising Non Performing assets and poor loan recovery rates.
(ii) Attitude of borrowers is wilful defaulting
(iii) Prevalence of illiteracy
(iv) High level of indebtedness due to natural calamities
(v) Non-availability of consumption credit
(vi) Time taken to sanction rural loans (one month to 18 months)
(vii) High loan transaction costs for poor rural borrower

With the help of some banks and a few committed NGOs, the numbers of SHGs in Orissa have been rising steadily as under:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SHGs in India</td>
<td>225</td>
<td>620</td>
<td>2122</td>
<td>4600</td>
</tr>
<tr>
<td>SHGs in Orissa</td>
<td>-</td>
<td>180</td>
<td>203</td>
<td>461</td>
</tr>
<tr>
<td>Women SHGs in Orissa</td>
<td>-</td>
<td>180</td>
<td>201</td>
<td>459</td>
</tr>
</tbody>
</table>

Though there has been a tradition of thrift and mutual help has been strong in villages, pooled cash savings in SHGs is an alien concept in Orissa. However, in some villages, the concept of grain 'goals' in tribal villages (especially, in times of drought) and 'Kothas’ or village funds has been prevalent. The linkage process which has been emphasised by NABARD since 1992, has been centred around the following broad concepts:
(i) Savings first, no credit without savings
(ii) Savings as partial collateral
(iii) Bank loans to the SHGs for on-lending to members
(iv) Income generation programmes to be popularised along with SHG concepts
(v) Credit decisions for on-lending to be prerogative of SHG members
(vi) Interest rates and other terms and conditions for loans to be left to SHG members
(vii) Joint liability as a substitute for physical collateral
(viii) Ratio between savings and credit contingent upon credit worthiness and could increase over a period due to good repayment record.
(ix) Small loans to begin with and then slowly based on repayment performance and needs, may graduate to higher credit amounts.

While the SHG linkage has the capacity to develop into an alternative credit delivery system, the problem is that of finding an adequate number of committed bankers and NGOs to carry out this programme. In spite of the blessings of RBI and the initiative taken by NABARD on an all-India basis, the progress in the formation of SHGs has not been encouraging. The status of banks/NGOs involved in the SHG programme since 1992-93 is as under:

<table>
<thead>
<tr>
<th></th>
<th>Orissa</th>
<th>All India</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of banks</td>
<td>28</td>
<td>300</td>
</tr>
<tr>
<td>No. of banks linked with NGOs/SHGs</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>No. of NGOs</td>
<td>5817</td>
<td>23780</td>
</tr>
<tr>
<td>No. of NGOs involved in RD/Thrift</td>
<td>105</td>
<td>1999</td>
</tr>
<tr>
<td>NGOs linked with banks in SHG formation</td>
<td>9</td>
<td>87</td>
</tr>
</tbody>
</table>

The banks have been apathetic to SHG linkage concepts partly because the linkage concepts have yet to percolate down to the branch level with each bank having its own guidelines. Also, SHG lending is not perceived as normal lending activity but it treated as a confessional dispensation while most bankers and their bureaucratic procedures, and most NGOs are not interested in thrift-based programmes as they depend upon easy foreign funding. Many NGOs feel that expert manpower is needed for maintaining thrift-based savings especially accounts maintenance, but the major problem is that of linkage with banks due to the suspicious attitude of bankers.

### III Success Stories of a few SHGs

#### A. Less dependence on money-lenders
Usury in its most deplorable form is where the lender tries to coerce the borrower into a dependency-relationship from which the borrower cannot escape. Rural moneylenders charge interest @ 10% per month (Lal Bangala in Sambalpur) or @ 25 % per month (Chami Kalantar in Bolangir and Kalahandi). The NGOs have been able to organise SHGs comprising women in these areas and inculcate in them habits of thrift and income-generation activities. Loans have been utilised for growing crops, blacksmithy work, making of hill brooms, trading and business, collection of sal leaves, tailoring, etc. Repayment among these women SHGs is 100 %. These groups have also taken up community development like adult education, fair price shops, and construction of village roads, mini-medicine banks, and community grain centres. No lien on the deposits of the groups has been taken in respect of loans advanced to the SHGs by the Bolangir and Kalahandi Anchalik Gramin Banks.

B. Food Security

For centuries, the tribals of Koraput have had grain banks in their villages where villages put in grain in times of harvest and withdrew grain when absolutely needed. But the setting up of co-operative forced the closure of these grain-banks. Under the active guidance of Ankurran, SHGs have re-established grain banks as a hedge against starvation deaths in tribal villages in most villages in Narayampatna, Rayagada district.

C. Village Funds

Jahnitala in Dhenkanal district is a small village with nil-overdues. All 93 borrowers have repaid their loan instalments to Canara Bank. The village has a common fund with all households making deposits and needy persons take and repay loans within a year @ 25 % per annum. As the interest amount adds to the fund, borrowers do not mind the additional interest. About 50 years back, the village elders took up forest plantation on common village wastelands and today the forests are over 40 years old and guarded at village expense. Another interesting innovation is that all houses in the village must be represented during all village meetings and a fine of 99 paise is imposed for non-attendance. The difficulties in gathering exactly 99 paise ensures that no household is unrepresented in the village meetings. Since 1947, no single police case has been registered in the village and no political meetings or smoking or drinking is permitted in the village. A model village indeed!

D. Stopping Tribal Exploitation
The poor tribals of Rampur, Kalahandi district are exposed to cerebral malaria and hunger for four months in a year apart from being exploited by moneylenders, middlemen and businessmen. Their main income is from shifting cultivation and collection of minor forest produce. Antodaya has been assisting these tribals and 800 tribal women have formed 35 SHGs with small savings and a loan of Rs.30, 000 from KAGH and RRB helped them to evade the clutches of moneylenders during the festive season and they avoided selling the forest/ agricultural produce to the moneylender traders at nominal prices. The NGOs also helped the tribals to break the trader monopoly on hill-brooms; instead of Rs.3/- per kg, the tribal now secure Rs.15 per kg. This has helped them repay loans in time. Various production activities such as leaf-plate stitching, bee keeping and agarbathi-making have also been taken up.

E. Production Oriented SHGs

Bimunda in Bolangir district had 140 families and a population of 641. As the nearest bank branch was 25 km. away, no credit facilities were available in the village. The milk production co-operative society could collect only 30 litres of milk daily. With the help of the BAGB, a RRB gave credit support of Rs.3.55 lakhs for 42 families and Rs.1.56 lakhs deposits have been mobilized in 95 accounts. Thirty families have taken dairy loans and the milk collection for the MPCS has shot up to 320 litres per day. All loan instalments have been repaid in time and the government has extended infrastructural support like addition of roads, water-harvesting structures, etc. A large number of trees have been planted and adult literacy programmes have been successful.

F. SHG for Mechanised Farming

Twenty farmers in Badjore village of Mayurbhanj district formed a Farm Mechanisation Co-operative Society in 1993 and purchased a tractor with bank loan from BOI under IRDP subsidy. The farmers cultivate their land extensively with the tractor, optimising farm productivity. During the off-season, the tractor is used for transportation of rural products like construction materials, vegetables and other village handicrafts. There is unity among the members who meet on a monthly basis to review expenditure and accounts. District/ bank officials also attend their meetings. A shed-cum-meeting place has been constructed. The tractor has been a boon to the economy of these poor farmers.

G. Banning/ Social Ostracism

In Bhadrak, the first SHGs linked with banks were started by several poor Muslim women going against the conservative social customs with the help of the BGB, a RRB and 'Fellowship a NGO'. Though the credit assistance was low, the impact on the economic conditions of the women members
makes it worth emulating. A few members purchased indigenous varieties of cows with a very small investment and the assets created have added to their family income considerably. Kumari Usharani Das, a SHG organizer in Chandwar, Cuttack district, was ostracised and her house regularly stoned at night as she tried to organise women SHGs and mobilise their savings. Against all odds and with the support of the womenfolk, the SHG saved Rs.4,000 in four months and was linked to Indian Bank in 1994.

IV. Operational problems of SHGs in Orissa

The emergence of Self Help Groups as a supplementary credit channel and its evolution from a pilot project to a business opportunity for the banks is a departure from traditional banking practices. This has necessitated constant review of the functioning of SHGs and assessment of their strengths and weaknesses.

The flexibility provided in operation and linkage process has encouraged ingenuity and helped the groups/ NGOs/ banks to evolve procedures and patterns suitable to their needs. This needs to be continued. At the same time, standardisation may be attempted only in areas where flexibility has been misinterpreted or where imposition of rigidity is a necessity.

A study of all the Self Groups, NGOs and Banks where the credit linkage had been established upto March 1995 was taken up in mid-1996. All the existing models of linkage have been covered. In all eight NGOs, 11 banks and 14 SHGs were covered during the study covering almost the entire state. Structured questionnaires were used for collection of data besides field studies on the basis of structured interviews and through non-participation observation at SHG level.

The major findings of the study are summarised below:

(i) The repayment performance of the SHGs vis-a-vis the same under IRDP and the branch’s overall recovery performance were compared. It was observed that the average recovery percentage of the branches visited in respect of IRDP, SHGs and branch as a whole were 36 %, 88 % and 71 % respectively.

(ii) An attempt has been made to find out the start up costs incurred by the NGOs in promotion and linkage of SHG and the source from which the same is met. It was agreed by the NGOs that when the numbers of groups are comparatively more, the initial start up cost incurred is less and vice versa.
The study team attempted to evaluate the transaction costs incurred by banks for linking SHGs with bank credit. Most of the bankers were of the view that the transaction cost for SHGs were low compared to other such small loans especially when the linkage was through an NGO.

The record keeping and accounting procedures maintained at the SHG and NGO level varied depending upon the involvement of NGO, the level of awareness of members, etc. There is no need to impose a common system.

Documentation of sanction of loans and securities collected at the bank’s level while providing credit linkages has brought out certain interesting observations. The number of such documents varied from bank to bank (4 to 11). While many banks kept the savings of the groups in fixed deposits as lien, a few preferred to keep the same in savings bank deposits and two banks did not keep any lien at all.

The rules and regulations formulated and adopted by the SHGs for smooth operations varied from SHG to SHG. There were a plethora of guidelines on group savings and credit discipline among the groups.

The choice of SHG members is limited to a few activities because the amount of loan is small in the initial years of linkage programme concerned. At a few places, group activities have been pursued with bank credit support and in most of the cases, there is provision for consumption loan to members. The repayment period was short in view of low level of operation to accommodate more members availing credit.

The groups were found to take conscious decisions on utilisation of earned interest. While in most cases the interest earned is ploughed back to the seed money of the group, there were a few instances where the same was utilised for common welfare activity.

The study team came across a few successful instances of conflict resolution and role of peer pressure, which need to be documented for the very practical approach taken.

The study team also made a survey of the group decisions on amount of savings, frequency of savings and the source of savings and most SHGs had a mastery over financial intricacies.

The income generated out of small ventures undertaken by SHG members varied depending upon the activity and the manufacture/marketing skills of the individual SHG member.
The membership size of the groups varied from group to group. However, it was observed that except two groups, others never considered that membership size has caused any problem to the functioning of the group.

The rate of interest charged for consumption and production loans varied from group to group, between ten % and 36 %.

The study team also explored the possibility or otherwise of rotation in leadership to maintain the democratic character of the group. The majority opinion is that the SHGs should decide the issue.

V. Conclusion

The poor can certainly save and the thrift-based SHGs have proved that given flexible conditions, the poor can also save significant amounts. But thrift groups alone will not be able to help its members unless a loaning programme is also set up for enhancing their income-generating capacity. The UAA, Ganjam, example reveals poor loans allocation capability if there is no bank linkage programme. But the other SHGs, which had a slender resources base, utilised the bank loans to augment lending capacity that could help more members by way of loans and enhance their income-generation capacities. After about 3-5 years of building up SHG funds corpus, the NGO could withdraw and set up new SHGs.

Thus, the concessional funds from NABARD in the initial years would be useful for SHGs to augment their funds and basically would stabilize the funds resource base of the SHGs. However, there is no indiscriminate showering of funds for SHGs, given the hostile environment for SHG linkage, even after three years of having the SHG-bank linkage programme.

Banks are way of giving excess credit especially when they are very conscious about non-performing assets (NPAs) and preparing a 'healthy' balance sheet. The availability of concessional funds would enable the SHGs to build up their financial resources base faster and help inculcate the principles of self-help as the corpus of SHG funds is building up over 3-5 years. The SHG would be able to generate more funds and rely on members rather than cheap bank funds. The banks would also find this system of lending convenient as the recovery rates exceed 90 % in most cases and the transaction costs are lowered while priority sector lending is carried out as per targets set by the Reserve Bank of India. The SHG linkage programme cannot be replicated without using NABARD refinance, as the volume of funds is low. For Orissa, only an amount of Rs.22.57 lakhs has been given as NABARD
refinance for 404 SHGs as on 30th September 1995 (over three years) revealing that per SHG refinance is only Rs.5615 with each SHG comprising 20 members.

The availability of concessional refinance has been targeted towards banks so as to popularise the SHG linkage programme and make it more attractive to banks which otherwise generally treat NGOs with suspicion. The use of refinance is part of NABARD’s strategy of healthy NGO-bank linkage to bring about integrated rural development with “people” participation which has been give importance in the eight plan document. No concessional funding is being contemplated under the NABARD bank linkage scheme. Refinance is available at the same rate as is available to banks for normal development purposes.

The issue of all NABARD refinance being concessional and the need for refinance when the process of economic liberalisation is being implemented is beyond the scope of the thesis. However, imposing higher refinance rates when other sections are being given concessional refinance for development purposes should not discriminate against SHGs/ NGOs. External funds do not dilute self-help concept for NGOs but refinance certainly helps in forging healthy linkages between banks and NGOs for more involvement in other rural development processes.

Taking into account the various factors started earlier, we conclude that if linkages between SHG-member banks and NGOs are usefully built up, there will be reduction of transaction costs for both banks and borrowers. There will be better loan recovery and mobilisation of deposits at low costs. This will not merely add one more tier in the complex rural credit delivery system or dilute the principles of self-help, as no subsidy is included at all.

In the initial stages, as banks and NGOs are both in way of each other, RBI/ NABARD intervention is necessary to enable SHGs to sustain/ expand their operations and over a period of 3-5 years, they will be able to sustain their operations and build up a healthy resources base. It is still too early to say if banks can provide funds from their internal resources (without resource to NABARD refinance). However, it may be stated that many NGOs prefer not to take recourse to funds from banks. Such a short-sighted approach does not augur well for the future of these NGOs. Many NGOs have been suspicious about the performance of banks in spite of the need to augment SHG resources, and have firmly resisted the bank linkage programme of NABARD.

Thus, NABARD intervention to reduce mutual suspicions and encourage a healthy working relationship should continue. This will not dilute the principle of self-help as no concessions/ subsidies have been envisaged in the linkage programme. But the truth is that, due to the non-availability of a number of good NGOs which have a diversity of activities and for whom the bank
linkage programme is one of many developmental activities, the SHGs can only be an efficient supplement to the credit delivery system rather than form an alternative credit delivery system. These are certain plus points in the NABARD-SHG linkage programme.

No subsidy is contemplated and the SHG is free to charge higher rate of interest ranging from 18 % to 36 % per year. The bank charges a lower rate of interest (9.5 %) and a 3 % margin is available to the NGO to meet their transaction costs. No concessional lending to the SHG borrower is contemplated in the scheme as it would dilute the 'self-help' process and provide only temporary crutches to the poor to lean on. One of the findings of a study (ODA PHEP Study - “Credit for Fisherfolk” - June 1995) states “There are a few NGOs who have started saving and credit programmes among marine fishing fold through the SHGs. For lending they rely mainly on mobilisation of savings. But the amounts being very small, credit based solely on the savings of the community is not adequate to meet the requirements, particularly for assets”.

330
Experience of the Campesino-to-Campesino Program in the buffer zone of the BOSAWAS Reserve.

by Abelardo Rivas Espinoza and Eduardo Zamora Gonzalez

Introduction

The Atlantic Region of Nicaragua with the largest tropical rain forest in Central America is known as the agricultural frontier, and has been exploited for its mineral and lumber resources for centuries. A 7,500 square kilometre area, the BOSAWAS reserve, in the North Atlantic Autonomous Region was designated as a protected area in 1991. Fifty five per cent of it belongs to the department of Jinotega and forty five per cent to the North Atlantic Autonomous Region (RAAN). BOSAWAS is a priority in the protection of biodiversity because of the low level of human intervention in the ecosystem of this area. However, the deterioration continues for different reasons- one of the most important being the advancing campesino (peasant) migration. This campesino migration pushing into the agricultural frontier in search of “new” and “fertile” land in order to survive, but making inadequate use of the forest, is a phenomenon that is very difficult to control and regulate.

No organisation, government, or institution has come up with a development strategy that would enable farmers to improve their production methods by adopting modern agricultural and forestry practices. Governmental credit policies, the granting of “idle lands” under the Agrarian Reform, continue to facilitate this destructive process.

The migration often results in a clash between a mestizo farm culture advancing from the Pacific and Central regions into the forest reserves of Atlantic coast. Indigenous groups live in harmony with their surroundings within the BOSAWAS Reserve. They still fear the mestizos as the destroyers of mother earth.
Beginning elements in the effort to construct alternative practices

For three years the Campesino to Campesino Program (PcaC) of the National Union of Farmers and Ranchers (UNAG) has been developing a new programme around the southeast sector of the BOSAWAS reserve in the municipality of Siuna. It has allowed the campesinos to create an alternative system for exploiting agricultural and forest resources to meet their food needs without advancing the agricultural frontier.

They are using land in a rational manner without planting large areas with grain. Some of the practices are:

- harvesting corn, rice and other crops in the same plot every year;
- planting corn, quesquisque or cassava, associated with pigeon peas (*Cajanus cajan*) and cutting the pigeon pea plants to fertilise the soil and maintain sufficient organic matter;
- planting cowpeas (*Vigna*) as a ground cover to cut in July and plant rice without burning or ploughing;
- planting velvet beans (*Mucunas*) when the corn tassels or the first small ears emerge. The corn stalks are left standing to help the beans grow better and control the weeds faster.

A majority of the farmers with two to three years’ involvement in the programme are now collecting seeds and establishing nurseries to promote forest regeneration. The community of Rosa Grande has been selected to assess the characteristics of the communities located in the buffer zone and to throw light on the work carried out by Campesino to Campesino in recent years.

1 Nicaragua: General aspects

1.1 Resources

Nicaragua has three large natural regions:
A. *The Pacific Region* comprising the plains bordering on the west by the Pacific Ocean and surrounding lakes including Cocibolca (Managua) and Xolotlan (Nicaragua), and the volcanic chain. Its rivers are not perennial. Sixty to seventy per cent of the population lives in this region because of the fertility of the soil and infrastructure facilities like farm, machinery, agrochemical and irrigation. Improved seed, and monoculture cotton farming for export is done here.

B. *The Central region* is a mountainous of a triangle with a broken geography with depressions that form river basins. The soil is poor. It has a large *campesino* population.

C. *The Caribbean or Atlantic region* with flatlands that descend gradually to the ocean, cut through by large extensive rivers and covered with dense tropical forests.

1.2 The economy and the regional framework

Farming is the main stay of the Nicaraguan economy. Milk, beef, fishing for local consumption, and agriculture for export are features of the economic activity. Mining and logging have picked up in recent years after suffering a setback due to the armed conflict of the 1980’s.

The way the economic development of the country has been handled has had a severe effect on the natural resources leading to increased poverty, forcing the marginalized sectors to make irrational use of these natural resources for sheer survival.

Since March 1991, the Structural Adjustment and Stabilization Program has further increased the poverty levels forcing *campesino* migration from the dry regions to the agricultural frontier in search of “new, fertile soils”. In 1995, it was estimated that 100,000 rural inhabitants travelled to Costa Rica for temporary seasonal work.

The gross national product in 1991 was 407 dollars (1980 prices). Approximately 70% of the population is not able to satisfy its basic needs. Fifty three per cent of the economically active population (1.4 million), are currently unemployed or underemployed. Parallel to this, each year
between 42,000 and 45,000 people enter the job market. Economic imbalance also means territorial imbalance and the Pacific Region dominates the other regions in terms of infrastructure, available capital, etc.

Recently the General Law on the Environment, prompted by civil society, led by the Nicaraguan Environmental Movement (MAN), was passed by the National Assembly. Also at the initiative of the Ministry of Natural Resources and the Environment (MARENA) and others, a Forestry Law is awaiting approval.

The insecurity over property ownership adds its mite to the dismal picture with farmers unsure of their land rights unwilling to plant trees as a long-term investment. They prefer to cut the existing ones to sell the lumber or fire wood.

This decade, campesinos have faced pressures from former owners and other large landowners who would like to reverse the Agrarian Reform. At the same time thousands of campesinos including demobilized “Resistance” demand land for forming.

In its medium range strategy, the Government has identified programs of integral rural development with zones for: developing coffee production; sustainable campesino production; the dry pacific region; non-traditional crops, managing and use of forest resources.

In recent years, it also wrote “A National Strategy for the Environment”. According to the government this intermediate phase consists of a process of strategic planning. Towards that goal a National Strategy for Conservation and Sustainable Development, a National Forestry Action Plan and National Environmental Action Plan have been written.

Among other things these efforts have helped determine the seven most critical areas with the largest problem of environmental degradation, BOSAWAS which makes up 17 per cent of the strip and the Indio-Maiz reserve in the zone called SI-A-PAZ.
This territory suffers from deforestation and conversion of forest lands for other uses by campesinos. This process is further worsened by extensive cattle ranching. After five years the programs haven’t either taken off or their presence has not been felt.

2. **The regional framework: The Nicaraguan Atlantic**

2.1 **Historical Background**

Nicaragua had suffered simultaneous occupation by Spain, on the Pacific, and England on the Atlantic Coast. The colonial powers left behind different cultures, traditions, mixtures, and different languages in the interior of Nicaragua.

The Atlantic Region was reincorporated into the nation after British Rule ended in 1894 under General Jose Santos Zelaya. This meant not our regaining sovereignty but also the surrender of the indigenous peoples who could no longer count on support from England. It led to foreign investment in the shape of large mining and logging concessions besides banana plantations. Musaseas, tubers (cassava, etc.) and basic grains (corn, rice and beans) are grown with low yields for family consumption.

Before the conquest, the native population had caused environmental degradation. The slash and burn cultivation, the hunting, fishing and the harvesting of a variety of crops had a minimal impact on the environment.

The short-term economic model of logging and mining for export did not contribute to the economic development of the country as a whole nor the Atlantic Region. Gold was the principal export during the decade of the 1940’s, and during this period Nicaragua became one of the three largest gold producers in Latin America.

The ecological damage caused by the companies has not been accurately assessed. Studies, however, show that 830,000 lbs. of cyanide were dumped into the “Dirty River” (Rio Sucio) of Bonanza between 1961 and 1978, and another 958,000 lbs. into the Bambana River between 1975 and 1979.
The expansion of cattle ranching 1950-1960 resulted in converting rain forest into pasture lands in the municipalities of Cua-Bocay, Wiwili, and Waslala. Then forest lands were converted into farm land.

Roads were built throughout the region, culminating at the beginning of the 1970’s with the building of the Managua-Waslala road and in 1976, the road from Waslala to Siuna. The real reasons for road building were to give large ranchers easy access to the markets of the Pacific; to convert forest land into an agrarian reform option for campesinos expelled from the Pacific (re-population policies); and help military combat guerrillas.

2.2 Autonomy Status

The Nicaraguan region has 50 per cent of the national territory with 300 thousand inhabitants representing roughly 9.5 per cent of the country’s population distributed in the following manners: 182,000 Mestizos who speak Spanish; 75,000 miskitos with their own languages; 26,000 Creoles who speak English; 9,000 Sumos with their own languages; 1,750 Garifonas the majority of whom have lost their language, and 850 Ramas.

On September 2, 1987 the National Assembly approved an autonomy statute for these regions, which were established as the North Atlantic Autonomous Region (RAAN) and South Atlantic Autonomous Region (RAAS). The Environmental Law, The General Forestry Law, The Fishery Law, etc., are being enacted to protect the ecology of the region.

In Managua, where logging and mining concessions are issued, the resources will run out within the next 15 years. A development model is being worked out to preserve natural wealth through consensus between the central and regional governments, the communities, civic organisations and others.

The region has 2,134,910 hectares to forests of which 1,770,000 hectares are latifoliate and 363,189 hectares coniferous. Some 21,000 families farm 44,1000 hectares.
2.3 The mining municipalities

Gold has been mined since the mid-1880s. The post 1934 period (armed conflict of the Sandino epoch), witnesses a capital intensive phase coinciding with the rise in world gold prices. By 1940, there were 1,244 workers in Siuna and 1,100 in Bonanza. The majority of them were from the Atlantic coast. A small number of skilled workers and artisans arrived from the Pacific, having come from the “India” and “Limon” gold mines.

The companies determined how the region would develop including where its roads and communities would be located. The closure of the Siuna mine in 1968 threw more than 1,000 workers out of jobs, the majority took up jobs elsewhere and some turned to farming. Siuna has been converted into an important commercial centre for the farm population of the surrounding region. Logging activity was revitalised after 1990 and the end of the war.

The average annual rainfall is 3,000 millimetres. The average temperature is 26 degree centigrade and the average annual relative humidity is 85 per cent. The biotemperature of the zone is calculated to be 24.5 degree centigrade.

Forest land with a clayish texture and a 4.5 to 5.0 pH, after being used for agriculture, its fragile soils quickly lose their fertility. The Reserve is shared by the municipalities of Waspan, Bonanza, Siuna, Waslala, CuaBocay and Wiwili, and includes areas of virgin forest which are destined to destruction due to migration.

2.4.1 Institutions operating in the BOSAWAS Area

The state has 10 to 12 institutions involved, including the Institute of Agrarian Reform, the Ministry of Agriculture, and the Ministry of the Environment and Natural Resources, etc. There are six national NGOs involved as well as eight regional NGOs and 12 local NGOs (co-operatives, associations, the Catholic Church, commissions, etc.).
2.4.2. Colonization Fronts

The advance of the campesinos into virgin land is termed colonization. In the 1960s the government resettled of campesinos who had been expelled from the Pacific region in the Nueva Guinea area.

Previously anyone could take possession of an area of National forest without being bothered, provided they did not interfere with the interests of powerful economic sectors. Any campesino could seek a bank loan by presenting evidence of having improved the land, meaning cutting down the trees and planting pastures.

Augustin Mendoza, promoter of Campesino to Campesino expressed:

“During the Sandinista government they used the slogan, ‘the land belongs to he who works it,’ and said that there should not be idle land. The fear of having their property confiscated forced many owners of large forest areas to cut them down themselves or allow campesinos with little land to come do the clearing and plant their grains. For example, I invited 15 families from my community to come and cut down the trees on the farm”.

This gives a clue to the large-scale deforestation.

After 1990, and the end of the war, thousands of demobilized combatants were given lands deep into the mountains, without any technical assistance and without an economic alternative. This led to them being forced to sell lumber exploitation rights to the loggers.

The BOSAWAS reserve has not escaped from the Colonization Fronts. The study carried out by Erick Ramirez identifies six Fronts. In this study, those that have to do with Suina are mentioned.
1. Rosa Grande colonization front of the municipality of Siuna, (the object of this study), is located between El Guayabo and Rosa Grande, and continues north, bordering Saslaya hill to the west, and is close to uniting with the Hormiguero colonization front.

2. The Horomiguero colonization front in Siuna, is part of the territory with this same name. It borders Saslaya hill to the east, and is close to uniting with the Rosa Grande front.

3. The Campesino to Campesino Program has identified a seventh colonization front located to the north Siuna and made by the communities of Campo Uno, El Dorado, Asadin and San Pablo de Aza.

3. **Life Strategies, Social Symbolism**

3.1 **The Productive Dimension: Farming Practices**

The campesinos with farming methods that do not correspond to the fragile forest lands (with at most 10 cm of top soil) cause deterioration of resources. The yields are low, which are made worse by plagues, especially rats and slugs, which result from upsetting the ecosystem.

Agricultural activity has as logic guarantee rough basic grains for self-consumption. Part of the harvests is sold at prices lower than national market prices. The basic diet is obtained through farming (corn, rice and beans), the typical dietary habits of the Pacific and Central Regions of the country which contrasts with the indigenous groups of the Atlantic.

These farmers have virtually no knowledge about forests. They have a three centuries old Mestizo farm culture which due to the migration phenomenon has pitted them in numerous historic periods against exuberant forestry resources not apt for agriculture. It was only in 1894 that the Atlantic Region was incorporated in the country through the military action of the Zelaya government. This
led the way for what would become the migration to the area during the middle of the present century.

Since they never had legal ownership, the migrating population considers the forests to either belong to the state or large private companies, even if they are in possession of the land. The majority of the campesinos have two or three cows, although there are around 50 individual farmers and co-operatives that each have between 100 and 1,000 head of cattle. The dream of the majority of campesinos is to become cattle owners. So, ranching is considered more desirable than agriculture because it is cheaper and less risky compared to the problems farmers face with the land, harvests and armed groups. Aside from their farm activities, part of the Siuna campesino pan gold to sell in the town. This provides them with a supplement to their farm income.

The campesino population settled around the mining towns like Siuna, provides food to meet the needs of the local inhabitants including the mining operations. The town serves as a market where the farmers sell part of their harvests and buy consumer products (salt, oil, soap, clothes etc.).

The campesinos felt insecure in the last ten years because of armed conflicts. Added to this are political conflicts over agrarian properties got through Agrarian Reform.

These factors determine the productive strategies of campesinos, affecting long term investment that they could make on their farms. They normally go in for short-term advantages like thatched houses.

In recent years, government-backed production programs have all but disappeared although the peasants considered them as beneficial. The farmers feel they have no role to play in environmental projects. Non-governmental organizations have tried to fill the vacuum left by the state institutions in recent years like UNAG.

Using natural reasoning like St. Thomas when he said, “seeing is believing”, participating farmers feel satisfied with the methods used in Campesino to Campesino.
3.2 Family Dimension

Family behaviour is based on the values sustained by the Catholic Church. This is a family which exalts the role of the man, who is also the one who fulfils church functions are delegates of the word. The majority of farm women have always played an active role in productive activities, in planting, weeding, and at harvest time. They are not involved in the marketing as this is done by the man who is the one who handles the money.

As a product of the past armed conflict, many households are headed by women who take on the productive activities. In few instances has land been given directly to women. Women are the most affected by the migratory phenomenon of the campesino family, because it is she who worries about the children having opportunities to study and for their health. The isolation breeds in these families a spirit of collaboration and mutual help.

3.3 Community Dimension

Christian values determine community behaviour. From the chapel, different community actions are promoted as part of the religious activities of the area. This spirit has spread to other activities such as commerce, political, civic organisations, etc. The Catholic Church unlike the Evangelical Church takes a keen interest in the economic well-being and community life of its congregation.

3.4 Organisational Dimension

With their integration into UNAG, the farmers tried to solve their production problems like credit, technical assistance, marketing assistance, etc. The strategy of the campesino organising in the territory clearly coincides with the identity of UNAG Suina. This includes campesinos that, while being activists in parties other than the Sandinistas, regarded UNAG as the only organization that was concerned about them.
Central, Rosa Grande and Yaoya, peasants from the communities of Alo say, “you shouldn’t confuse faith with image worship” and that the “chapels should not serve only for prayer”. The Catholic Church is deeply involved in the environment issues. Chapels are being used as reference points to multiply experimental agricultural alternatives and the distribution of seeds of nitrogen fixing cover crops. At the trimestral gathering called by the priest of the municipality with the delegates of the word, the experiences of Campesino to Campesino had been given a place on the agenda.

**Political organizations in the life of campesinos**

Owing to the repression of the National Guard in the Somoza era, many campesinos population here by the late 70’s collaborated with the Sandinista guerrillas. There were some dissension also and a portion of the farm population joined the Resistance, splitting the campesino family. Sandinistas within UNAG and the opposition collaborated with the Resistance.

The political organizations still play role in the life of the campesino population but with reconciliation the role is diminishing. For example, Don Agustin Mendoza, a promoter of the program is connected with the Liberal Party and was a former member of the National Guard. Yet he has close relations with Sandinista activists who are fellow promoters.

The destruction of the natural resources of BOSAWAS and its buffer zone is the main problem. The population living in these communities feels that the institutions only lecture to them about the environment without offering any alternatives for them to survive and improve economically.

Dona Ignacia Gonzalez, a farmer, states that the institutions that have traditionally worked in the area come every year to ask about the problems. In the best of situations this information is used to write a project and the worst remains only a list of problems”.

We should view this from the standpoint of campesinos with poor education, little marginal land, without capital, despite which grow food for internal consumption and not for earning foreign exchange.
4. The Campesino to Campesino Process

4.1 The Methodological Approach

The original idea of Campesino to Campesino was to promote a program of soil conservation oriented to small hillside farmers” and to train voluntary campesino promoters capable of leading and generating a sustainable process of transforming Nicaraguan agriculture through a horizontal training process.

The key to the Program is the communication among equals to dispel the distrust among participants.

It starts with the farmer and his/her plot of land, from their experiments and from the concrete results obtained. This strategy made possible the expansion of the program new territories, farming methods, learning methodologies productive capacity ecological consciousness, organization, etc.

The program was extended to regions with different agro-ecological or socio-economic conditions and with different cultures. The promoters offered to share the techniques they had learned at semi-humid hillsides, flat areas, and those with humid tropical conditions. But this was only a copy.

The process of Campesino to Campesino consolidated itself, opening in each of the topographic and climatic regions a process of experimentation and innovation to determine precisely the farm practices appropriate for each reality.

4.2 The Role of the Agricultural Adviser

The agricultural adviser should adopt close links with the Campesino to Campesino Program. This permits them to be in a permanent search for better comprehension of campesino farming systems before trying to promote changes that might prove inappropriate. A respectful attitude towards the
farmers and their knowledge is the best way for facilitating fertile collaboration between the farmer and the agricultural adviser.

Under this system the adviser gives an important role to the farmers in the solution of their problems, and to accompany them in that process. On their part it is important for agricultural advisers to adopt. The adviser should be acquainted with:

- The history of farming in the zone, soil types and uses, rainfall data, the local agricultural calendar, the principal crops grown for self-consumption and sale.

- The topology of the farmers, local farm production systems and the composition of the local labour force and its movement.

- Maps and sketches of the municipality and the communities.

This information can be got through research, working on the land, in interviews with the men and women of the community and opinion polls and self-diagnostic studies.

*Campesino to Campesino* wants the agricultural advisers to carry out the following functions among other things:

- Facilitate the flow of information between groups of farmers where the agricultural adviser is not the principal actor.
- Help with the planning and preparation of workshops interchanges, etc.
- Exchange of techniques used in different zones.
- Identify questions that the farmers have in their process of experimentation and innovation.
- Be a link between sources of available information and research and groups of *campesinos*.
- Identify bottlenecks and the needs of farmers to carry out the integration process on their farms.
- Articulate local proposals and promote the *Campesino to Campesino* methodology.
4.3 Birth of the Process

The Exchanges

The interchange of farming practices between campesinos of UNAG’s Campesino to Campesino Program led to the identifying and multiplying of some practices among farmers of the municipality, leading to the small farmers valuing campesino knowledge. The implicitly includes the recovery of rural peoples history with the land and nature.

In Siuna, like in the rest of the country, people are taken into account. The Program tried to respond to hurdles to production such as the gradual loss of soil fertility; the difficulty of planting on the same plot every year, etc.

A group of farmers from the Siuna Municipality visited communities of the departments of Boaco and Matagalpa to learn about the experiences of farmers participating in Campesino to Campesino. This motivated the beginning of the process in Rosa Grande. These interchanges supported by UNAG, serve to motivate the new group to participate and exchange seeds, plants, etc.

The mutually understood campesino language made it easy for the farmers from Siuna visiting Matagalpa and Boaco to “understand” the motivation of the latter to carry out changes in their production systems and that this is not done in a mechanical way.

With these experiences as a base, they began the multiplication process with other farmers in the community and the municipality, using different mechanisms and tools such as interchanges, training workshops, direct conversation, promotional visits to other communities, etc.

This is summarized by Jesus Garcia of Road Grande: “With the Campesino to Campesino methodology we multiplied these experiences in our municipality. Between 1993 and March 1995,
my community, and the farms where we use the fertilizer bean were visited by more than 300 campesinos from our municipality”.

And he continues... “In 1994, 1995 and what has passed of 1996, in other communities they have also planted the fertilizer bean. There have been many training workshops given about this experience and more than 3,000 campesinos have taken part in visits, field days, gatherings or interchanges”.

Jesus Garcia, community leader and Campesino to campesino promoter, came to Rose Grande in 1995. There were only two families there. His was part of eight families that came from Matagahpa. They came to Rose Grande on foot. It took eight days. Jesus owns a 40 mzs farm - 21.5 mzs area in the regeneration zone.

The following are the activities that have been carried out in Siuna during 1996:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Number</th>
<th>Total Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workshops on the use and handling of the fertilizer bean</td>
<td>16</td>
<td>320</td>
</tr>
<tr>
<td>Interchanges experiences between Communities of the same municipality</td>
<td>30</td>
<td>600</td>
</tr>
<tr>
<td>Promoting experiences of using the fertilizer bean with videos filmed on the farms of the Siuna promoters</td>
<td>35</td>
<td>1400</td>
</tr>
<tr>
<td>Interchanges outside of Siuna</td>
<td>10</td>
<td>69</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>91</strong></td>
<td><strong>2389</strong></td>
</tr>
</tbody>
</table>

“None of us on the co-operative have been able to sell a tree even though we have an abundance of them. If you can plant 10 trees per manzana, your costs are low and the care isn’t all that much”.

The farmers acknowledge that the National UNAG has been their constant accompaniment at every step. “We have been informed that in Managua the National UNAG is putting together a reforestation program (BID-MARENA-UNAG), and it is planned that they will be coming here in near future. The
advantage here, is that we already have a lot of areas selected for natural regeneration and this can be seen on the maps of the farms and the community as a whole”.

These are the first steps in which UNAG is supporting our own initiatives, and that’s what the Campesino to Campesino Program is for, and that is why this financing for the forests.

The interchanges outside the country continue in order to get to know more about the experiences of the COATLAHL project on the north coast of Honduras (humid tropics) and in the Talamanca region of Costa Rica, with the objective of: Learn about the experiences of managing latifoliate forests by its owners, on co-operative or individual basis, and their rational exploitation.

**Promotion and Experimentation**

The farmers on their plots carry out usually small-scale experimentation.

- Successful results on a farmer’s land is what motivates the rest of the area farmers who are also interested in finding a solution to their productive problems. Without good results and progress on the farms, there cannot be promotion.
- The visits by promoters to neighbouring communities are important to give follow up to the work and promote encounters among communities.
- The promoter speaks personally with friends, communicating their experiences during the interchange visits, discussing points of view, thus creating conditions to join efforts and knowledge in the task of together finding solutions to the problems that affect them.

The distribution of fertilizer bean seed has been one of the mechanisms for promoting the program. A good quantity of these seeds has been distributed making possible for many farmers to experiment and make decisions about their use.

**Work of the promoters**
Twenty six promoters, the agricultural adviser (who recently began working with the program here) and the president of UNAG, Siuna, are the ones in charge of developing the process. Among the promoters are seven municipal leaders of UNAG Siuna and four of them are also leaders of the Siuna Union of Co-operatives (UCA).

4.4 The Community of Rosa Grande

History and Population

The Campesino to Campesino process is currently being developed in 32 communities. Rosa Grande is the community where the work began and for that reason is considered a special case by itself. The community is nine km long and an average of eight km wide, so its territory is made up by approximately 63 square km, some 6300 hectares (8,820 mzs). The community is one of the colonization fronts of the BOSWAS Reserve. In 1990, there were hundred families with 650 inhabitants. Currently, there are 251 families with a population of 1,500 inhabitants.

“From 1955 to 1976 (the year the dirt road uniting Matagalpa and Siuna was build), the population had grown to some 20 families, having increased by 10 in 21 years. These families were from Matagalpa, Dario, Chaguite Grande, some from El Naranjo, 40 km away. From this time to the present the population has gone from 63 inhabitants to nearly 1,500 people and the wild animals have left going deep into the jungle. Now there are hardly any fish in the river”, says Jesus Gracia.

The way to Produce

The story of Jesus Gracia illustrates the situation, “In our family there were three boys and we also had hired hands. We would deforest around 10 mzs every year, that’s to say in those 21 years (1955-
1976), we levelled about 200 mzs The idea of my father was that by cutting down 8-10 mzs per year by the time he had grown old, the hardest work of clearing the land would be completed. He wanted to make the farm while he was young”.

Of the total 466 mzs only 3.25 mzs (representing 0.7 per cent) is dedicated to crops other than basic grains. This reflects the low level of diversification on these farms.

Land Distribution

The campesino families have between 20-60 mzs, another 8.4 per cent possess an average of 70 mzs. Until 1994, both of these groupings managed their farms in the traditional manner, that is, a migratory agriculture within the boundaries of the farm, little crop diversification, extensive ranching, and minimal areas of conserved forest to avoid water sources from drying up. These families possess 96 per cent of the community land.

Twelve per cent of the families possess less than 20 mzs each. Besides working their land in the traditional manner, these farmers are obliged to work state lands or to borrow cleared plots from other campesinos that have more land. This group constitutes a strong pressure group on the forest, and it has been prioritized in the Campesino to Campesino interchanges for the use of cover crops.

Eight per cent of the families own no land and normally borrow land from neighbours in a share cropping arrangements as payment. Lately this has become more difficult because there is more vigilance of BOSAWAS and because the community itself doesn’t want to see the deforestation and burning continue.

Forest Resources
Jesus Garcia speaks about the forests: “... while we were dedicating ourselves to planting grains, taking care of our cattle and other crops, the large North American logging companies exploited the woods. In 1966, when I was 18 years old, these companies came with tractors and built paths that could be used for hauling out the fallen lumber by Oxen in the dry season. They would cut down all the cedar and mahogany trees and came with a whole fleet of people to haul the stumps in ox carts to the Labu River from where they would be transported out via the Prinzapolka River. They didn’t even bother to ask us if they could cut down a tree in the area, and nobody received a cent from them”.

The majority of the farmers believe if the yield increases there would be less pressure on the forest. But another factor in a farmers parcel are problems caused by plagues and plant diseases, something that usually are not present during the first years of a recently deforested plot.

The Experiments being carried out by the area of campesinos demonstrate their motivation and interest in enriching their farming methods in order to survive as farmers. They are carrying out experiments with the velvet bean and typical crops of the zone such as the gramineas: rice, corn and sorghum, cucumber family such as watermelon and cucumbers, as well as experiments with other types of leguminous plants including canavalia bean, cowpea and mung beans, the latter two which have a short cycle.

Vicente Mairena, another campesino from Rosa Grande owning a 40 mzs farm (7 mzs in regeneration) says: “In May of 1995, I cut a two year fallow area, later burned it and planted corn. When the corn tasseled, I planted the fertilizer bean. I harvested the corn and cut the fertilizer bean plants after they had grown for five months, then I planted the commonly eaten beans, harvesting 800 lbs in a half a manzana but where I planted and cut the fertilizer bean, the harvest was 5,500 lbs per manzana. For that reason, I now have 5 mzs fertilized with the fertilizer bean”.

If we take the case of the 15 farmers from the study, the 36 mzs that they manage with the fertilizer bean represent, in theory, leaving an area nine times greater (324 mzs) for natural regeneration. This
assures that potentially the farmers could be protecting an additional 294.25 mzs of fallow and forest on their farms.

This permits the stubble areas that are no longer being used for agriculture, and that are protected from burning, to be converted into second growth forests. With simple handling on the part of the farmers, plus the planting of some species of valuable woods, a component of forestry management is being introduced into the community that will clearly lift up the local farm economy.

Community Initiative

Five leaders from other communities participated in carrying out this study on the community of Rosa Grande. They are promoters who have been implementing the practices discussed in the study. The enthusiasm and experience they have acquired from the workshops and the efforts on their own farms has motivated them to promote carrying out studies of their communities. These will allow them to have more clear, understandable information about the existing productive, human, social, and natural resources, helping them to evaluate what they call “the ordering of the community”.

This information is already helping in the writing of projects geared towards attacking the principal health and land problems in one of the communities.

Conclusions

Supported by the Campesino to Campesino Program, the experience being built upon in Rosa Grande and other communities of mining municipality of Siuna constitute an alternative to detain the advance of the campesino colonization fronts on the agricultural frontier, and especially the Great BOSAWAS Reserve.
Stop agricultural migration and increasing the amount of fallow land that will turn into forests. They talk about 500 mz managed with fertilizer beans that are no longer directly pressuring the agricultural frontier, plus 1,500 mz that indirectly will stop pressuring. In practice, one mz worked with the velvet bean represents 3 or 4 mz of plough fallow land. Also, the yields for each mz planted with the velvet bean are superior.
Theme II

Educational innovations for Conservation and Resource Management
Farmers’ Workshops as Tool to Evaluate Watershed Management Projects: An Account of Experiences and Problems in South India

Barbara Adolph\textsuperscript{57} and Matthias von Oppen\textsuperscript{58}

Introduction

As part of a research project on the role of farmers’ participation in watershed management (WSM) projects in semi-arid South India, a 3-day farmer workshop was held in Kadiri (Anantapur District, Andhra Pradesh). Farmers from a “participatory” project (PP) and a “top-down” project (TD) were invited to visit each other’s project sites and critically observe and discuss the soil and water conservation (SWC) measures implemented by the project agencies.

Farmers observed differences in the design and quality of work, the location of the structures, and the mode of payment for the three main project components (water harvesting structures, soil conservation measures, and fodder and tree development) and attributed these differences to the implementing agency’s approach. Farmers’ observations confirm the research teams’ earlier findings on a positive relationship between participatory planning and implementation approach and sustainable project impact.

Farmers’ workshops are recommended as evaluation tools for SWC projects, so that suggestions from the participants can be incorporated into the ongoing project activities. Evaluations carried out after completion of a project may raise expectations that cannot be met and thus might cause disappointment among the participants.

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Background

The concept of watershed management (WSM) as an integrated way to increase agricultural productivity in a sustainable way is thought to be an answer to soil degradation and declining ground water levels in red soil (alfisol) areas of South India. Today, we are looking at more than 15 years of experience with WSM programmes in India, managed by government departments, research institutions, or NGOs using a diversity of approaches.

However, results in most cases have been disappointing despite the amount of national and foreign funds spent on these programmes so far. Farmers generally do not maintain soil and water conservation (SWC) structures created under the project, and do not follow the recommended practices once the project support (generally in the form of subsidies and technical assistance) is withdrawn. Project practices have hardly ever spread to neighbouring non-project areas.

Nevertheless, a number of “successful” WSM projects exist, showing a sustainable impact on the natural resource base as well as on agricultural productivity and rural incomes. Several such examples were presented at a workshop in Bangalore last year. Common to these successful case study projects was that they utilized so-called “participatory” approaches to watershed development. The results of the “New Horizons Project” demonstrate that increased involvement of farmers in project planning and implementation results in a positive project impact.

The ICRISAT/Hohenheim research project aims at identifying a more effective approach to WSM, i.e., the strategies for planning and implementation most likely to result in sustainable impacts. Specifically, it tries to answer the following questions in relation to WSM:

- What are the critical factors associated with project approach for its success that lead to parameters, which ultimately result in differences in the programme impact?
• What is the mechanism in the more effective approach that leads to differences in the impact?

Answers to these questions are necessary for identifying weaknesses in project design and for achieving greater impact on target groups.

As part of this study, a case study of two WSM projects in Anantapur District, Andhara Pradesh, was carried out in 1995. One of the projects used an approach with a high degree of peoples’ participation (PP) and one used a top-down approach (TD). The case study used both qualitative (RRA) and quantitative methods to compare project approach and project impact in the two project sites, one being NGO managed and the other government managed. The basis for this paper is “Farmer Evaluation Workshop” that held in Kadiri, Anantapur District from December 10 to 12, 1995, as part of the comparison between the two projects. The workshop had the following objectives:

• To give farmers the opportunity to evaluate both their own and another project by visiting the project sites, interacting with farmers from that area, and discussing their findings with each other.

• To mobilize farmers to improve the management of natural resources in their watershed as a result of a learning process through exposure and exchange of ideas.

• To identify farmers’ criteria for measuring project performance and, thus, to create a basis for comparison between farmers’ and researchers’ perceptions of project impact.

• To find out about farmers’ perception of participation (i.e. to see whether farmers are aware of the differences in the project approaches and whether these perceived differences are similar to the ones identified by the researchers).
The workshop was organized by the author and four assistants, all of whom were familiar with the two projects sites and with some of the farm families in the project villages. The terms of reference were developed in consultation with farmers from both watersheds in several preparatory sessions during earlier visits to the projects (see Appendix 2).

**Some thoughts on the Role of Participation**

Farmers’ participation in the planning and implementation of development projects has been an issue for several decades. In the 1970s, the World Bank committed to foster participatory approaches to development. An increasing number of studies documents the “success” of the so-called participatory approaches to development programmes in general and natural resource management programmes in particular, using both quantitative and qualitative methods.

Because the term “participation” means different things to different people, a definition is required. For the purpose of this project and in the context of watershed development, participation is defined as follows:

Participation is the active involvement of all users in groups in a watershed, in the identification of problems and solutions, the planning and implementation of these solutions and the monitoring and evaluation of their performance. Participation includes joint decision making (what is done where, when, how and by whom), based on mutual agreement of the project implementing agency and the people in the project area, as well as accountability of the agencies’ activities to the people.

Thus, characteristics of participation or participation “indicators” are:

- *Decision-making*: the users and project agency take all major decisions jointly.
- *Source of knowledge*: Indigenous technologies are utilized wherever possible.
- *Involvement of all*: All interested groups/stake holders are involved in planning and implementation.
• **Contribution:** Beneficiaries contribute their own resources (cash, kind or labour) to the project.

• **Joint management of common property resources (CPR):** Management responsibilities for CPR and usufruct rights lie with the user groups.

• **Time frame:** The time frame of the project is adjusted to farmers’ time frame.

• **Accountability:** The project is accountable to the farmers; project objectives and strategies are transparent for them.

• **Felt needs:** Project interventions respond to farmers’ felt needs.

The more advanced stages of participation as described by Pretty are rarely achieved by development or research projects. The “highest” stage of participation would naturally include the monitoring and evaluation of the intervention by the people affected by it.

Just like “participation”, “impact” is a subjective concept. Different actors, depending on their background, objectives, resources etc, will assess a project’s impact differently. The following definition is used here.

A project’s impact is assessed by all the changes (short, medium and long term) that come about in an area or indirect consequences of project interventions. These include biophysical, economic and social changes.

Standard indicators that have been used to evaluate the impact of WSM projects in India and elsewhere include a range of physical and economic indicators, such as metres of bunds constructed and change in yields. However, sustainable development expresses itself not only in short-term physical and economic achievements, but also in the social changes that take place in a project area and that enables the people in this area to organize themselves to cooperate and to manage and maintain SWC structures.

For this research project, farmer’s perceptions of changes that they attribute to project interventions, as well as own observations of the relevant indicators were used as proxies for project impact. This is
consistent with the “emic approach” described by Uphoff (1992), using the beneficiaries’ own frames of reference for project evaluation. Indeed, farmers’ perceptions of impact will ultimately determine their willingness to adopt and maintain a conservation practice. The indicators are:

- Farmer’s perception of changes in the resource base and in productivity as a result of project interventions.
- Maintenance of SWC measures (including on-farm measures as well as community structures such as check dams and percolation tanks).
- Ability of the community to protect CPR effectively from over-exploitation.
- Changes in the status of women, landless and members of low castes as a result of project interventions.

These impact indicators were analyzed in 13 villages in South India during a first phase of this research project in 1994. A comparison of impact indicators and project characteristics (approach) showed that those projects were more successful, in which:

1) Farmers contributed to the costs of the SWC measures that were being introduced;
2) Local farmers organizations were formed to organize the works on private and common land;
3) Indigenous technologies were incorporated into the project design.

All these factors are components of participatory approaches. But while there is now almost a general consensus among researchers and development practitioners on the importance of farmer’s participation in the design and implementation of rural development or resource management programmes, few examples of participatory evaluation and monitoring are documented. The reason for this might partly be the recent start of many participatory development programmes that have not yet reached a stage where evaluation is required. It seems, however, that several other reasons exist for avoiding participatory evaluation (i.e. a joint evaluation of those affected by the intervention and those who are responsible for the intervention) or for reluctant practices.
First, as there is little experience with participatory evaluation, one cannot rely on readily available manuals or guidelines as are available for participatory planning.

Secondly, there seems to be a general reluctance to involve the “target group” in the evaluation process, as the group is likely to come up with criticism of the project design and the agency responsible for this. This is so in particular with projects where the clients were little or not at all involved in the planning and implementation of the programme. Accountability to the clients of rural development projects is far from being established as a general rule.

Thirdly, there are often not sufficient funds for project monitoring and evaluation in the budget and, even if there are funds, there are no clear instructions about whose responsibility it is to carry out the evaluation.

These reasons explain, but don’t justify why participatory evaluation is rarely practiced, as it provides a number of opportunities for the participating farmers as well as the project implementing agencies.

1) The residents in the project area know best about the changes following intervention because their livelihood depends on the resources in that area. Therefore, their findings are likely to be more accurate and relevant than those of outsiders.

2) During a participatory evaluation process, farmers tend to be personally more involved than in an external evaluation and tend to respond more critically than they would do if interviewed, being merely informants to an outside evaluator.

3) Similarly, a participatory evaluation can help to develop or strengthen a feeling of “ownership” and responsibility toward the project among the participating farmers.

4) At the same time, farmers benefit from an exchange with outsiders, or, in the case documented here, with farmers from neighbouring areas, and are motivated to undertake development activities in their village.
5) Participatory evaluation is generally much cheaper than similar work undertaken by an external consultant.

**Evaluation workshop in Kadri**

The workshop in Kadri was for three days (see the programme in Appendix 1). As both WSM projects consisted of the same three main components, namely water harvesting and percolation structures, soil conservation measures, and plantation and fodder development, three groups of farmers were formed from each watershed, with each group (consisting of around five to six farmers) focusing on one of these components. Thus, the total number of participating farmers was 35 (see Table 1). Selection of participating farmers was done according to the following criteria:

- The participants should be willing and interested to participate in the workshop.
- At least one medium to big farmer, one small farmer and one landless person should be in each group; at least one of these should be a woman.
- If possible, very rich and/or influential farmers should be excluded; for fear that they dominate the activities of the groups.
- The participating farmers should have some experience with the technologies they were supposed to evaluate.

Table 1: **Composition of farmer’s teams in the evaluation workshop (the numbers indicate the numbers of farmers per team)**

<table>
<thead>
<tr>
<th>Projects</th>
<th>Water harvesting</th>
<th>Soil conservation</th>
<th>Fodder and trees</th>
<th>All theme groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Participatory&quot; project</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>&quot;Top-down&quot; project</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>Both projects</td>
<td>11</td>
<td>12</td>
<td>12</td>
<td>35</td>
</tr>
</tbody>
</table>
Farmers were given terms of reference (TOR) (see appendix 2) that contained the main issues that were to be discussed in groups. Farmers from both watersheds had developed these TOR during several planning sessions. Some of the farmers who participated in these preparatory sessions also participated in the workshop.

The first two days were devoted to exposure trips/transect walks, where the three “theme” groups visited sites of SWC measures they were concerned with. Thus, on day one, farmers from PP visited TD and on day two vice versa. A facilitator who was part of the research team and who knew the project sites well accompanied each group of farmers. The facilitators also acted as guides by showing farmers the respective SWC measures. Apart from this, they interfered as little as possible in the process of exchange between the farmers and concentrated on taking notes. Farmers from the watershed hat was being visited were also present at the SWC sites in order to give information to their visitors.

On day 3, all participating farmers met in Kadri at the training centre of the NGO that implemented PP to discuss their findings. Discussions were held in the morning in three theme groups (water harvesting, soil conservation, fodder and trees). Each theme group had two groups (i.e., one group from each project). Posters and charts to be presented in the plenary session were prepared. These presentations were made after lunch, followed by more discussions and the closing session.

**Process**

For all participants, this was their first experience with such a workshop; therefore, both the organizers and the participating farmers were initially skeptical. However, general understanding developed as participating farmers and researchers know each other.

Farmers from both the watersheds were keen on telling their neighbours the work done in their area. They were generally more reluctant to criticize their own project than to criticize the one they visited, possibly due to the peer pressure from farmers from their project area.
As mentioned earlier, it was tried to exclude farmers who are very influential and might dominate the whole discussion. However, some of the local leaders had to be invited in order to avoid conflicts at a later stage. Initially these farmers (generally upper caste, wealthy, and elderly) dominated some of the discussions, but later on they withdrew. It seems they felt the need to show their authority, but once this was done they were willing to let things proceed.

In each group, a few articulate farmers did the bulk of communication. However, other group members got also involved in the evaluation by observing, listening, taking notes, and by preparing posters for the plenary session and explaining these to their fellow participants.

Although farmers from TD were on an average better educated than those from the more “backward” area of PP, the latter were at least as articulate as their counterparts. This is likely to be the result of the participatory process in their area, which focused on the development of self-help groups and extensive training schemes in different domains, such as health, education and credit management.

Almost everybody joined eagerly in the poster preparation for the plenary presentations and discussions on day 3. Even farmers who had hardly ever touched a pen discovered their drawing skills and prepared very impressive posters. Visual presentations allowed all participants to articulate their observations and suggestions.

The participants appreciated the “formal” set-up of the workshop, i.e. having terms of reference, being provided with notebooks and pens, presenting their findings to a plenary etc. It seems that through these procedures they felt that they were being taken seriously and thus were more motivated than they would have been during an informal interview conducted by the researchers. Some of the younger farmers who had been to school asked for a certificate of participation, which they deemed useful for their future search for a job.

It was not an easy job for facilitators, as they had to be well prepared for the responsibilities. While they are supposed to interfere as little as possible during farmers’ interactions, they also needed to
encourage all participants (including those with a low social status, such as women, landless, and members of low castes) to express their views and at the same time they needed to make sure that the TOR are kept in mind. They were also in charge of organizing the show.

Farmers’ Findings
Farmers came up with a lot of detailed observations. The first ones relate to the differences between the two project sites, such as slope of the land and vegetative cover (PP has relatively more land with medium to step slopes and a desert vegetative cover) and the “remoteness” of the PP site (although the distance from the town of Kadiri is the same as for TD). On the other hand, TD site was perceived to be better developed, with more irrigated land and better roads. At the same time, farmers observed a scarcity of trees and bushes and a large proportion of wasteland.

Besides the three main components of the projects (namely water harvesting, soil conservation and fodder/trees), farmers discussed also other aspects of the intervention, such as the sanghas (self help groups) in PP, and the contractor system used in TD. However, the groups followed mostly the terms of reference that had been discussed and explained beforehand, which facilitated the exchange of observations and ideas on day 3. The following observations were made on the three main aspects of the watershed management projects:

Soil Conservation (SC)

In both projects, the same SC technologies were used, i.e., stone bunding and gully checks/rock filled dams. However, farmers observed significant differences between the two projects in terms of design and location of the measures as well as the quality of work done and the mode of payment. Farmers’ findings confirmed by and large the researchers’ findings, but farmers gave more importance to financial aspects such as wages paid for SWC works. Farmers made the following observations:

• While stone bunding had been done in both projects, the coverage (= proportion of project area treated) is larger in PP. Farmers interpreted this as a sign of the implementing agency’s commitment to the work in PP.
• Regarding the design of the bunds, while almost all observed stone bunds in PP were sturdy (farmers “tested” the strength of the bunds by walking and jumping on them), many of those in TD were too low and not well constructed. Farmers paid special attention to the height of the bunds and any apparent signs of collapse/destruction. Also, farmers from both projects criticized the orientation of the stone bunds in TD wherein the sloping side of the bund extends in to the neighbours’ fields, this encroachment can cause conflicts. The reasons given for the quality of work in TD were the contract system (in TD, bunds were constructed by hired labour and not by the owner farmer, both contractors and labourers are not interested in the quality of work, but only in the commission/wages) and the lack of farmers’ involvement in the decision making regarding the design of bunds, as well as lack of “awareness creation” among farmers about the usefulness of the bunds.

• The second aspect of the technology, i.e. the location of the soil conservation structures, was considered to be equally important. Farmers observed that bunds in TD were often constructed contour parallel, without respecting the property boundary, or in places where they are not useful.

• The third aspect discussed by the farmers was the mode of payment. Some of them sat together, calculated and found that farmers in PP are receiving higher wages from the project, as all the money is paid directly to them, whereas in TD, more than half of the wages go to the contractor. Farmers also calculated that the overall costs for soil conservation works must have been higher in TD owing to commissions given to contractors and irregularities in the accounting procedures.

**Water Harvesting**

The water harvesting measures in the two projects included the construction of check dams (cement structures) in the waterways and the desiltation of existing reservoirs. Farmers again distinguished between the three aspects of the construction: design and quality of work, location and mode of payment. Farmers observed the following:
• In TD, there are more check dams than in PP. There are also more wells, and farmers contributed both to the topography of the watershed in PP site, which consists mostly of upland areas with little valley bottomland. However, the TD farmers identified some potential sites for check dams in PP (who are more experienced in the utilization of wells and ground water recharge) and they suggested to the PP farmers to follow up on this issue with the project-implementing agency.

• The design and the quality of work of the TD check dams were criticized frequently. Farmers kept track of all the check dams they saw during their exposure trip, and their respective state of functioning. They came to the conclusion that most of them are not functioning well because of faulty construction (not enough cement, foundation not deep enough, etc). This again was contributed to the contractor system. Criticism of the contractor system came up frequently; farmers linked it directly to poor maintenance and the lack of a feeling of ownership from the users’ side. The farmers from PP explained how the sanghas in their villages feel responsible for the check dam.

• The location of some of the check dams was criticized in both TD and PP. Farmers carefully noted whether or not each check dam serves a purpose (e.g. fish rearing, drinking water for cattle, ground water recharge, and irrigation through diversion of the retained water) and who is the beneficiary. It should be noted that farmers do not distinguish (as researchers do) between the “intended” uses of a structure (here, ground water recharge), but consider all uses, even those that are “illegal” (e.g. diverting water from the check dam for irrigation, whereas a check dam is meant for percolation only).

• The desiltation of existing reservoirs (“tanks”) in PP was considered (if, as a result of the increased water holding capacity, fish could be raised), but TD farmers remarked that this is not a substitute for a larger number of check dams.
• The wages earned by farmers during check dam construction were seen as one of the main benefits, especially by farmers who do not have wells. The researchers had to realize that they underestimated the importance people give to the earning of wages.

**Plantation and Fodder Development**

Here, the differences between the two projects became most obvious. The plantation work in TD was so poor that TD farmers initially refused to show the site to their visitors and only changed their mind after some discussions with them. Farmers found out the following:

• In TD, the forestry department was in charge of the plantation works on forestlands. Apparently, they first cut down the existing trees and then planted new ones, of which hardly any survived. Lack of protection was blamed for the low survival rate, as well as the contractor system.

• Farmers from PP were very proud of their achievement in the field of biomass production and explained how the *sanghas* protect the trees and water them, while at the same time they enjoy the benefits, such as custard apple and grass from the protected hills.

• However, some of the big farmers (thus farmers who do not depend on minor forest products) from TD questioned the profitability of forest protection. They argued that wages should have been paid in PP for the plantation work and the protection of the trees.

• Farmers from both sites agreed that they would only look after a forest area or a regenerated wasteland, if they were given the usufruct rights. Farmers form PP suggested to their colleagues to divide the whole forest area into plots and give them to individuals or groups for protection and use. However, TD farmers argued that this is not feasible, as the forest area is too far away from the village and protection is difficult.
• During the exposure trip, farmers exchanged information on the variety of trees, nursery techniques, frequency of watering required and other aspects of maintenance.

• The concept of NFR (Natural Forest Regeneration, i.e. social fencing of hillocks) was entirely new to the farmers from TD. There was a lively exchange about the benefits from NFR, the wages paid by PP for the construction of a protective wall, and the usufruct rights. Again, some of the TD farmers looked at this from a more commercial ankle, while PP farmers argued in favour of this strategy because of the benefits for the community as a whole. However, it became clear that the sanghas, who are in charge of protecting the NFR areas, and who provide loans to their members through a thrift and credit system, are a vital element of the PP strategy.

Farmers’ perception on participation

The participants observed not only the project interventions as such, but gave importance to the planning and implementation procedures. They related the project outcome to the project strategy. This confirmed the researchers’ hypothesis of a positive relationship between participatory approach and impact. It became clear during the workshop that farmers have a very clear idea of differences in the project approach. Their criteria for participation include a notion of decision-making; on several occasions they characterized TD by its failure to ask farmers’ opinion on and permission to works on their land.

This came out in particular during the final day’s plenary session. Farmers made a poster to show the level of participation in both projects during the different project stages. According to them, when TD was v in 1990, people did not know anything about it (0 per cent awareness), whereas in PP, villagers’ awareness was about five per cent in relation to the work going on around them. PP reached a level of participation of 90 per cent within five years, whereas that of TD never increased to more than 20%. These percentages were supposed to represent the proportion of farmers who were actively involved in the project by participating in the planning of SWC measures on their own land or on community land.
Participation was closely associated with the existence of *sanghas* (self-help and credit groups) in PP. These groups were initialized by the project in order to form a basis for collective action. Initially, their activities concentrated on income generation and savings, but later on natural resources management was included as one activity. Farmers in TD became convinced that the *sanghas* are the main force behind the development in PP and that the TD villages would develop better through *sanghas* as well.

**Some Problems and Lessons**

Although the workshop was considered a success by all parties involved, some problems came up that should be noted.

First is the question of bias. The research team had worked more closely with the NGO (PP Project) than with the government agency (TD project). The main reason for this was that the government had completed its activities in the watershed and did not leave any permanent staff in the project area, whereas the NGO continued working in areas adjacent to the study watershed. Therefore, the NGO and not the government provided the venue for the third day of the workshop. Farmers were certainly aware of the good relationship between the research team and the NGO and might have been hesitant to criticize the NGO’s work.

Secondly, there is the question of how important is consensus among the workshop participants. On some issues (for example the usefulness of NFR), farmers did not agree. According to their financial status and resources, farmers would give more or less priority to this measure. However, these differences of opinion were also a chance, as they showed to everyone that different types of farmers rely on different resources and thus have different priorities for the project. Organizers of such joint evaluations should keep these potential differences in mind and ensure that all parties can articulate their opinions.

Thirdly, there was a danger of the work of the PP project being undermined by the PP farmers’ visit to TD. In TD, the works were fully subsidized by the government and farmers did not contribute any
of their own resources (neither labour nor cash) to the SWC measures carried out. In PP, however, farmers contributed free labour to a number of activities. By questioning the PP farmers about their contribution, TT farmers might have created the feeling that the NGO is exploiting the farmers, whereas the government provides everything. Fortunately in the case described here, the impact of the NGO:s work was perceived to be so much that contribution was justified. However, organizers of such activities should be known that exposure visits can cause envy and discontent among some of the participants.

The fourth may be the most important point refers to the raising of expectations. The workshop has given farmers new ideas and shown new possibilities, which they would like to put into practice. Both projects had been completed and no further investment was to be expected from any side. Whatever improvement farmers in TD intended to undertake, they would have to be done on their own initiative. During day 3, TD farmers asked the NGO for support in *sangha* formation, but this support is unlikely to be provided, as the TD watershed is outside the mandate area of the NGO. There was certainly some disappointment among the TD farmers about this. The authors have not visited the two project areas since January 1996 and do not know what activities might have resulted from the exchange between the two groups of farmers.

**Conclusions**

The workshop has brought together farmers from different projects and enabled them to critically review their own and another watershed management project. The positive effect lies in the mobilization of initiative. Farmers came up with new ideas and plans on how to organize natural resource management in their area. On the other hand, some of these ideas are difficult to put into practice without external aid in the form of organizational support and funds. The workshop failed in standing up to farmers’ expectations.

The workshop had provided an opportunity for the research team and project implementing agencies to understand the farmers’ priorities and perceptions. It became clear that the farmers see technologies in a multi-functional way, considering all positive and negative effects, whereas
scientists tend to look at the desired effects only. In the case of the described research project, farmers’ perceptions of impact had been studied in both watersheds separately for quite some time, thus not many new aspects were discovered during the workshop. However, farmers discovered in a few days many issues that had taken the research team weeks to see. Therefore, such workshops can be seen as a tool to quickly gather information on a project area without risking focusing on too narrow a perspective.

The question is as to how participatory such a workshop can really be. If researchers use it as a tool to gather information for their own purpose (as was done in the project described here), one can hardly speak of a participatory activity. Even if the results are fed back to the implementing agencies (who might or might not learn from them), the participants of the workshop will only marginally benefit from this. Therefore, potential organizers of such joint evaluations should set aside funds in the project budget to take up and implement suggestions from farmers. If the evaluation is supposed to be participatory, it needs to take place at a stage where the findings can still be fed back into the project to provoke changes as suggested by the evaluators.

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Appendices

Day One
Morning - Picking up farmers from MYRADA Kadiri project in their hamlets, travel to DPAP Jesta watershed
       - Introduction of the participants to the farmers of Jesta WS
       - Division into three groups, transect walks/visits to sites
Noon    - Meeting at Badavandlapalle school, lunch
Afternoon: Further discussions in the groups, return to their residence villages

Day two
Morning - Picking up farmers from DPAP Jesta watershed in their villages, travel to MYRADA Kadiri project
       - Introduction of the participants (if still necessary)
       - Division into three groups, transect walks/visits to sites
Noon    - Meeting at Dasarivandlapalle balwadie school, lunch
Afternoon - Further discussions in the groups, return to their residence villages

Day three
Morning - All participating farmers meet in the MYRADA training centre for breakfast
       - Welcome address and introduction / program of the day
       - Tea Break
       - Division into three theme groups, discussions and preparations of posters
Noon    - Lunch
Afternoon - Presentation of results in the plenary, discussions
             - Closing address/vote of thanks

(translation from Telugu by Ms. Poonam Jaiswal)
Soil Conservation (SC)

A - Technology
1. Type of SC works done; purpose of the SC measures
2. Quality of work done (design and location of structures)
3. Impact of the SC measures - do they serve the purpose?
   Farmers’ criteria for the selection of a particular technology.

B - Distribution of benefits and costs
1. Positive and negative consequences due to the project interventions
2. Distribution of benefits and costs

C - Project Approach
1. Farmers’ participation in planning, implementation and monitoring of the SC measures.
2. Problems in the above stages and solutions tried out.
3. Pole of sangha (self-help groups) in planning and implementation of SC measures
4. Farmers’ contribution to the construction and maintenance of SC measures (in cash or kind/labour)
5. Farmers’ opinion on project approach and suggestions for the improvement of the design and the location (participants can make a sketch of the improved design).

Water Harvesting measures (WH)

A - Technology
1. Type of WH structures / measures taken under the project, purpose of the WH structures
2. Farmers’ opinion about the design and the location of the structures
3. Farmers’ opinion on the quality of the work done.
4. Maintenance of the structure / repair works (done by whom? when? why?)
B - Distribution of benefits and costs of WH measures:
1. What are the benefits and who gets the benefits (user groups/looser groups)?
2. Any conflicts during these stages and how are they resolved.
3. Farmers’ opinion about the distribution of benefits.

C - Project Approach
1. Farmers’ participation during the project interventions (planning, implementation and monitoring)
2. Role of sangha during planning and implementation of WH structures
3. Farmers’s contribution in this (labour wages, mode of payment)
4. Farmers’ opinion on project approach and design and location of the structure. Suggestions for improvement?

Plantation/fodder/NFR (Natural Forest Regeneration)

A - Technology
1. Project measures undertaken, what species planted, where, maintenance
2. Measures taken to protect the grazing land / NFR.
Farmers’ opinion on the plantation works (quality of work)

B - Impact due to the above measures
1. Benefits (equity, short term and long term benefits) and costs
2. Who are the beneficiaries of these measures, any losers?
3. Criteria for selection of beneficiaries
4. Role of sangha during the plantation / fodder broadcast / NFR
5. Changes seen due to these project measures: changes in fodder availability before and after the project, changes in availability of fuel due to plantation and NFR, changes in consumption and sale of firewood.
C - Project Approach

1. Projects approach during these measures

2. Farmers’ participation/contribution during the plantation (how were species selected, how were locations selected, who worked, what wages... )
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Knowledge in the Making: Learning to Sustain Yields in the Green Revolution Era

Yunita T. Winarto

Introduction

Farmers do not like spoon-feeding. They would like to supplement their knowledge to raise better crops and protect them from pests. In 1990, the Government of Indonesia tried to change farmers’ views on pest control through Integrated Pest Management (IPM) project. Knowledge transmission rather than technology transfer was the aim of the programme. In 1992-93, the government introduced urea tablet - a nitrogen fertiliser in place of the granular nitrogen (urea pril), which the farmers were free either to use or not to use. This was in contrast to the earlier practice of forcing things on them. Some compulsion still remained.

This paper deals with some aspects of the case. First, the farmers efforts to keep up production through suitable rice varieties Secondly, devising new strategies by modifying what they received from outside through IPM. In this paper, two cases, both from northern coastal region of west Java-Kalensari, Indramayu and Ciasem, Subang, are examined. The farmers liked the IPM system that enabled them to grow rice by using old methods. Without medicines (pesticides), the farmers have to contend with another pest- the rat. Farmers the world over would not like to be compelled to do something. Each farmer is a scientist in his/ her own right and every field a laboratory. The urbanities, that visit the fields to help better agricultural practices, can establish a rapport with peasants if they realise this.

‘...Do not preach to farmers on what they have to do...’ said Akim, an IPM farmer. ‘...Do not provide instruction to us, but give us adequate explanations...’ told Ardi, another IPM farmer.’ These were the farmers’ hope when I left them in early 1992. Then the government told them to go in for the urea tablet. Crops were satisfactory and not plagued by white rice stemborer (WRSB) pest. However, in 1996 rice seed bugs infested the crop. Arpan, an IPM farmer, used a banned chemical fertiliser and

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sprayed it six times a season. The insecticide became popular through word of mouth. Under the IPM scheme the trainers did not stay with farmers. FAO-ARF (Action Research Facility) staff that lived among the farmers assisted the IPM farmer.

'Back to Nature and Farmers': Benefits and Challenges

Indonesia’s rice self-sufficiency in 1984 was threatened by the recurrent outbreaks of brown planthopper (BPH) in 1986. Scientific discovery proved that BPH was induced rather than controlled by insecticides (Kenmore, 1992). The economy was also threatened by the high cost to control the menace. National scientists and macro-economists convinced the country’s top administrators to change the pest control policy (Wardhani, 1992; also see Fox, 1991). Presidential Instruction No.3/1986 agreed to promote IPM crop protection strategy. Fifty-seven broad spectrum pesticides were banned, subsidy on pesticides was withdrawn and thousands of agricultural officials and thousands of farmers were to be trained in the IPM principles. An empowering, participatory approach became the ‘trademark’ of this human resources development programme (Fox, 1991; Wardhani, 1992; Ruchijat and Sukamaraganda, 1992; Roling and van de Fliert, 1994). Farmers Field Schools were set up in the first six provinces in Indonesia to impart IPM knowledge to local farmers. The idea was to make farmers learn about the ecology of their fields and make decisions on their own based on their discoveries.

In some places IPM-led farmers set up field schools. Workshops and studies were an important spin-off of the scheme. Another result was that farmers stopped using pesticides unnecessarily, resulting in a saving on their meagre resources. There was a 63 per cent fall in their use, according to a FAO-IPM survey of 1991. IPM farmers (51-58 per cent) and non-IPM farmers (51-73 per cent) used banned insecticides in three provinces in 1993-94. In Ciasem, only one popular insecticide was on the banned list. The supplier maintained a discreet silence lest his sales should be affected. In Jalur Pantura region of West Java there was a fall in WRSB incidence due to use of non-chemical means to control the pest, but it kept on appearing on and off.

Rice varieties and planting schedule: Accumulated knowledge
Now comes the question - how to improve seed varieties? In Indonesia, farmers have no role in seed breeding programme. A government owned-company (Perum Sang Hyang Seri) produces certified HYVs. The government asked farmers to plant a uniform certified-high yielding variety resistant to BPH in a block of rice field area in the same planting schedule (tanam serempak) on a rotational-seasonal basis. The IPM-FFS strengthened this recommendation as part of the strategies to grow healthy crops.

In my research area, it was found that the individual farmer was free to select his/ her own seeds despite a collective decision. Their choice was based on high productivity, market value, palatability, and resistance to pests and disease.

In one village (Ciasem Baru), the individual decision-making produced not only a high percentage of IR64, but also a diversity of variety. This helped the farmers when there was a WRSB outbreak in 1989-90. This enabled the farmers to evaluate different strains.

The farmers learnt that if they planted early they could avoid WRSB and rice gall midge outbreak. Many IPM farmers said that it was their own discovery.

Secondly, planting diverse maturing age varieties proved susceptible to RSB. Hence, a uniform harvesting schedule was necessary. Thirdly, their awareness to know and consider their neighbours’ choice had shown a wide gap between the short and long age varieties would be favourable for rat attacks. Fourthly, they gained knowledge of which varieties were more resistant to WRSB and rat attacks.

The farmers gradually adopted a locally named uncertified variety, Muncul first tried as an alternative to IR 64 in 1990 when there was WRSB attack. In the 1996 season, most farmers planted this variety. They learned that its long age enabled the plant to compensate the damaged stems attacked by rats. Its quality was in no way inferior to IR 64. Muncul was, however, not resistant to the dry season where rat attacks were more severe than in the rainy season. Farmers eventually decided to rotate varieties. Perum (the government owned company) is thinking of planting this local variety.
This is an example of how farmers advanced knowledge enabled them to modify the official’s message.

Not only farmers but also farm labourers had also been part of the learning process. This was not the case when only a small number of farmers (25 farmers) in each place experienced learning through the IPM ‘school’. The same farmers (plus some non-IPM farmers) were selected to join the ARF project in Indramayu. It will be examined how, through these selected people, knowledge of WRSB and its control strategies has become a shared knowledge.

'School without walls' and Action Research Facility: Engaging Farmers Creativity

Both Ciasem, Subang and Kalensari, Indramayu had WRSB attacks. The IPM farmers learned from the trainers about WRSB reproductive cycle and its control strategies. The trainers asked farmers to collect a sample of egg clusters in a plastic bag or a cup, to follow the incubation. If larvae hatched from the egg clusters, they had to apply granular insecticide soon after the incubation. If parasites were found, they had to return them to the fields. Farmers learned that the most dangerous things were not the moths, but the egg clusters that produced larvae. In the years that followed, farmers in both places carried out a diverse range of practices. The government officials provided recommendations to handpick the egg clusters, put light-traps, or apply granular insecticides. The officials distributed granular insecticides on credit to farmers. Broadcasting granular insecticide was the significant message the Indramayu farmers received from the government officials.

The ARF farmers wanted to save their crop by using chemical pesticides rather than rely on natural enemy. During 1990-95, there was, therefore, a difference of opinion on the strategy to fight the menace. A non-IMP farmer said, ‘...how could the small natural enemy prey upon the big caterpillars? so, I used insecticides It was still difficult to believe it.’

Recurrent WRSB attacks from 1993 to 1995 made individual farmers realize the futility of their methods. In Ciasem, the IPM farmers also complained about the incompleteness of IPM training.
They also encountered difficulties in spreading IPM ideas to the non-IPM lay farmers without evidence. During the 1990-92 planting seasons, the IPM farmers were able to convince the ‘lay farmers’ about the need to know the pest behaviour as a basis of counter measures. Some of the IPM methods were modified.

- Instead of waiting until the moths laid eggs, they killed the moths with bare hands;
- Some farmers improved this a year later by using rubber slippers to avoid skin irritation;
- Instead of collecting egg clusters as a sample of observation, many farmers collected all egg clusters as a preventive measure;
- Applying granular insecticides without looking at the age or size of larvae would be useless. It was also a costly strategy under the continuous outbreak (Winarto, 1993, 1995).

There were some differences among the learners. There was consensus on the correlation between planting schedule and pest outbreak but not on how best to control WRSB outbreak. But individual farmers, through their innovative methods, provided answers to some questions.

Towards the end of the 1991-92 rainy season, some farmers said that the lower population of WRSB in that season compared to two previous years was the result of their own control practices. Others, however, relied on pesticides.

*Learning from the Action Research Facility (ARF): responses to WRSB outbreaks*

After joining the ARF activities in May 1995, some IPM-ARF farmers in Indramayu said they had gained confidence and learnt more than through the IPM ‘school’. Some farmers avoided using granular insecticides to control WRSB and termed insecticides ‘poison’ instead of ‘medicine’. They were also eager to tell other farmers and local officials, as well as to speak out against the officials’ critical argument. Eventually the officials incorporated farmers’ proposal of WRSB non-chemical controls in their regional plan (Arif and Masduki, personal communication 1996; Pemerintah Kabupaten Daerah Tingkat II Indramayu 1996).
In this process, an ARF facilitator acted as a stimulator. He tried not to provide answers and explanations to the farmers. He always asked farmers to try to prove their own questions. The farmers felt that they learned and found their own answers. They also learned new terms and concepts used by the ARF staffs. This interaction led to a systems analysis by the farmers themselves.

The materials were the same as in IMP schools. The farmers drew maps or diagrams and noted down observation in the field or at the base camp. They used plastic bags, mosquito nets, and other locally available materials. Weekly observation and discussions were carried out in both places. The ARF staff also provided equipment such as microscopes, which enabled the farmers to observe ‘micro’ things, e.g., WRSB larvae of BPH eggs and nymphs.

Farmers conducted three kinds of studies. First, the ARF facilitator divided the whole area of rice fields of 300 ha into five parts. Each group, consisting of five farmers, was responsible for carrying out observation and individual studies in one part of rice field area, and disseminate their findings to their neighbours. Second, the ARF rented a one-hectare rice field as a field study and divided it into five parts. In each part, the group had the responsibility to carry out studies on one kind of pest other than WSRB, or disease (e.g., brown planthopper, army worms, leaf folders rice seed bung, and red disease). Third, the ARF facilitator assisted farmers as a group to carry out a collective study on WRSB.

After evaluating the result of their studies, they formulated their own propositions, e.g.,

- Spraying on moths did not prevent them from laying egg clusters. The dead moths could still lay egg clusters;
- Spraying egg clusters was ineffective to prevent the hatching of larvae. The sprayed egg clusters hatched on the third day after spraying whereas those that were not sprayed hatched on the ninth day;
- Broadcasting granular insecticides was useless since the larvae were still alive, whereas the natural enemies were killed;
• Burning the stalks in the fallow period, flooding the stalks with some amount of water (*macak-macak*), or hoeing the dry soil with a tractor were ineffective; and
• Flooding the stalks completely for seven days was the effective strategy in eradicating larvae.

Furthermore, they were able to formulate two main strategies and created their own terms:

• To ‘avoid’ (*menghindar*) or to do ‘early cleaning’ (*bersih awal*): to delay making the seedbeds. If there is a moth-flight before the beginning of planting time, so as not to allow the moths laying eggs on the seedling. However, this strategy has a consequence; that the second-moth generation would infest paddy later;
• To ‘fight’ (*memukul*) or to allow crashing (*tabrakan*): not to delay making seedbeds so as to avoid infestation of the second moth-generation. As a consequence, they have to fight collecting egg clusters in the nurseries.

After noticing egg clusters in the nurseries in the 1995-96 rainy season, they decided to collectively handpick the egg clusters. Neighbouring villagers too were involved. The ARF facilitator acted as the mediator. A meeting of farmers’ representative from three villages was held to discuss the mass egg-picking plan. When the yields in that season turned out to be satisfactory, the plan became popular. A special farmers’ seminar on WRSB spread the idea to other farmer in other districts of Indramayu.

**Urea tablet: Adopting a forced-technology intervention**

The urea-tablet was virtually forced on the farmers. The urea pril was removed from the local market. Farmers caught bringing the pril from distant places were forced to return them. Some farmers crushed the tablets into granules. Those who persisted to broadcasting the granular the ones decided to apply the fertilizers very early in the afternoon to avoid being caught by officials. The main reason of farmers’ objection was the forced change they had to experience in a sudden. The government said the tablet boosted yield and reduced costs. The granule on the other hand made plants greener in a shorter time. But the healthy colour did not last long. During my research, some farmers were
already curious about this phenomenon. Several farmers tried to re-use animal dung or the ‘urea-pril’.

The way they used the tablet shows their innovative method. Putting the tablet into the ground was a backbreaking job. Finally, farmers decided to broadcast the tablet in the way they applied the pril. In another village, the tablets are not put inside the ground. The tablet is thrown on a rice hill while walking around it. Some farmers continue to use the pril. Farmers say that the tablet makes their plants greener and wider in a longer period. They are healthier; the grains are heavier and completely filled. They were not able to mention the difference in the yields. Those who use tablet want to stick to it. This is again an example of how confidence gained from direct evidence is a significant means in changing farmers’ behaviour in whatever ways of intervention or learning process they had to experience.

Even though the local extension workers in both Subang and Indramayu said that a forced operation by the local officials were beyond their expectation, the successful adoption by farmers constituted part of their pride. ‘Fortunately, all farmers in my area have now adopted the urea-tablet’, claimed one extension worker. This mirrors how ‘technological messages and recommendations from the top to the farmers’ still underline their main job.

Conclusion

*Farmers as Masters and Partners: a Reality and a Dream*

Farmers are expert in their own fields who are capable of adopting and modifying ideas taken from others. In the first (rice varieties) and second cases (responses to WRSB outbreak), farmers’ learning took place by responding to the unexpected phenomena, evaluating the success and failures of their strategies. Throughout these events, they continuously reinterpret new ideas, terms and concepts according to their understanding. Their knowledge improved day by day.
Even though the IPM ‘school’ and the ARF project began with only a small number of farmers, their approach in ‘transmitting knowledge instead of transferring technology’ or ‘encouraging farmers’ own experimentations’, proved beneficial in stimulating farmers’ creativity and inventiveness. In Ciasem-Subang, the continuous WRSB outbreak in the post IPM training provided an opportunity for the IPM farmers not only to prove the outsiders’ teaching, but also to enhance, modify and transmit their recent understanding to other farmers. In Indramayu, this learning process was constrained by a more intensive recommendation to use granular insecticides and farmers’ perspective of avoiding damage (e.g., by developing a ‘rather than’ concept). It is fortunate that the ARF project in Indramayu conducted at a later stage, was quite effective in building up a greater degree of farmers’ confidence and belief about their own discoveries than the IPM ‘school’ was able to provide.
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Modernization in Disguise? The Problem with a Theory of Indigenous Knowledge

Kimberly Pfeifer

Introduction

Forty years after decolonization of Africa and the development decade in the 1960s, the mood associated with development is one of disillusionment. It is admitted that a major portion of the world has yet to develop, and it is the responsibility of Western scholars to find solutions to the problem of development. Indigenous knowledge has a vital role to play in development and such knowledge should not degenerate into cultural imperialism.

Writings on indigenous knowledge should not be merely treated as critiques of modernization theory. This essay shows that while scholars of modernization and indigenous knowledge may tackle development issues in different ways, their approach remains rooted in modernization. First, indigenous knowledge aims at constructing a unified field of development that simultaneously bestows power. Second, they assume the existence of a development/underdevelopment polarity. Third, they distinguish between the traditional or indigenous, and the scientific knowledge. Theories based on these assumptions fail to acknowledge people’s own construction of identities.

The construction of development studies

With the rise of modernity, development became specifically linked to this project of properly ordering the world. The institution of development replaced colonialism. Development studies cannot escape the influence of the historical conditions from which they arose. This essay will focus on the theoretical terrain of development, once development studies emerged as a sub field, rather than historical circumstances.
Some view development studies as two main philosophical orientations - neo-classical liberalism and Marxism- from which three major schools of thought have emerged: modernization, dependency and world systems. Development theories have branched in different directions after the shortcomings of the three streams became evident. Such theories attempt to address the weakness of understanding underdevelopment by reformulating and merging the theory of modernization and dependency.

Development studies can be viewed also as a historically constructed field of inquiry on the Third World. (See Smith, “Requiem or New Agenda for Third World Studies,” 533). “Formal mechanisms such as the SSRC” provide evidence of the ways in which analysts formed an academic community for the study of development. Informal ties bind development scholars together and they tend to view their work as complementary (Smith). Arturo Escobar talks of how researchers established a unified project and legitimized it. The basic organization of this discourse was laid down during 1945-55 and still persists, with some minor changes. The “systematization” of the relations between the “variables of capital, technology, and certain institutions” enabled the discourse the ability to survive in a changing environment while retaining the same discursive space. In this paper I will illustrate how a theory of indigenous knowledge contributes to the perpetuation of domination.

**Indigenous knowledge as a reaction to modernization: the differences between two theories**

Modernization theory was a response to decolonization. Western scholars asked a host of questions like how can the poor, backward societies join the materially advantaged West. By the 1970s and through the 1980s, modernization was criticized for an ethnocentric account of a single path to development. It was also criticized for assuming that traditional institutions disintegrate due to modernization. It was claimed that in developing countries traditional institutions showed their ability to adapt to change. Finally, some critics suggested that modernization is harmful as it undermines indigenous institutions which provide social and cultural cohesion.

Indigenous knowledge literature criticizes modernization as ethnocentric and hegemonic. Scholars of this persuasion argue that a top down/ urban bias approach ignores population who live in rural areas, who are mostly poor farmers. The modernists deny the utility of rural peoples’ knowledge in
bettering their lives. Indigenous knowledge advocates deny that tradition is a hindrance to development.

Scholars who believe in native lore distinguish between rich/poor and focus on the cultural values and practices of the poor rather than applying the western model to the “local” to suggest how one should modernize.

Science and technology are not the only tools needed for development; there is science and technology even in the indigenous identity. This, according to traditionalists, puts the local community in focus where development is concerned. They recognize the shortcomings of the top-down approach. These scholars suggest a participatory role for rural communities.

**Illustrating how Modernization resides within Indigenous Knowledge Rhetoric**

Despite differences between the two theoretical orientations, three similarities exist. First, both promote a unified field of development as they engage in knowledge production. The knowledge not only disciplines the beneficiaries, but promotes development. Second the developed/ undeveloped polarity provides a framework for diagnosing the disease and provides the cure for poverty. Third, they both distinguish between the traditional, or indigenous, and the scientific. Both regard science as the only legitimate method of inquiry and locate its origin in the west. Knowledge production is a part of the human condition, which gives meaning to the world. When development scholars become part of a power network of control, they determine what constitutes appropriate, or formal, knowledge that intentionally or not functions as a mechanism to preserve control. This critique is concerned with the construction of “formal knowledge”. The remainder of the paper will illustrate how writings on indigenous knowledge preserve the above three conditions of development studies.

**A discursive web: Power, Knowledge and Development**

As Escobar points out, power and knowledge jointly produce discourses. Knowledge is thought, experience, and meaning which becomes truth through a system of power. Power, in turn, is a
complex strategic situation and position; it involves planning or conducting a process or act to
product a desired effect.

Michel Foucault’s work on dynamics of discourse is a valuable resource for analyzing how developed
countries effect domination over developing countries. Such an analysis involves two things:
disciplining of bodies and regulation of populations. The first ensures power and the unity of society
and generates and distributes norms as a scientific or objectively true discourse. Population
regulation creates techniques of power and leads to an acceptable level of health, life expectancy and
quality. Professionalization occurs when institutions ascribe formal, fixed social identifies, in the
management of life.

Advocates of indigenous knowledge may dispute that western development scholars have a superior
understanding of development the latter, however, continue to control undeveloped regions through
professionalization and institutionalization of development. In the following passage George Dei
asserts that,

“Development experts must recognize and acknowledge the presence of knowledge and
experience that are challenging and may be inaccessible to the ‘experts’ own social positions.
They must encourage local people to assert the legitimacy of their own definitions of
’sustainable development’ and the meaning and implications of their actions in their own
terms.”

Scholars of indigenous knowledge are obsessed with western hegemonic mentality. It is the
responsibility of the western (or western trained) scholars to encourage local people to devise
strategies for sustainable development.

A beginning has already been made. International funding agencies like the World Bank, CIDA,
IDRC and UNESCO have begun to incorporate indigenous knowledge in their financial activities.
Newsletters and journals that underscore indigenous knowledge are being brought out. Development
scholars and professionals talk about investigating indigenous knowledge and creating national and
international archives for storing it. Centres like CIKARD, ILEIA, CIRAN are doing the coordinate and collection, storage and dissemination of indigenous knowledge, LEAD located in the west or metropolitan areas in developing countries. They institutionalize indigenous knowledge. They also decide which knowledge should be disseminated.

Warren provides the following justification for scientific intervention into and control for indigenous knowledge.

Rural communities know about of their ecosystems, but may not have access to the knowledge available in other indigenous systems as well as international scientific knowledge. Science can help in this by identifying the ecological functions of various ecosystems and by designing them for specific localities. Science can help prepare guidelines for obtaining, assessing and presenting traditional conservation knowledge. Scholars must first systematize indigenous knowledge and create international professionals who work away from ‘top-down’ approach in which scholars and practitioners control the “undeveloped” rather than the nation state.

The New Mechanism

Implicit in this is the position of the “developed” as the subject, the giver/ creator of development; and the “undeveloped” as the object. This section explores how this is possible. The issue is not to question the existence of rich and poor (developed and undeveloped) but to illustrate how development scholars use these identities to influence the social formation of other peoples.

The subject has a double meaning for Foucault. It is a process of self-formation in which the person/group is active, yet it entails a process of self-understanding, which is mediated by an external authority. That he calls subjectification. Both are involved in the normalization of peoples.
The dissatisfaction with state-centred, ethnocentric, urban/rich biased approaches to development provides a guiding conviction to create new interpretations of subjectification and objectification, which sustain the development/ undevelopment polarity.

The poorer rural people, it is said, must help themselves, but this, trapped as they are, they often cannot do. The initiative lies with outsiders who save more power and resources and most of which are neither rural nor poor.

The outsiders’ role in spurring improvement enables them to control the rural poor; the former conceptualize the solution. Chambers assumes once the rural poor are visible to the outsider that they will be saved. He is merely upholding the outsiders’ control over the poor and preserving the distinction between developed and undeveloped peoples.

Rural development is defined as,

...a strategy to enable a specific group of people, poor rural women and men, to gain for themselves and their children more of what they want and need. It involves helping the poorest among those who seek a livelihood in the rural areas to demand and control more of the benefits of development.

This suggests that people’s wants and needs are important and secondly, that scholars and practitioners give people the power to effect their own lives by providing them with a plan of action—a body of organized knowledge articulating the path to the objective. Giving people the means to control their lives is an alternative to determining how people will change. However, giving in this context suggests that there is a possessor (outsider) and a receiver (insider); and the possessor controls what is given.

IK literature sustains the development/ undevelopment polarity invoked by modernization not only by grouping all rural people of the 'Third World' together in opposition to the urban rich, but in less
subtle ways as illustrated in the following statement by the editors of *Indigenous Knowledge Systems and Development*:

In order to have development and to have people understand how development is to be applied to their particular case, developers need to communicate with “developees” to get to know. To do this, one must understand what the “latter” mean when they use their language. There is no guarantee that interpreters are also well versed in the domain of the developer’s interest (e.g., medicine or agriculture). That is, interpreter training is crucial. The best way to do this is to teach interpreters ethno science methodology and then turn them loose to study the crucial domain(s) of their own culture.

The developer has the responsibility to instill in others the need to develop, the method to understand oneself, and the knowledge to give to the developer. The interpreter is a convenient individual to utilize as a mechanism for infusing how developees should understand their own culture and necessary changes; the interpreter relieves the developer of his/her obvious role as an imperialist and bestows indigenous peoples with the responsibility of transforming themselves into the object of inquiry in the process of development.

**Controlling the Traditional through Science**

In Western philosophy, science is the practice that legitimates its own classifications as truth, excluding others; it is the realm of the development scholar. He invokes scientific classification to give the developed and undeveloped identities the status of science. The classification denies the “undeveloped” a position in the production of development identities and strategies for constructing meanings of development. Science divides the “undeveloped” from the “developed” and preserves it as the mirror image of the developed.

The indigenous knowledge literature, like modernization, does not evade privileging its own epistemic roots in the attempt to engineer a strategy of development sensitive to undeveloped peoples.
Despite indigenous scholars' own attempts to render such knowledge as scientific, it remains an inferior knowledge signified by a distinction made between science and ethno science. Science refers to a set of theories, concepts, and propositions produced by natural and social scientists subsequent to the “systematic application” of the scientific method in seventeenth century Europe. Ethno science refers to a set of theories, concepts and propositions “unique” to a specific culture group; “Western science” is the “ethno scientific knowledge” of the United States.

Chambers constructs rural people’s knowledge in the following way:

The ‘rural’ includes those farmers, both small and large, who are thoroughly in the market, purchasing inputs and selling cash crops, as well as groups... who have been much more autonomous. The ‘people’s’ part of the term emphasizes that much of the knowledge is located in people and only rarely written. ‘Knowledge’ refers to the whole system of knowledge, including concepts, beliefs and perceptions.

And Outsider’s knowledge (modern, scientific...)

.... is accessible to them in books, and information retrieval systems, is easily communicated, and is taught all over the world. It both supports the state and the state apparatus and is supported and propagated by it. It can claim to be universal.

Rural people’s knowledge is located in memory, not documented; thus it cannot be disseminated to incorporate groups outside a specific context. It is holistic and focused on agriculture. Scientific knowledge is preserved on paper, which means it is easily disseminated. Scientific knowledge is monolithic, rural people’s knowledge is diverse. Chambers wants to account for the diversity of rural people’s knowledge, yet he creates a monolithic category and lumps all different knowledges into it. While thinking he is empowering the poor, Chambers is really only renaming the traditional, the underdeveloped, as the rural poor. What unified this group is their relation to the outsider.
According to Warren, the value of indigenous knowledge has been recognized, or disregarded because it is not scientific. By recording indigenous knowledge systems (IKSs) they can be compared and contrasted with the international knowledge system. It is possible to identify beneficial aspects of indigenous knowledge as well as those that could be improved through science-based technologies.

Conclusion

This paper shows how indigenous knowledge can lead to an ethnocentric and imperialistic vision. Scholars are quick to accuse one another of ethnocentrism yet they often ignore imperialism.

Imperialism can be useful context to understand development studies as scholars realize the importance of controlling what constitutes knowledge. Indigenous knowledge advocates recognize the need to control and produce knowledge or they would not be concerned with giving indigenous people a voice. They also recognize that such knowledge is “controlled and manipulated by certain groups and classes in pursuit of their own interests”. It is assumed that rural people willingly relinquish knowledge to the scholar. In the study of African art it has been suggested that owning secret knowledge, and expressing that is a form of power. “Secrecy is a channel of communication and commentary; a social and political boundary marker; and a medium of property and power. A Dange elder is quoted as follows on secrecy and knowledge: “What I know, that you ought to know but do not know, is what makes me powerful. Could it be possible that indigenous knowledge only seems “indigenous” because attempts are made to conceal it or make it inaccessible as a means of acquiring and preserving power or resisting a dominating knowledge?

Jean-Francois Lyotard states, “[s]cience will maintain and no doubt strengthen its preeminence in the arsenal of productive power is already and will continue to be, a major-perhaps the major-stake in the worldwide competition for power”. Indigenous knowledge is located in this competition for power; knowledge indeed is the commodity. Allowing the indigenous to articulate their lifestyle and how it can be facilitated gives them power, in the sense of having the ability to produce their desired effects.
However, influencing its articulation is the outsiders’, the West’s, attempt to control what is knowledge and the commodity of knowledge in order to maintain the upper hand in the struggle for power.

People matter, that cannot be denied by anyone studying development; a(n) (acted upon) concern for people, their knowledge, and realizing the needs, wants and position of power of the grass-roots level is critical to the study of development, as scholars of indigenous knowledge propose. But to what extent can a field of study engage in self-criticism, particularly when the absence of control can be perceived as undermining the discipline itself? Development inextricable involved directing or engineering change, in other words, controlling how change is conceptualized. Development studies as an academic institution inextricable involves producing knowledge about a subject, in this case development. Producing knowledge first involves imagining how something can be conceptualized and applied; it involves producing but not necessarily controlling ideas, or what constitutes as Truth.

As long as development studies imagine undeveloped peoples to assist, scholars will always be involved in the formal production of knowledge. However, scholars do not control the form all knowledge should take, the appropriate methods for acquiring it, and who has it and who does not. Critical reflections on development studies need to ask in what ways do scholars continue to appropriate a position of power understood as control and not simply production. Until indigenous knowledge scholars ask this question of their work, they will continue to be involved in a project of imperialism as they pursue the building of an indigenous knowledge empire.
Science education at the primary and secondary levels is thought to be influenced by students’ experience at school and their background (Driver, 1989; Drive & Oldham, 1986). The “background experiences” include family and community interaction with peers and exposure to the media. This paper deals with the family and community experiences in relation to science learning. These background experiences have not been studied in any great depth.

This paper is based on my experiences, observations and research as a science student, secondary school science teacher and university science educator in the Republic of Trinidad and Tobago in the Southern Caribbean area. It explores the role of indigenous knowledge in the school science curriculum. I will describe my own experiences to provide an appropriate lens to view the rest of the discourse. Then, I will sketch the background of science students and teachers in our secondary schools. A national survey of lower secondary science teachers (George, 1995a) was of help to me. This will be followed by a detailed exploration of some of the issues that crop up while imparting science education keeping sight of background experiences.

Introduction

I spent the first 11 years of my life in a village in Tobago, under the care of my maternal grandparents. My sister, brother and I attended primary school there while our parents worked in the Trinidadian capital of Port of Spain. My childhood was guided by the indigenous knowledge existing in our village besides some influences from the metropolis through our interaction with our parents and the literature that they supplied on a regular basis.

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61 School of Education, The University of the West Indies, St. Augustine, Republic of Trinidad & Tobago
My siblings and I moved to Port of Spain for high school studies. Thus began my life of unconsciously straddling more than one world. At high school, I studied general science for the first three years and separate sciences for the remaining four years. I was particularly fond of communicating in symbols and equations that the uninitiated could not understand. I eventually pursued a B.Sc. (Honours) degree at the University of the West Indies.

I did not make any conscious link between the science I was studying and my life outside school. I was, however, aware of some of the applications of scientific knowledge in the working of some gadgets such as the telephone, the refrigerator, etc., but that was the extent of the link. I began to consider seriously the links between science in school and my everyday experience at the postgraduate level. This has resulted in an interest in understanding the indigenous knowledge, particularly (but not exclusively) in the rural areas, with a view to exploring how this might function in the school science curriculum.

I now realize that I have been making selections from conventional science as well as from the traditional wisdom in the conduct of my life. The details remain unarticulated.

**Students and Teachers**

Trinidad and Tobago, with a population of about 1.3 million, was a former British colony. It has two main ethnic groups - people of African and East Indian descent. Indigenous knowledge exists in both the communities. There is also some degree of influence from the traditions of the Caribs, the Arawaks and the colonial settlers. Some communities are distinctly rural, with a high level of indigenous knowledge, while others are more western in orientation. Trinidad is an oil producing country.

Around ninety per cent of the secondary school science teachers are graduates. Less than half of them have been professionally trained. People have a few years of teaching experience before they are exposed to professional training in education. Many of the teachers and students have backgrounds influenced strongly by indigenous knowledge. It is, however, not pronounced. For example, some
students now evaluate the utility of a subject in the school curriculum by asking, “Can you make money with it?” Others find the subject simply boring and irrelevant to their lives. Some of the teachers would like to (and do attempt to) relate the science that they teach to the daily lives of the students. However, they find this a very difficult task, especially since there is a dearth of resource materials to help them accomplish this goal (George, 1995a).

**Provision of Quality Education in Science**

Elsewhere (George, 1993), I have argued that exposure to quality science education enhances our understanding of environment and leads to better interaction. It, therefore, follows that we cannot claim to have exposed our children to quality education in science if that exposure is devoid of any reference to the indigenous knowledge found in their environment. Science instruction does not take into account the indigenous knowledge in the students’ lives.

For many, indigenous knowledge is the “first call”, knowledge which is instinctively called upon when there is need for immediate action. Thus, in times of sickness, childbirth, crop planting, food gathering, and so on, it is this indigenous knowledge that is first called upon. Only if that fails, the western scientific knowledge is drawn upon. To cure a cold, the first remedies used are often herbal ones. Only if this fails, is a doctor consulted (George, 1993).

Indigenous knowledge is multi-faceted. It may pertain to agricultural technology, food technology, or marine technology. It may relate to health practices and customs or household practices. Thus there are many avenues available to science teachers for incorporating indigenous knowledge in their science teaching. The problem is that such knowledge has not been documented and does not exist in a form that teachers can use readily. The enthusiasm of the students has been overwhelming when indigenous knowledge was used in the classroom. Normally dull classes have sprung to life, students have been contributing to class discussions on these topics without reservation. But, these attempts by teachers have not been sustained as they find the preparatory work needed to use indigenous knowledge as burdensome (George, 1992).
The practice of using indigenous knowledge in the teaching of science is not widespread. The situations that I have observed involved trainee teachers. However, the normal classroom teacher is not generally so disposed. Science teachers in a developing country like Trinidad and Tobago have to develop a whole new vision of themselves, and of the discipline, if the student has to interact with his/her local environment.

Teachers should understand the creativity of their forefathers, who, with little formal education were able to harness their resources to serve them. The existence of the musical instrument, the steel pan, as well as many other forms of indigenous technology and practices, is testimony to this in Trinidad and Tobago. Teachers also need to be re-oriented to understand that the indigenous knowledge and conventional science knowledge a two different ways with some areas overlapping.

With the above understanding, science teachers would be in a better position to use indigenous knowledge in their teaching, thus exposing their students to quality education in science. Teachers could use examples of such knowledge as the set induction to the lesson, or as a springboard for discussing environmental and societal issues.

A sound grounding in indigenous knowledge is essential for the teacher before he/she can use it. Fishing and agriculture are the main occupation in the village. There is no formal industrial activity. The area has three primary schools and one secondary school. The secondary school was established as recently as 1977. Young people have to move to urban areas for jobs and further educational opportunities. The village has a health facility at which minor complaints can be treated. More serious cases are referred to the hospital in a nearby town. Other government departments such as a postal agency and the works department can be found there.

I interacted with a cross-section of villagers to study their traditions and beliefs. I purposefully sought the views and practices of the young people in the secondary school in the district. The interview data gathered were transcribed, analyses and interpreted, using the ground theory methodology (Strauss & Corbin, 1990) to arrive at a description of the interpretive framework or worldview that villagers use to guide their lives. Following are some highlights of this worldview:
• Villagers view nature with respect and want to manage their interaction with it appropriately for their well-being. They particularly value their coastal environment.

• Villagers place a high premium on the acquisition of knowledge. They believe that an individual must possess the appropriate knowledge if he/she is to function effectively in a particular context.

• They treat knowledge in various ways. They accept some traditional practices and beliefs by faith. They accept others because they have been found to work well in their lives. Yet others are rejected because they have not been validated in the villagers’ experience. Villagers accept some conventional science claims on account of the authority of the school or of the conventional science community (usually the medical community). However, they also reject many conventional science claims because these claims do not mesh with the prevailing indigenous knowledge.

• Villagers believe that skills are best acquired in the context in which they are to be practiced.

• Villagers reason purposefully. Their arguments consist of knowledge supported by warrants. Villagers’ personal experiences constitute a high percentage of the warrants that they use.

• Villagers attach much importance to the individual. In particular, there is a pre-occupation with taking care of oneself as one interacts with the environment and with other human beings can be lot beneficial and harmful, depending on how that interaction is managed (George, 1995 b).

Thus the worldview prevailing in the village differs from the worldview of conventional science. One such difference related to how the individual vies himself/herself. The village attaches a far higher level of importance to the individual than would conventional science. This difference is seen most clearly with respect to the decision-making process.
This brief summary clearly highlights that a very dynamic situation exists in the village, particularly for those villagers who have had exposure to conventional science/school science in addition to the traditional practices and beliefs to which everyone in the village is exposed. Students studying science at school are immersed in this dynamic situation. These students can only be thought to have been exposed to quality education in science if they have had opportunities in their science classes to explore the guidelines for daily living that exist in their community and to compare and contrast these with those provided by conventional science as presented in school.

Some Issues

This brief overview of some aspects of the science education scenario in Trinidad and Tobago raises some issues that are occupying our attention and the attention of researchers elsewhere as well:

- Why is it that we, in Trinidad and Tobago, have failed to put systems in place so that our students’ background can be incorporated into science teaching? Why are there no official curriculum development and teacher education efforts with this philosophical orientation in Trinidad and Tobago, and in some other developing country contexts? What are the barriers to this kind of activity? What has facilitated the process in the relatively few countries where such innovation is taking place?

- What is the impact on students’ learning in science of having general agreement, at the very board level, between principles in conventional science and in the indigenous knowledge, but having great divergence at the specific levels at which these principles are operationalized in people’s lives?

- What cognitive and other processes are involved when students, with a strong indigenous knowledge background, attempt to make sense of conventional science as presented in schools? What are the processes involved when people, like myself, consciously choose to use aspects of indigenous knowledge in some areas of life and conventional science in others? How effectively can these processes be taught in the classroom?
• What can be done in teacher education programmes to empower teachers to fully understand their own background experiences and the impact of these experiences on their lives, as well as to understand and cater for the background experiences of their students in their attempts to make their science teaching relevant and of quality?

• How can science students in a context such as Trinidad and Tobago be encouraged to value the creativity of their forefathers and to seek to be creative themselves, in ways that are relevant to their own life situations?

These are the challenges that face science teachers and educators, particularly in a developing country like contexts such as Trinidad and Tobago. The challenges are great and must be tackled through continuous research and curriculum development work involving science teachers in the classroom, with considerable support from science educators in tertiary institutions, and the Ministry of Education, particularly with respect to the documentation and analysis of the indigenous knowledge. The challenges are great, but the possibilities are many if the task is tackled with some degree of seriousness.
References


George, J. 1995a. Practices, needs and beliefs of lower secondary science teachers in Trinidad and Tobago. St. Augustine, Trinidad and Tobago: The University of the West Indies, Faculty of Education.


Ecological Knowledge of Rural Children: Educational Innovation and Natural Resource Conservation

P.G. Vijaya Sherry Chand\textsuperscript{62}, Shailesh R. Shukla\textsuperscript{63} and Anil K. Gupta\textsuperscript{64}

Introduction

Erosion of biodiversity has been an issue of concern for quite some time. But it is only of late that the erosion of the knowledge associated with such biodiversity has attracted attention. Two key local-level processes that may help in stemming this erosion are: (a) generating an attitude of curiosity and a sense of commitment to this issue among children and (b) enabling children to draw upon biodiversity knowledge extant in the older generations. At another level, a third process of valorizing alternative modes of knowledge may be required.

Biodiversity-rich areas also exhibit poor educational performance. Children in these areas, however, possess a fund of informally imbibed knowledge about biodiversity. Very often, such knowledge is unrecognized since it is not directly relevant to the competencies the formal schooling system seeks to develop. Thus, recognizing biodiversity-related knowledge may counter the loss of self-esteem that results from being labeled "laggards" and highlight the importance of conserving such knowledge.

"Biodiversity contests” have the potential to initiate all these three processes. A biodiversity contest aims at uncovering, in a healthy competition mode, the ability of children to articulate their knowledge about local biodiversity, by drawing upon their own knowledge or that of their elders.

This paper focuses on the methodological aspects of biodiversity contests, drawing on the experience gained with 14 contests held in various schools of Gujarat, India, in which 1562 children participated. These contests were limited to knowledge about flora. In a few villages, data regarding

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academic performance of the children were collected. The paper examines some preliminary results regarding the relationship of age, caste status, sex, and academic performance of the children with their performance in the contests. It concludes with some pointers for future action.

1.0 Background

A biodiversity contest, in simple terms, is uncovering, in a healthy competition mode, the knowledge of children about local biodiversity. In the experiment under discussion, the definition of biodiversity was limited to plant diversity, primarily because of ease of implementation. Thus, in the present context, biodiversity contests included uncovering the children's ability to identify the plants in their environment and to catalogue their uses. The contests were limited to school-going children and were conducted as an extra curricular innovation with the help of schoolteachers. The specific goals were the following:

1. Scouting out of children knowledgeable in ecological matters
2. Strengthening the process of lateral learning among children through display of specimens and dialogue
3. Generating respect for excellence in ecological knowledge through recognition and reward
4. Inventorying children's knowledge of local plant diversity and eco-indicators (specific knowledge or thumb rules which indicate status of natural resources or presage occurrence of natural events)
5. Examining the value of biodiversity contests in enriching formal curricula.

The “contest” mode is often criticized for its promotion of unhealthy competition and for succumbing to the “competition-based social ethos”. This criticism is valid in the context of an increasingly visible tendency in society to let the ends override the means. The rewards system associated with the examination process supports this tendency. However, when the basis of taking part in a contest is an academic ethos which promotes uncovering of the knowledge base of children and which provokes curiosity and a desire to explore nature, the participation per se becomes important. This spirit is best exemplified by the participation of a twelve year old ‘drop out’ girl, Amriben Thakore, in village Tadav, who brought just one leaf of the Neem tree as her entry. This gesture was appreciated by the judges who awarded her a special gift. The prizes awarded to the best performers serve to reward the children for the knowledge they have imbibed and for the effort they put in for collecting the best specimens. Future contests could explore alternative ways of organizing, for instance, working through small teams, cooperative ways of collection and display of specimen.
Three such contests were initially held; two in Gangagarh, Uttar Pradesh (Mukhia, 1994) and one in Madurai (Vivekanandan and Athimuthiah, 1992). The most striking feature of the Madurai contest was that the student of grade 5 who came first listed as many as 116 different species of plant along with their uses. The adult who was considered the best could identify 240 species. In other words, the student, only 11 years old, had already covered almost half the intellectual journey of the most knowledgeable adult of the community. Building on the knowledge base of such children can possibly prepare them for leadership positions in nature and conservation-related matters. The tragedy is that the reward systems in society do not appreciate such talent and rely on formal qualifications in spite of the well known “diploma disease”. The next section describes similar contests held in Gujarat in collaboration with primary school teachers. In Gujarat four rounds of contests, covering 14 schools, have been held over the last three years. (See Appendix 1 for the list of schools.) These contests were primarily meant for school-going children. The participants included 905 boys (38.6 percent of a school enrollment of 2346) and 657 girls (47.2 percent of a school enrollment of 1372). Thus, 1562 children, out a total of 3718 children in the 14 schools (42 percent) participated.

2.0 Process

1. The first step was to communicate the concept and purpose of the innovation (biodiversity contests) through initial letters followed by a group meeting of the teachers involved.

2. It was decided that parallel contests be held for students and the community. The idea was to tap the knowledge available in the community as well as to promote community-school links.

3. A printed pamphlet explaining the aims of the contest and the procedure for participation (see Appendix 2) was distributed to students and villagers. Since the schools were ashram shalas, the evening prayer gathering, which is attended by all students, was used as a forum for explaining the

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66 All the prizes were sponsored by SRISTI (Society for Research and Initiatives for Sustainable Technologies and Institutions), Ahmedabad and the Honey Bee Network, and conducted by local partners of the network.

67 These contests, as well as the three contests mentioned earlier, focused only on flora.
concept of biodiversity and distributing the printed pamphlets. The pamphlets were also distributed to parents, either informally or through the cooperative societies in the villages.

4. *Pilot testing*: Ten days after the first meeting with the teachers, a second visit to the host schools was made in order to expose the students to the concept of biodiversity. Groups of students, each group consisting of six to seven children, were formed at random. They were then taken to nearby farms and forest land. The children identified plants they were familiar with. Things worth noting, but which they had missed, were also pointed out -- for instance, the specific micro-locations of plants. This exposure served to familiarize the students with the contextual dimensions of biodiversity.

5. *Program scheduling*: The program schedule was announced in advance so as to enable the parents to adjust their timings. The contests were held in the afternoons of the specified days.

6. *Evaluation of the participants*: On the day of the contest, all the children were arranged in class-wise groups. A list of the participants (class-wise) had been prepared by the teachers in advance in order to facilitate the administration of the contest. Each child had brought specimens which he or she had collected and arranged on thick sheets of paper or cardboard. Evaluation committees of three members each, were formed. Each committee covered one or two classes, meeting the students allotted to it one by one. Every school had at least one teacher very knowledgeable about and interested in local biodiversity. The evaluation criteria used were the following:

- Number of specimens brought by the student.
- Number of plants listed by the student.
- Presentation style.
- Novelty of the specimens brought.
- Knowledge about uses and habitats of plants.
- The committee members graded the children separately. All three scores were then combined to arrive at an average figure for every child. The children were then ranked according to their average scores.
• The winners were awarded prizes, which included school bags, crayon sets or art material. All participants received a token gift (a pencil set).

7. Parallel activities: On-the-spot drawing competitions for children on themes related to environment and biodiversity, were also conducted. The drawings were displayed in the school classrooms and evaluated on the bases of the idea, use of colour and composition. Prizes were awarded to the best drawings. Singing folk songs and writing poems on environment-related issues were other activities conducted when spare time was available. In addition, a quiz program on environment-related issues was conducted in Jalotra.

3.0 Preliminary Findings

3.1 Knowledge about biodiversity and related factors: A preliminary analysis

The contests under discussion were aimed at scouting out children who were knowledgeable about plants and inventorying their capabilities in this field. They were not specifically designed to examine the relationship between the plant diversity knowledge of children and the potential of children to perform in the schooling system (academic performance). Nor were they designed to determine the correlates of biodiversity knowledge. However, a few tentative explorations to generate issues for in depth examination later, were made. Specifically, academic performance, as measured by the rank obtained by the students in their school examinations over the previous year, was compared with the number of plants brought or listed, which was assumed to indicate knowledge about biodiversity. The results of this exploration are summarized below. (It should be noted that the contests were held with the help of volunteers and schoolteachers. Data collection tended to concentrate on the factors, which were locally relevant. For instance, children prepared lists of plants in a few villages. Such lists were not prepared in all villages. These variations are reflected in the summary reported below.)

3.1.1 Plants brought and listed
The average numbers of plants brought and listed are presented in Table 1.

**Table 1: Number of plants brought and listed (eight villages)**

<table>
<thead>
<tr>
<th>Village</th>
<th>Children</th>
<th>Mean # of plants</th>
<th>Highest # of plants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>Total</td>
</tr>
<tr>
<td>Tadav</td>
<td>79</td>
<td>32</td>
<td>111</td>
</tr>
<tr>
<td>Jalotra</td>
<td>70</td>
<td>71</td>
<td>141</td>
</tr>
<tr>
<td>Thalvada</td>
<td>51</td>
<td>33</td>
<td>84</td>
</tr>
<tr>
<td>Padan</td>
<td>40</td>
<td>3</td>
<td>43</td>
</tr>
<tr>
<td>Ambla</td>
<td>216</td>
<td>172</td>
<td>388</td>
</tr>
<tr>
<td>Dholwani</td>
<td>79</td>
<td>82</td>
<td>161</td>
</tr>
<tr>
<td>Makhiyala</td>
<td>79</td>
<td>62</td>
<td>141</td>
</tr>
<tr>
<td>Ninghat</td>
<td>31</td>
<td>26</td>
<td>57</td>
</tr>
</tbody>
</table>

The performance of the children of Tadav and Jalotra schools, broken down by caste (scheduled castes and tribes, other backward classes and other communities), by sex (boys and girls) and by stage of schooling (lower primary—grade five and below; upper primary—grades six and seven) is described in Table 2.

**Table 2: Performance of children, by sex, caste, stage of schooling: Tadav and Jalotra schools**

<table>
<thead>
<tr>
<th>Category</th>
<th>Participants</th>
<th>Mean # of plants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>All children</td>
<td>149</td>
<td>103</td>
</tr>
<tr>
<td>Boys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scheduled castes/ tribes</td>
<td>31</td>
<td>23</td>
</tr>
<tr>
<td>Other Backward Classes</td>
<td>64</td>
<td>32</td>
</tr>
<tr>
<td>Others</td>
<td>54</td>
<td>48</td>
</tr>
<tr>
<td>Lower Primary</td>
<td>57</td>
<td>67</td>
</tr>
<tr>
<td>Upper Primary</td>
<td>92</td>
<td>36</td>
</tr>
</tbody>
</table>

In these two villages, about 80 percent of the students had brought five samples or less. However, the highest number of samples brought in Tadav was 35. Likewise, while 43 percent of the children listed 50 plants or less, 39 percent had listed more than 100. These figures indicate the existence of a rich
knowledge base among primary school children, perhaps unevenly distributed, in matters relating to identification and utilization of plants. This base needs to be explored further.

The differences between the means of the plants listed are displayed in Table 3. There are significant differences between boys and girls, and between the children lower and upper primary stages. The differences between the scheduled castes and tribes (these categories were clubbed together since there were only three children belonging to the scheduled tribes) and other communities are also significant. Knowledge about plants appears to be significantly high among those castes ranked lowest in the caste hierarchy. This issue needs further exploration.

Table 3: Differences between means of plants listed

<table>
<thead>
<tr>
<th>Categories compared (means in brackets)</th>
<th>t value</th>
<th>df</th>
<th>p values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys (103.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girls (66.9)</td>
<td>3.57</td>
<td>250</td>
<td>0.000</td>
</tr>
<tr>
<td>SC/ST (117.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBC (73.8)</td>
<td>3.14</td>
<td>148</td>
<td>0.002</td>
</tr>
<tr>
<td>SC/ST (117.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Others’ (87.8)</td>
<td>2.20</td>
<td>154</td>
<td>0.029</td>
</tr>
<tr>
<td>Lower primary (55.8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper primary (120.6)</td>
<td>-7.11</td>
<td>250</td>
<td>0.000</td>
</tr>
</tbody>
</table>

3.1.2 Correlation between academic rank and performance in biodiversity contests: Jalotra and Tadav

In an effort to explore the relationship between the performance of children in the biodiversity contests and their academic performance, the correlation between their ranks in the biodiversity contests and their academic ranks (ranks obtained in the latest annual examination conducted by the schools) was examined. Academic rank appears to be positively and significantly correlated with biodiversity rank (correlation value of 0.2063, significant at 0.01 level), though the value of the coefficient is small. One reason for this correlation may be that since all the students come from relatively homogeneous environments—in the sense that they are all exposed to the same environment of biodiversity, it is reasonable to expect those who do well in class also to perform well in biodiversity. Perhaps if the contests were to be held for mixed groups (students from different
environments) the relationship of biodiversity knowledge with academic performance may be brought out better.

Academic rank is not significantly correlated (though the sign is negative) with number of plants brought and listed (Table 4).

Table 4: Intercorrelations: Plants brought and listed, academic and biodiversity ranks, Tadav and Jalotra

<table>
<thead>
<tr>
<th></th>
<th>Plants brought</th>
<th>Plants listed</th>
<th>Academic rank</th>
<th>Biodiversity rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plants brought</td>
<td>1.000</td>
<td>0.2336**</td>
<td>-0.0572</td>
<td>-0.2320**</td>
</tr>
<tr>
<td>Plants listed</td>
<td>1.000</td>
<td>1.000</td>
<td>-0.0873</td>
<td>-0.2607**</td>
</tr>
<tr>
<td>Academic rank</td>
<td></td>
<td>1.000</td>
<td>0.2063**</td>
<td></td>
</tr>
<tr>
<td>Biodiversity rank</td>
<td></td>
<td></td>
<td></td>
<td>1.000</td>
</tr>
</tbody>
</table>

The biodiversity rank appears to have incorporated the number of plants brought and listed into it quite well, since its correlation with the plants brought and listed are negative and highly significant. The rank, then, also reflects the evaluation of the students’ verbal and presentation skills. Disregarding these skills, that is equating the biodiversity knowledge with only the number of plants listed and brought, indicates that there is no significant correlation between the latter and academic rank. This issue needs further exploration.

3.2 Pedagogical value of the contest: Feedback from teachers

Thirty-six teachers from the five schools of Padan, Tadav, Jalotra and Thalvada and Valavada provided written feedback on the contests. Their comments were coded and are presented below (Table 5).

Table 5: Feedback from teachers
### Dimension |

**A: Identification of alternative knowledge systems**
- Knowledge of various plants uncovered, environment subject links clearer | 14
- Medicinal uses of plants were brought out | 4

**B: Pedagogical value**
- Children's interest in school and their curiosity went up | 7
- Visit to nearby farms and other locations initiated | 3
- The methodology of the contest was novel and interesting | 1

**C: Possible methodological modifications**
- Parallel activities like debates on the issues of conservation and exhibitions, demonstrations can be introduced | 7
- Initiating conservation of local plants in a school garden is necessary | 2
- Contests should include not just the identification and knowledge but also action taken to increase local biodiversity; for instance conservation | 2
- Contests should be organized in other seasons like monsoon | 6
- Evaluation may be done on the basis of therapeutic uses of the plants | 1
- Contest may be organized in groups, involving community | 3

The feedback illustrates an important linkage between the biodiversity contest and the environment subject taught as part of the formal syllabus. If such efforts can help teachers ‘make sense’ of the prescribed textual content, the result will be a pedagogy which is more exciting for the children. The teachers have also indicated the nature of some of the follow-up activities necessary. An important suggestion is extension of the contest to conservation action. However, a larger program of extending the biodiversity contests, to be sustainable, will have to be ‘owned’ by the teachers themselves. Those who were involved in the contests could form an informal forum to discuss the related issues and carry forward a program of action.

### 4. Major Lessons And Future Planning

This section deals with the major lessons, which have been learnt from this experience, and suggests follow-up activities.
4.1 **Participation:** Most of the contests were held in semi-arid or forest areas of Gujarat, where the educational problems of ‘drop-out’, poor enrollment and low achievement are more severe. About 42 percent of the enrolled children participated, with boys being more enthusiastic. Though the contests were conducted through the schools, and therefore were perceived to be for school-going children, in a few villages a few physically handicapped children and children who had dropped out of school did take part. Future contests should aim at participation of all sections of children, especially girls, ‘drop-outs’ and the non-enrolled.

4.2 **Methodological aspects:** In all the contests held so far, the focus was on flora. Future plans may include other forms of biodiversity like fauna. Some of the teachers who participated in the contest suggested that the jury should go to the children instead of the children coming to the jury. One way to do this is making children sit in rows (group-wise) with their specimens, and to ask each member of the jury to visit them individually. Other ways can be worked out in consultation with the partners. The contests should also be replicated in different seasons in order to encompass the seasonal diversity. Also if specimens can be obtained in pairs, one can be sent for identification and the other can be preserved in a herbarium.

4.3 **Accountability towards partners:** The schools, which helped in the organization of the contests, were presented with token gifts like wall-clocks or books. However, it is very important that they should be aware of the major outcomes of the contest. Some of the schools have shown interest in developing biodiversity conservation centres. The idea of helping schools prepare their own herbaria was tried out successfully in one school and may be replicated in other schools. A mobile exhibition on general information on biodiversity is another activity that may be taken up. Follow-up activities like creating school nurseries and gardens, and in-situ conservation banks of valuable local plant diversity may need the support of local institutions like the panchayats.

4.4: **Networking interested teachers:** The feedback provided by teachers of five schools was presented above. Many of them have been motivated by the contests to explore the alternative
knowledge systems of children in greater detail. Such teachers may be networked in order to develop a group of teachers who can work consistently on biodiversity conservation-related issues.

4.5 **Rich knowledge base of eco-indicators:** Another spin-off benefit of these contests was the identification of about 60 eco-indicators (local proverbs, saying or beliefs that indicate the occurrence of some natural phenomenon–impending rainfall, high soil-fertility, presence of water etc.) through discussions with the parents and also some children. This process was related to the discussions that children had with their parents before the contests. In other words, in some places the contests may have spurred the children to gain knowledge by talking to their parents. If contests were to be organized twice at the same place—the first a surprise contest and the second a planned one, which gives enough time for preparation—the inter-generational transfer of knowledge may be assessed.

4.6: **The future of “little geniuses”:** Regardless of the relationship between academic performance and biodiversity knowledge, it is evident that there are many children in educationally backward areas who possess a wealth of knowledge about biodiversity. Unfortunately the reward systems in society are so structured that they often discount alternative knowledge systems. It is likely that such children, from the dry and forest areas, will find their way into the ranks of the “unskilled labour”. The formal schooling system does not provide scope to such children to develop as naturalists or herbalists. The nurturing of such children should be a matter of great concern. Simple steps like organizing nature-tours for the winners of the contests, or setting up nature clubs or a newsletter, or running summer camps, may provide some rewards to these children.

If such children can be encouraged to become teachers themselves, the transfer of their knowledge to the next generation would be greatly facilitated. Any program of biodiversity conservation must ensure a sense of belonging and active participation by children and the community. Mentoring of the knowledgeable children with outstanding primary teachers who have developed educational innovations on nature-related aspects, may also be thought of.
References


Appendices

Appendix 1: List of schools in Gujarat where biodiversity contests have been held

Virampur, Banaskantha district
Amirgadh, Banaskantha district
Sembalpani, Banaskantha district
Thalvada, Banaskantha district
Jalotra, Banaskantha district
Tadav, Banaskantha district
Padan, Banaskantha district
Nandanvan Ashram school, Chhikari, Sabarkantha district
Valavada, Valsad district
Ambla, Bhavnagar district
Dholwani, Sabarkantha district
Ninghat, Bharuch district
Two schools of village Makhiyala, Junagadh district
Appendix 2

Invitation to participate in biodiversity contest

Dear friends,

Our country is richly endowed with a wide variety of natural wealth. However, this wealth is getting eroded. Knowledge about such wealth and about conserving our biodiversity is also eroding. In order to reverse these trends we have to make this kind of knowledge important. Children, who are the future citizens of this country, need to be involved in this movement. If children are to be involved, the schools also have to be involved. If the schools have to be involved, the matter taught in the schools and the ways of teaching will have to accommodate such knowledge about biodiversity and its conservation.

One starting point is to recognize and reward children's practical knowledge of plants. We plan to do this through a biodiversity contest to be held at your primary school on the date and time given at the end of this pamphlet.

Who can participate: Any child, whether going to school or not attending school, girl or boy, can take part. There will a separate contest for parents also.

How to participate: On the day of the contest, each participant should bring as many samples of plants or plant parts as he or she can identify and name the uses of. The samples of plants should have at least the fruit, flower or sufficient leaves so as to facilitate identification. The participants will be ‘quizzed’ by a panel comprising of local herbalists, elders and scientists and the evaluation will be based on the quality of information and the number of samples brought. The best performers will be awarded prizes.

How to prepare samples: The samples should be collected before the contest and dried by pressing in between old newspapers. The well dried samples pasted or stitched on thick paper. On the reverse, or on a separate paper, the names of the plants and their uses should be written down. The teachers of the school will be happy to help in the writing down in case you have any difficulties in writing.
We wish the participants all the best.

Date of contest:     Time:
Venue: ___________________________ Primary School

*In case you need further information please contact the teachers of the primary school*
Sustainable Tropical Livestock Systems

Brian Ogle 68 and Thomas R. Preston69

Introduction

It has become a routine procedure to copy the West while evolving university teaching programmes in tropical animal production. Such programmes are not suitable for developing countries. Livestock raised by resource-poor farmers plays a vital role. Inappropriate technologies result in avoidable degradation of an already fragile ecosystems in the low-rainfall regions or rain forests.

The Swedish Agency for Research Cooperation with Developing Countries (SAREC) has devised a programme to support higher education and research cooperation by building research capacity in the Third World universities.

Such a project was originally launched and funded by the Swedish International Development Authority (SIDA) with the aim of catering to the needs of small farmers. The project titled “Development of Sustainable Livestock Technologies for Fragile Zones in the Tropics” was drawn up by Dr. T.R. Preston and submitted to SIDA.

A M.Sc. programme on ‘Sustainable Livestock System in the Tropics” and a technology transfer arrangement based in villages in Vietnam, Colombia, and Tanzania were the features of the project. The first programme is the responsibility of the Department of Animal Nutrition and Management (HUV), and Swedish University of Agricultural Sciences (SLU). The second programme is to be administered by Dr. Preston and HUV. The countries were chosen because of the on-going research projects between the institutions involved and the range of agro-ecological conditions like high rainfall to semi-arid conditions. The relevant technologies to suit the conditions have been developed

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by CIPAV (Convenio Interinstitucional para la Produccion Pecuaria en el Valle del Rio Cauca) in Colombia. The funding was then taken over by SAREC in 1994. The programme was broad-based to enhance research cooperation between Swedish universities, research institutions and those of the developing countries.

**Target countries, admission requirement, and curriculum**

Most of the 11 students of the first batch belonged to CIPAV and research stations and universities involved in SAREC projects in Vietnam, Tanzania and Colombia. The second group came from Vietnam, Tanzania, Ethiopia, Colombia, Nicaragua and Cambodia. The future groups will be trained at a few university departments and research stations. The participants should either be B.Sc. in animal science or a related subject and should have two years’ research experience either as junior university lectures or research assistants. It was not possible to have equal number of female students, as qualified candidates were not available. The M.Sc. degree could be had after completing 60 approved credits, each credit equivalent to one week of full-time study. But there was no rigidity about it and course work and research can account for 20 or 40 credits. The first course has nine months of lectures and laboratory work in Sweden and a further nine-month research project in Vietnam, Colombia or Tanzania. After this the students return to Sweden to write and submit their theses, which takes another six months. The teaching part of the last course is transferred to the University of Agriculture and Forestry (Ho Chi Minh City) and Cantho University (also in Vietnam).

The emphasis is on fieldwork and problem solving. The students have to work as a team and extend their knowledge through reading, discussions, seminars, and to integrate modern ideas with traditional methods. This is in fact an important aspect of the course to make the resultant technology relevant to local needs. Guest lectures are invited from Southeast Asia, Europe, Africa and Latin Europe.

Each student is given a personal computer to improve his/her communication skills. After the course is over, the Notebook PC, and word processor data management, graphics and statistics package is handed over to the home institution.
The students have to know everything about the animal - physiology, nutrition, management, feed chemistry, etc. This will help the students to evaluate and develop sustainable management systems based on local needs and available resources.

As the focus of the programme is to evolve better alternatives or to improve the existing ones, a lot of student-farmer interaction is required. For the latest course, participatory rural appraisal (PRA) exercises were carried out with the help of students and local researchers in Tanzania, Colombia and Vietnam. Special stress is laid on animal productivity and the impact that climate has on this. Current livestock based systems are described and overgrazing and soil degradation are taken into account while evolving a viable alternative with the aid of the data collected.

Field visits are arranged to Mekong delta, sub-Saharan Africa and other areas relevant to research so that students can have a feel of the actual situation. The linkages established with the research institutes in the various countries are invaluable to the studies. The link-up is a part of SAREC strategy and the institutions include four in Vietnam - Universities of Agriculture and Forestry, HUE and Cantho and the National Institute of Animal Husbandry in Hanoi, Sokoine University of Agriculture and Mpwapwa Livestock Institute in Tanzania and CIPAV in Colombia. Students for their field research took up problems arising from SAREC projects and whatever they did is to be of help to the small holder that is the guiding principle.

The other aim is to set up south-south linkages. For this if students of a country work within their own borders, the very purpose will be defeated. So the field research conducted in Tanzania, Colombia and Vietnam had groups of two or three students from different nations so that they can learn from each other. In the first course, half of the students carried out research in a country other than their own. The results were very positive.

The usefulness of such projects need not be over-stressed. Those who seek to improve matters ought to know what is wrong with the previous practices. That is where interaction with small holders comes in. When the defects, if any, are pinpointed remedial action can be taken. Moreover, projects
with a western bias are very costly. The practices include use of trees for fuel, grazing habits, etc., and by keeping these things in mind a strategy, which is not very costly, can be evolved.

Some of the projects will show the scope of the work done by researchers in the last course:

- Studies on village poultry production systems in Ethiopia;
- Experiencing of recycling manure in Colombia;
- A study on the use of the sugar palm tree for different purposes in Cambodia;
- Identification and evaluation of plants used as livestock feed in Mekong Delta (Vietnam);
- The influence of indigenous browse and other local feeds on the milk production and nutrition of dual-purpose groups in central Tanzania.

**Conclusions**

It is proposed to transfer full responsibility of M.Sc. course including award of degrees to the University of Agriculture and Forestry in Ho Chi Minh City. Of course, more staff is needed but that will result in cutting overall costs.
Theme III

Technological Innovations
Empowering Poor through Technological Innovations

Raman Jaggi and Rajesh Patel

Introduction

This paper documents two cases of institution driven innovation by the government and non-government sectors. The first relates to an NGO working among the small/marginal farmers in the northern part of India. The second one is about a state owned regional technology centre in the west of the country engaged in the promotion of appropriate technology for reviving traditional artisan-based production activities in rural areas. The paper is divided into three sections. The cases are described in detail in the first two sections. Section three presents a comparative analysis of the interventions, experiences and sums up the discussion.

Section I

1.0 The SOTEC Experience

There was a bumper potato crop in 1985 and the glut led to a steep fall in prices; the small and marginal farmers were not even able to recover the expenses of harvesting the crop and transporting it to the market. They chose to destroy the crop rather to incur further losses.

One of the founding members of Compatible Technology Incorporated (CTI), USA, with a base in Uttar Pradesh, happened to be in Bareilly in the western part of the district decided to help the farmers. CTI is a voluntary organization founded in USA in 1981 to evolve simple technology that can help process agricultural produce in rural areas. The representative settled down at Bareilly soon after and set up a liaison office. He started working on a system for storage and processing of
potatoes. The Society for Development of Appropriate Technology (SOTEC), a non-government organization, was born in 1985 with technical and financial support from CTI.

Fall in market prices immediately after the harvest was a recurring problem for the farmers. They had to make distress sales, as they could not store the produce due to absence of cold storage facility. The market prices usually went up by almost three to five times within four months from the harvest. If cold storage were available, the farmers would be immensely benefited. With the creation of potato storage facilities in the village, the farmers could have the option of setting up potato processing units, which, on one hand, would give them increased returns and, on the other, generate employment opportunities within the village.

Keeping all these factors in view, SOTEC developed village level potato storage facility know as ‘Rustic Store’ in collaboration with the Central Potato Research Institute (India), International Potato Centre (Peru) and Compatible Technology Inc. (USA).

1.1 The Rustic Store

It is a hut shaped structure made of poor third quality bricks, mud mortar, locally grown dry grasses for roofing and bamboos for flooring. The primary advantage of a rustic store is that it does not involve any energy whatsoever. Also the installation is quick and it does not require any specialized skill. Moreover, the raw materials needed are available locally, easily and at a cheaper rate.

1.11 Design and Construction

The size of the rustic store is 25' X 10' with storage capacity of 10 tons of potatoes. A pucca flooring is done using 3" flat bricks. Pucca drain is made around the construction, of 4" width and 7" height. For flow of water on the floor vertical bricks of 9" size are fixed and above that flat bricks of 3" size are fixed. The floor is covered with a bamboo structure. Fly mesh is laid on the floor and around the pucca drain to prevent the entry of rats and other rodents harmful to the stored potatoes. 3.5' size wooden door is fixed on a steel frame. The four corners are made of 12" size bricks and the rest of
wall structure is made of 9" size bricks having inter-connection with the water drain. Riverbed sand is put on the floor below the bamboo structure. The roof is made of bamboo and covered with the locally grown grasses. The cost of a 10 ton rustic store is approximately Rs.6, 500 (approx. US $185). The rustic store can preserve potatoes for 10 to 12 weeks. Potato chips, sticks and powder could be made out of the stored potatoes.

1.12 Technical Details

The Rustic Store is developed on the principle of direct evaporative cooling. Evaporation of water produces considerable cooling effect - faster the evaporation, greater the cooling. Evaporation cooling occurs when air that is not already saturated with water vapour is blown across any wet surface.

1.13 Operation of the Rustic Store

Before putting the potatoes for storage, water is poured into the drains so as to fill the floor completely below the bamboo structure. Care should be taken to avoid water coming in direct contact with the bamboo floor and the stored potatoes. Storage of potatoes is done in uniform layers. Also a regular sorting is done to remove rotten pieces during the storage period.

1.14 Temperature and Relative Humidity

The temperature and relative humidity recorded inside and outside the rustic store during mid-April and June, 1996 is shown through graphic presentation at Annexure 2A and 2B respectively.

The temperature inside the rustic store is considerably low compared to the outside temperature during this period. During April, the temperature difference between outside and inside the rustic store was recorded to be ranging between 6 °C and 7 °C. The maximum difference of about 10 °C
was recorded during May. It may also be noticed that when the water level is maintained at the bottom of the rustic store the temperature inside was in the range of 30 °C to 35 °C.

The relative humidity of the rustic store is maintained at around 40 per cent during the period it was recorded. It may also be noticed that while the outside humidity level decreased during April end the inside humidity level was maintained at around 40 per cent.

1.2 Developing a technology package

SOTEC also decided to work on developing low cost potato processing technologies with support from CTI. Potatoes can normally be sun-dried during mid-February to mid-June, SOTEC thought of providing employment for about four months to the farmers/potato processing unit holders. Also the prices are lowest immediately after the main harvest, and this is the time when potatoes should be purchased for processing if the farmer does not have sufficient stock of his own. As the rustic store could store potatoes for three months, SOTEC decided to develop processing machines that could be economically viable if operated for at least 60 days. The economics of a nine-ton capacity processing plant is presented at Annexure 3.

SOTEC developed a complete plant for producing potato products such as potato chips and sticks. Such machines included the following:

1) Potato Peeler
2) Potato slicer
3) Potato blencher

Either hand or foot could operate the machines. The total cost of one set of equipment for a processing capacity of nine ton during a project cycle of 90 days works out to approximately Rs.16,000/-.
SOTEC set up a demonstration cum commercial plant at its Research and Development Centre (RDC) located at about 12 kms from its administrative office at district Bareilly. Its field staff visited the surrounding villages disseminating information to the farmers throughout meetings organized at villages. Also, farmers, were invited to RDC for a demonstration and were provided with all the relevant guidance and information. Interested villagers (mainly farmers) were then provided with training in potato storage and processing technologies by the SOTEC.

SOTEC provided Rs. 5.50 lakhs (approx. US$ 15700) as interest free loan to unit holders besides marketing support. The repayment loan was initially adjusted from the sales proceed of processed material supplied to SOTEC. As there was deterioration in the quality of processed items, SOTEC insisted on tough quality control measures. A lot of production was rejected thereafter. The unit holders found it impossible to sell their products in the open market. Some of the units closed their operations due to lack of funds. SOTEC could never recover its remaining dues from such units. As there were no legal documents SOTEC could not take any legal actions.

1.4 Impact on the Society

The dissemination of the technology resulted in the establishment of 22 potato storage and processing units during 1985 to 1990. SOTEC was either directly involved in their establishment or extended technical support. The number of rustic stores and potato processing units set up each year and their subsequent operation is shown in Table 1 for the period 1985 to 1990:

Table 1

| Year |  
|------|------|
|      |      |
|----------------|------|------|------|------|------|------|
|                | 3    | 2    | -    | -    | -    | -    |
|                | 2    | -    | -    | -    | -    | -    |
|                | 6    | 2    | 1    | -    | -    | -    |
|                | 3    | 2    | 2    | -    | -    | -    |
| Operating      | 3    | 4    | 6    | 5    | 9    | 10   |

It may be seen from the chart above that during the initial years not a single unit could survive for more than two years. The market for dried chips was initially poor and quality of production was bad. Selling of potato powder was much more difficult as compared to the dried chips and sticks. Marketing efforts were then made through demonstrations in schools and colleges and with woman’s groups, which boosted the sales in the nearby markets. The sales, however, was limited to a few large urban markets. A recently conducted survey of potato producing units shows that seven units are still running successfully on their own at various places in District Bareilly and nearby areas.

An interview with an owner of a potato-processing unit reveals some critical gaps in the NGO intervention. This unit was set up in 1990 with financial and technical support from SOTEC. The owner of the unit Mr. Intjar Ahmed was given support for creating facilities for potato storage and processing. The average per day processing was reported to be about eight to nine quintals. Mr. Intjar, a marginal farmer, never grew potatoes on his field and instead purchased from the market for processing in the season. In the three years of its operations the unit also marketed its products through SOTEC and never tried to create its own market. The entire produce was supplied to SOTEC for marketing. The sales proceed was adjusted against the loan installments and only the labour charges paid were allowed to the unit. During the fourth year due to lack of sufficient funds the unit had to be closed down. The interviews has brought forth the following factors as reasons for the closure of the unit:

1. High transaction costs incurred on purchase of potato from outside;
2. Inadequate finance;
3. High maintenance costs as SOTEC had to be approached and every time production suffered;
4. Delayed payments from SOTEC and poor liaison between SOTEC field staff and the unit holder.

It is evident that SOTEC made only scattered efforts at disseminating the potato storage and processing technology and had no concrete follow up action. The results hence are not as impressive as they should have been. Also as SOTEC was entirely dependent on the funds from CTI and ATI, which were available for a project period of 3-5 years, it could never keep pace with the requirements of the society and do justice to its dissemination efforts.

1.5 Conclusion

The SOTEC experiment highlights a number of issues that an intermediary should focus on while dealing with technology oriented projects at the grassroots level. First and foremost, it suggests the importance of ensuring community participation in making the intervention socially accepted. The participation of the local community at all stages of technology dissemination is highly essential, to achieve successful commercialization of innovations at the grassroots level. At the same time the intermediary has to have the vision to sustain the benefits of the technology through income generation projects based on sound principles of business. Thirdly, it should integrate innovative and commercially viable support mechanisms, especially for provision of credit and marketing support, with the ongoing process of technology development.

SECTION II

The RTIG Intervention

India ranks number one in world in terms of livestock with 70 per cent of the global cattle population. Indian goat - calf/ sheepskins are regarded as speciality products commanding a good market.

Small-scale units still dominate the leather industry. There are about 1100 tanneries with an annual capacity of about 200 million pieces of hides and skins, which produce 12500 million sq. ft of
processed leather. Of these, 88 per cent units are SSI/ cottage industry! In terms of employment generation also, leather industry plays a crucial role providing employment to about 1.5 million people and as per the projections by the year 2000, it will generate approximately one million additional direct employment. Leather exports totaled Rs.48,994 million (approx. US$ 1400 million) in 1994-95 and were the fourth largest foreign exchange earner.

2.0 Problems Faced by Leather Industry

Despite these positive points, the leather industry faces problems like poor technology, paucity of funds for up-gradation, hazardous pollution and inadequate infrastructure for value added products. Obsolete technology affects the quality of finished products. The leather industry has two main elements: tanning and selling the tanned leather to cobblers directly or indirectly. Both tanners and cobblers have a problem in measuring leather pieces. In order to know where and how it arises, let us understand the industry in some detail.

The small and village level tanneries are engaged in:
- Vegetable tanning
- Wet blue tanning
- Chrome tanning

In the case of vegetable tanning, the processed leather is sold by weight. The tanners have no difficulty in calculating the quantity of tanned leather pieces while selling to the middlemen. This leather is being used mainly for footwear and low quality products.

The wet blue leather (semi finished chrome leather) and chrome leather, being high value products, are sold on area basis, i.e., in rupees/ deci square centimeter. They come normally in irregular shape, making precise measurement of finished leather pieces very difficult.
To overcome this problem, advanced tanneries use digital leather measuring devices. The cost ranges between Rs.1.5 lakhs and Rs.2 lakhs (approx. US $ 4285- 5715). The village tanners cannot obviously afford to use them.

While buying semi-chrome and chrome leather from tanners, the middlemen take average length and average width for computing the area of leather pieces, ignoring the projections of the leather piece. This results in considerable monetary loss to the tanners. But the middlemen sell the leather on actual area basis using electronic leather measuring devices.

Thus the tanners are forced to sell their products at a lower price because they cannot afford measuring device.

On the other side of this transaction lie the cobblers who buy leather pieces, especially chrome tanned leather from the retailers. The area in deci square centimeter is marked on the leather pieces. The retailers charge the cobblers according to the area marked. As again irregular as the pieces come in, the cobblers cannot measure their actual area. The poor artisans have no option but to believe the traders. There are chances of getting cheated by the middlemen by manipulation of the area of leather pieces.

The Rural Technology Institute Gujarat (RTIG), a development agency, promoted by the Government of Gujarat is engaged in identification, development and dissemination of appropriate technologies to revitalize traditional economic activities like leatherwork, pottery, carpentry, etc. of rural areas having good employment potentials. The institute identified the problem while working with the tanners in the field.

2.1 The innovation

To reduce the chances of middlemen exploiting poor artisans, RTIG has designed and developed an area-measuring instrument called ‘Planimeter’, which can be used to measure irregular shaped leather pieces by tanners as well as cobblers.
2.11 Planimeter

The planimeter consists of the following parts:
1. Fixed arm - made from stainless steel bar.
2. Tracing arm - made from stainless steel bar
3. Main Scale
4. Vernier scale (calibrated disc) - made from aluminum plate
5. Bevel - gear mechanism
6. Ball bearing - for easy rotation of calibrated disc on tracing arm
7. Cover on the bevel gear mechanism

The diagram of Planimeter is enclosed at Annexure 4 & 5. The planimeter functions on the principle: Area = length of tracing arm multiplied by distance covered by the disc.

2.12 How to use

1. Place the leather piece on a smooth flat surface.
2. Mark one point on the boundary of the leather piece. Put the tracing point of Planimeter on it and set “Zero” of main scale as well as Vernier scale.
3. Attach fixed arm with tracing arm in such a way that the disc does not come on the leather piece while moving the tracing point along the boundary of leather piece.
4. Move tracing point slowly on the boundary of the leather piece in clock wise direction.
5. Ensure that while moving the tracing point, the tracing arm and the disc is not lifted up. Otherwise due to non-rotation of the disc, there are chances of error.
6. Stop the tracing point at the starting point.
7. Read the area of leather piece on main as well as vernier scale.

2.13 Salient features of Planimeter
1. The cost of Planimeter is Rs. 800 (approx. US $ 23), which is affordable to individual tanner and cobbler.
2. Light in weight, so portable in nature.
3. Minimum moving parts, so low maintenance.
4. Design so easy, that local manufacturers can fabricate it also.
5. Semi-skilled workers so can use no complicated calculations, effectively.
6. It can be devised to measure the pieces as per requirement.
7. The percentage of error in measuring area is negligible.

2.2 Economic gains to tanners and cobblers

A village tannery on an average produces 200 pieces of semi-chrome tanned leather pieces per month. At present, the average selling prices for wet blue is Rs.30/sq. ft (approx. US $ 0.86/ sq. ft). The difference between the area of leather piece measured by the crude method and by use of the Planimeter at the field level is found to be in the range of 15-20 per cent. This implies a monetary loss of approximately Rs.20-25 (approx. US $ 0.57-0.72) per leather piece to the tanners. In other words, on a monthly production of 200 leather pieces, the tannery loses Rs. 4000- 5000/- (approximately US $ 115-143) and annually Rs.50, 000- 60,000/- (approx. US $ 1428- 1714).

Similarly, cobblers are cheated while purchasing chrome leather in bulk from the retailers. It can be minimized by cross checking of area of leather pieces with the use of planimeter. Planimeter was introduced as a device that can eliminate economic loss to both tanners and cobblers to a great extent.

2.3 How was the Technology Disseminated?

After developing the planimeter at the in-house R &D unit of RTIG, the instrument was tested by Regional Reference Standard Laboratory, Government of India at Ahmedabad. The Institute described the device as unique and developed for the very first time in India. As per the laboratory tests, the percentage of error in area measurement was found to be a negligible 0.99 per cent. The
institute could transfer the technology through organizing a series of one-day demonstration cum exposure programmes for different groups of tanners and cobblers at their doorsteps in different districts of Gujarat. The information of Planimeter was widely circulated through publication of small booklets on Planimeter in local language among the artisan groups.

2.4 How was the Technology Diffused among Artisans?

While conducting demonstration/exposure programmes, it was observed that the artisans were reluctant to break the age old practices of selling their products to middlemen, because of the threat of being thrown out from the established marketing channels. So initially, artisans were not enthusiastic about the device. But after having been convinced as to the monetary gains associated with the use of the new device, comparatively big tanneries located near Ahmedabad came forward. But the middlemen resisted the move. As usual in rural areas, the transfer of technology takes a little longer time. RTIG made continuous efforts and eventually the big tanneries succeeded in convincing the middlemen about the use of Planimeter while selling leather products to them. The small tanneries in other parts of Gujarat followed this. It took more than a year for the device to be diffuse widely among the smaller tanneries.

It was not the case with cobblers. They adopted the planimeter at an early stage to avoid exploitation by the retailers while purchasing the leather pieces from them. The device was later redesigned and redeveloped to measure the area of leather pieces in square foot instead of deci square centimeters to suit the needs of end users.

2.41 Extent of Use

The Planimeter developed by RTIG in 1992 has been widely accepted and is being used by more than 30 large as well as small village tanneries spread all over Gujarat and about 75 cobblers’ cooperatives located in Ahmedabad, Jamnagar, Surendranagar, and Banaskantha districts of Gujarat, India. The artisans have found the instrument of immense help to keep them away from middlemen’s exploitation.
2.5 Conclusion

Thus conscious and planned interventions can facilitate the local rural economies for effective translation of grassroots level innovation into profitable economic opportunities. Through such appropriate technologies, the community in general could improve their socio-economic status. It demonstrates how innovative efforts, if recognized and give proper direction and timely support, may lead to people’s empowerment.

SECTION - III

Summing Up

We discussed in this paper the process of diffusion and adoption of innovation at the grassroots level, initiated by institutions in the government and non-government sectors. A comparative picture of the two interventions is in table 2.

Table 2: Comparative Analysis of the cases

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Case I</th>
<th>Case II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature of intervention</td>
<td>Institution-driven (non-government)</td>
<td>Institution-driven (government)</td>
</tr>
<tr>
<td>Genesis</td>
<td>Impulsive response to a real problem; no community participation at the designing, planning, and implementation stages</td>
<td>Conscious response to a felt need of the artisans</td>
</tr>
</tbody>
</table>
Both the innovations had the potential to change the economic status of the targeted segments. However, they differ in their form and approach. The former, the NGO, aimed at developing micro enterprise based on technological innovation tried to have an integrated approach, whereas the latter with the limited objective of devising a facilitative technique has a one-shot approach. The experience of the Rural Technology Institute, Gujarat, demonstrates how a timely and appropriate technology intervention driven by institutions can lead to solutions with far reaching economic consequences to relevant target groups.

The case of the NGO brings forth the danger of having a piecemeal and ill-coordinated approach to an issue that needs a comprehensive solution. Perhaps, the major lesson from the discussion presented here is that technology development, *per se*, cannot offer sustainable development options to communities entangles in number of problems on various fronts. Any intervention should try and establish proper forward and backward linkages for it to be successful in the long run.
References


Sandee, Henry. 1995. *Innovation adoption in rural industry*. Amsterdam: Vrize universiteit

Annexures

Annexure 1: Rustic Store

Annexure 2A: Comparative temperature inside and outside Rustic Store during Potato processing and storage
Annexure 2B: Comparative humidity percent inside and outside the store during Potato processing and storage

![Graph showing comparative humidity percent inside and outside the store during Potato processing and storage.]

Annexure 3: Economics of a Nine Ton Capacity Potato Processing Unit

(A) Fixed Capital Requirements

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Item</th>
<th>No.</th>
<th>Unit</th>
<th>Cost (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hand slicer (Wooden)</td>
<td>1</td>
<td></td>
<td>3500</td>
</tr>
<tr>
<td>2</td>
<td>Washer-cum-peeler</td>
<td>1</td>
<td></td>
<td>6000</td>
</tr>
<tr>
<td>3</td>
<td>Stainless steel tub</td>
<td>1</td>
<td></td>
<td>2000</td>
</tr>
<tr>
<td>4</td>
<td>Racks (Drying)</td>
<td>10</td>
<td></td>
<td>2500</td>
</tr>
<tr>
<td>5</td>
<td>Nylon bags</td>
<td>4</td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>6</td>
<td>Nylon nets</td>
<td>20</td>
<td></td>
<td>500</td>
</tr>
<tr>
<td>7</td>
<td>Small tube</td>
<td>4</td>
<td></td>
<td>800</td>
</tr>
<tr>
<td>8</td>
<td>Water tank</td>
<td></td>
<td></td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td>16000</td>
</tr>
</tbody>
</table>
II Rustic Store (10 ton capacity) 6500

<table>
<thead>
<tr>
<th>Raw Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.No</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

II Labour cost & other expenses for 90 days

Total Working Capital 27500

(C) Total capital (Loan) required

Equipment cost + Working Capital = 22500 + 27500 = Rs. 50000

(D) Profitability Analysis

I Expenditure

<table>
<thead>
<tr>
<th>Expenditure</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials</td>
<td>17500</td>
</tr>
<tr>
<td>Labour cost &amp; other expenditures</td>
<td>10000</td>
</tr>
<tr>
<td>Interest on WC loan</td>
<td>2131</td>
</tr>
<tr>
<td>Interest on equipment loan @ 15.5 % p.a.</td>
<td>3487</td>
</tr>
<tr>
<td>Depreciation @ 10 %</td>
<td>2250</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>35368</td>
</tr>
</tbody>
</table>

II Income from sales

<table>
<thead>
<tr>
<th>Weight</th>
<th>Unit price</th>
<th>Total</th>
</tr>
</thead>
</table>

446
<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>T</th>
<th>/ T</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average recovery from 9 tons potato products</td>
<td>16</td>
<td>1.44</td>
<td>32000</td>
<td>46080</td>
</tr>
<tr>
<td>Starch 1%</td>
<td></td>
<td>0.09</td>
<td>7000</td>
<td>630</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total 46670</td>
</tr>
</tbody>
</table>

Net Profit: Rs. 46670 - 35368 = Rs. 11302

Return on Investment (Project cycle: 3 months): 22.6 %
Annexure 4: Planimeter

1. Fixed Arm
2. Tracing Arm
3. Leather Piece

Annexure 5: Planimeter

Parts
1. Fixed Arm
2. Main Scale
3. Bevel Gear Mechanism
4. Tracing Arm
5. Tracing Point
6. Vernier Scale
Chicory (Kasni), A highly economical crop under limited and brackish water conditions:

Farmers Innovation

B.S. Dahiya, Jagdev Singh and Satyavir Singh Yadav

Introduction

Chicory (Cichorium intybus B&H) (Kasni), is a weed raised as fodder in south-west Haryana and adjoining area of Rajasthan. It is preferred to berseem, lucerne and oats as it can be cultivated with brackish underground water. It produces approximately 225-300 quintals per ha green fodder in 3-5 cuts and 6-10 q per ha seed when raised as pure crop. In mixed stands with mustard, it produces a seed yield of 4 to 8 q per ha without any adverse effect on mustard crop. It is highly economical because its seed sells @ Rs.2000-4000 per q. However, the scientific community has not explored the economic potential. The technology is available through the innovation of the cultivators which was highlighted during “farmers - scientist interaction group meeting”. This paper discusses the economic potential of the weed.

Chicory

Chicory is a native of Europe (Langer and Hill, 1982) and is a perennial plant. It has been cultivated since Roman times for a number of purposes, e.g., as a root crop in south India and Gujarat, forage crop in New Zealand and USA, and seed crop in Himachal Pradesh. The plant has medicinal uses and “LIV- 52”, a traditional Indian medicine contains contains C. intybus. The roots of chicory are a rich source of insulin, an industrial source of fructose. The different ethnic groups in Jammu and Kashmir are also using it against rheumatic pains.

Chicory is widely adapted under diverse ecological situations and grows well under arid-subtropical and arid-temperate climates, which are characterized by light sandy soils with low organic matter

71 CCS HAU, Regional Research Station, Bawal. 123501
where the cultivation of other winter season forage crops is not economical. The crop also establishes reliably in the dry land pastures. The abiotic stresses due to saline/saline-sodic/ sodic water quality have little effect on its growth. As a seed crop, it needs dry climate. Some cultivars have been identified which are specific in their adaptation.

**Farmers Innovation for Cultivation of Chicory**

On the basis of information collected from 25 farmers, the practices adopted for cultivation of chicory under different cropping systems are described below:

<table>
<thead>
<tr>
<th>Practices</th>
<th>Chicory sole crop</th>
<th>Mustard + chicory (mixed crops)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Green fodder/ seed or both</td>
<td>Seed</td>
</tr>
<tr>
<td>Cultivar</td>
<td>Non descript - indigenous local strain</td>
<td>RH-30, T-59, Varuna (Mustard)</td>
</tr>
<tr>
<td>Seed source</td>
<td>Local market - no official seed outlet for chicory</td>
<td>Certified seed of mustard</td>
</tr>
<tr>
<td>Sowing time</td>
<td>First half of October</td>
<td>Planting of mustard upto 3rd week of Oct. and sowing of chicory simultaneously with mustard or at the time of application of irrigation to mustard i.e. 35-40 days after sowing</td>
</tr>
<tr>
<td>Seed rate</td>
<td>18-20 Kg ha⁻¹</td>
<td>Mustard 2.5 - 4.0 Kg ha⁻¹</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chicory 10 - 15 Kg ha⁻¹</td>
</tr>
<tr>
<td>Sowing method</td>
<td>Broadcasting and mixing in top soil followed by light irrigation</td>
<td>Broadcasting of chicory followed by sowing of mustard at 45 cm row spacing in conserve moisture conditions</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>No basal dose except FYM + ash. 20 to 25 Kg urea ha⁻¹ after first cut i.e. when the crop is 30-35 days old. 15-20 Kg urea ha⁻¹ after every cut</td>
<td>125 Kg DAP + 60 Kg urea ha⁻¹ at sowing. Another dose of 60-85 Kg urea at the time of first irrigation. Urea @ 100 Kg ha⁻¹ in chicory after mustard harvesting.</td>
</tr>
<tr>
<td>Irrigation</td>
<td>At 20-25 days interval</td>
<td>One or two irrigation in mustard and after</td>
</tr>
</tbody>
</table>
mustard 3-4 irrigation are applied for seed crop of chicory

<table>
<thead>
<tr>
<th>Water quality</th>
<th>Range of EC 2-8 dsm⁻¹ and RSC 0-10 mel⁻¹</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Cuttings/harvesting</th>
<th>First cut after 30-35 days and subsequent cuttings at 20-25 days interval. The crop is left for seed after 4-5 cuttings in the month of March.</th>
<th>Mustard harvesting in 2nd half of March. Thereafter, chicory will pick up growth and harvested in mid-June.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Yield</th>
<th>Fodder  225-300 q ha⁻¹</th>
<th>Seed  6-10 q ha⁻¹</th>
<th>Mustard  18-20 q ha⁻¹</th>
<th>Chicory  4-8 q ha⁻¹</th>
</tr>
</thead>
</table>

**Economics of Innovation**

The figures of average production and economics of mustard and chicory alone and in combination with each other at farmers’ fields are presented in the following table:

<table>
<thead>
<tr>
<th>Cropping system</th>
<th>Average yield (q per ha)</th>
<th>Gross returns (Rs. per ha)</th>
<th>Cost of cultivation (Rs. per ha)</th>
<th>Net returns (Rs. per ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mustard (Sole)</td>
<td>20.2</td>
<td>21210</td>
<td>8125</td>
<td>13085</td>
</tr>
<tr>
<td>Chicory (Sole)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green fodder</td>
<td>250.0</td>
<td>12500</td>
<td>11100</td>
<td>1400</td>
</tr>
<tr>
<td>Seed</td>
<td>9.0</td>
<td>22500</td>
<td>5175</td>
<td>17325</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>35000</td>
<td>16275</td>
<td>18725</td>
</tr>
<tr>
<td>Mustard + chicory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mustard</td>
<td>18.4</td>
<td>19320</td>
<td>8125</td>
<td>11195</td>
</tr>
<tr>
<td>Chicory</td>
<td>7.0</td>
<td>17500</td>
<td>5850</td>
<td>11650</td>
</tr>
<tr>
<td>Total</td>
<td>25.4</td>
<td>36820</td>
<td>13975</td>
<td>22845</td>
</tr>
</tbody>
</table>

≅ Market price of chicory seed: Rs. 2500 per q (Range: Rs. 2000-4000 per q)

≌≌ The rental value and interest on the working capital are not included
Results indicate that farmers’ innovation (mustard + chicory) is highly productive as well as economical as compared to the sole crops. The innovation gives 74.6 per cent higher net returns over the recommended cropping system (mustard alone). Chicory sole crop for green fodder as well as seed crop also gives Rs. 5640 per ha more net returns than mustard crop, but this cropping systems is not adopted by farmers on a commercial scale.

Implications of Innovation

The innovation by the farmers is sustainable, eco-friendly, technically feasible and economically viable because:

1. There is no adverse effect on the yield of main crop, i.e., mustard.
2. The mixed cropping of chicory gives an additional net income ranging from Rs. 10,000 - 20,000 per ha depending upon the market price.
3. Chicory does not have any report of insect/pests and disease incidence; hence saving the already polluted and deteriorated agro-ecosystem from the additional burden of pesticide application.
4. The farmers have reported beneficial residual effects on subsequent crops of pearl millet - which needs to be scientifically analyzed.
5. Chicory as a green fodder increases milk yield and ensures better health of the animal.

Improvement of Innovation - Approaches

The research on mustard + chicory cropping systems and cultivar improvement has been initiated at this centres. However, there is need for scientific improvement of the innovation and the approaches suggested are as follows:

- Development of high yielding cultivars/hybrids for dual purpose (fodder and seed)
- Generation of technology for safe use of highly brackish water and agronomic management
- Biochemical studies for nutritional and medicinal values
• Studies on chicory for soil amelioration

Acknowledgments

The authors are highly thankful to Dr. O.P. Chaudhary, Assistant Entomologist, for this help in critically evaluating and typing the manuscript.
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Management of Red Hairy Caterpillar: A Sustainable Approach

T.V.K. Singh and J. Satyanarayana

Introduction

The problem of pest attack on major crops, vital to feed our communities and for the growth of the economy is as old as the history of agriculture. Over the centuries, Indian farmers from the very earliest times have not only done careful selection of seeds and crops, but have also developed appropriate methods of land, water and crop management. With the growth of agrarian communities from the Rigveda period and before, farmers have found that crops are susceptible to diseases and pests. Methods of controlling such pests find mention in our earliest texts from the Vedic period. Such methods were codified into operative manuals at the time when Kautilya’s Arthasastra was written in the 3rd Century B.C.

Great scholars wrote textbooks dedicated to agriculture in the early centuries of our millennia. Kashyap’s *Krishi-Sukti* was as essential agricultural treatise of the 10th century A.D. The *Vriksha-Ayurveda* of that period lists the bio-pesticidal properties of plants, such as neem, *Pongamia* and *Calotropis*, which are in use till today. The principles of inter-cropping, crop rotation and trap cropping were known to prevent pest attack, preserve soil fertility, and the carrying capacity of the region. The careful cultivation of several species of trees, crops and vegetable by Indian farmers is evident from the earlier accounts of early Arab travellers, such as Ibn Batuta. and conquerors, such as Babur himself. The pleasure loving Jahangir was no less a lover of Nature than his forebears, and one of the best accounts of the flora and fauna of his times is found in the *Tuzuk-I-Jahangiri*, penned by the emperor himself.

The Indian farmers continued to sustain our populations through ecological farming methods right down to modern times as witnessed by Dr. Voelcker, Consulting chemist to the Royal Agricultural Society of England, who said in the late 19th century that he had never seen a more perfect picture of

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72 APT, RARS, Palem- 509 215, Mahaboobnagar (A.P)
careful cultivation combined with hard labour, perseverance, and fertility of the soil. He said that Western experience could contribute little to the wisdom of the Indian farmer, and added that any advance may come from “an enquiry into natural agriculture and from the extension of better indigenous methods”.

In early ’60s, along with the rest of the world, Indian agriculture adopted expensive methods of monocropping and chemical management of crops, wasteful of the rich heritage of bio-diversity with which India is endowed. From the early ’70s scientists throughout the world have started to evaluate the heavy dependence on chemical agriculture produces over time, diminishing returns over capital employed, the inexorable destruction of the fertility of soil, and the diversity of plant life, itself necessary to maintain agricultural production levels. Scientists started to place an emphasis on Integrated Pest Management technique utilizing local knowledge of farming communities; better understanding of the capacity of crops towards tolerance of pest infestation; and the promotion of non-chemical methods for managing the pest problem. It was seen very clearly that any attempt to eliminate completely a pest would be counterproductive and might result in bringing even more voracious pests into fields or even make the pest resistant to known pesticides.

Bitter experience has taught scientists, extension workers, and farmers to search for traditional and new non-chemical methods for managing pest attack. The problems faced by the ordinary farmer in the field are complex in nature since the farmers has to deal not only with the protection of several crops that are important, but with the attacks of various pests during different periods of plant growth, the under varying soil and weather conditions. While our farming ancestors were able to manage such complexities with success, perhaps modern farmers face a far more difficult task, since vast areas of our countryside are now facing deforestation and environmental degradation, leading to profound ecological disturbances. Such disturbances have unleashed massive attacks by voracious pests on our crops such as the red headed hairy caterpillar (RHC), which was not known to be so serious a pest in the Deccan till about two decades ago.

In addition irreversible changes have taken place in community practices at the village level, so that forms of group action for the common good, which were the form in rural life a few generations ago,
have now become rare. Further, changes have occurred in the aspirations of the farming community, and the present generation of farmers desire goods and services, and a lifestyle, which were not thought of by the previous generation. In agricultural era the farmer faces an uphill task in trying to design a comprehensive methodology for containing pest attacks through non-chemical means. The farmers will always face the temptation of trying a quick fix by spraying his fields with a handy dose of pesticides, rather that patiently and labouriously carrying out different non-chemical practices for controlling pest attack.

With the increase in crop yield from modern farming practices reaching a plateau, and environmental problems due to excessive use of plant protection chemicals, the need for sustainable and ecological agriculture is need of the hour. The indiscriminate use of pesticides leads to:

- Destruction of beneficial organisms
- Resistance against pesticides
- Resurgence of treated pests
- Pesticide residues in food chain
- Environmental pollution
- Pesticide associated health hazards

The gravity of the environmental degradation, arising from faulty practices has set every one involved in agriculture on to think of ecologically sound, viable and sustainable farming systems. Sustainability has emerged as a major goal as well as a criterion for overall socio-economic development. In this day and age, concern for sustainability among policy makers, scientists, and social organizations is more pronounced in the agricultural sector, to highlight the adverse effects of the pesticide use. This paper is an attempt to emphasize the relevance of Integrated Pest Management of Red hairy caterpillar with a focus on sustainability.

**Red Hairy Caterpillar**
The Red hairy caterpillar, also known as Red headed hairy caterpillar (RHC) belongs to Arctidae family of order Lepidoptera. Two species of RHC’s, viz., *Amsacta albistriga* and *Amsacta moorei* are prevalent in South and Northern India, respectively.

**Geographical Distribution**

The RHC is widely distributed in arid and semi arid regions of Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, Madhya Pradesh and Gujarat. The RHC has grown to become a major threat in Nalgonda, Mahaboobnagar, Ranga Reddy, Warangal and Medak districts of Andhra Pradesh. The pest is also reported in parts of Anantapur and Kurnool districts of Andhra Pradesh.

**Host Plants of Pest**

The pest is polyphagous in nature, damaging almost all rainfed crops of light red soils. The most preferred crops that suffer total annihilation (the RHC cut the plumules of seedlings) are castor, sesamum, jowar, pearl millet, maize, groundnut, red gram, green gram, cotton and cucumber. At times tobacco nurseries sown in June are also destroyed.

Among the different crops, the damage to castor is very severe in Andhra Pradesh and unique, as the peak activity of the caterpillar coincides with the optimum time of sowing of castor and hence the young seedlings are sheared off as soon as they emerge on the soil surface. Hence, very often, the farmers in the endemic areas resort to resowing of the crop. Guided by the past experience with crop failure, most of farmers adopt the practice of late sowing in August to escape the onslaught of larval attack as it enters into pupation phase by end of July. Under delayed sowing castor productivity crosses hardly a level of 2-3g/ha against 10-12 g/ha under optimum sowing.

**Bio-Ecology**

The parent moths of the pest emerge from pupae 2-3 days after the pre-monsoon or monsoon showers. Thereafter, the emergence continues until the middle of July. The mating takes place within
few hours to one day after emergence. The female moth starts laying eggs within a day or two on the underside of leaves of natural vegetation, if available, and on the sides of clods, stones, stems, walls, irrigation channels, etc. The eggs are laid in patches of 100 to 300 eggs. On average a single female lays 1000 to 3000 eggs over a period of 4 to 5 days after mating. Hatching of eggs take place in 2 to 3 days. In the initial stages of larval development, they tend to aggregate on the under surface of leaves and as a result goes unnoticed.

The farmers first notice the caterpillars when they are 8 to 9 days old and about 1 cm long, approximately 10 to 12 days after soaking showers when they attack the sprouting seedlings of the crop. The colour of the head will be coral red. Initially larvae are reddish brown, and slowly they turn to ashy brown and within 30-40 days the larvae become fully-grown. Full-grown larvae will be totally reddish brown or reddish brown with black bands on either side with reddish brown hairs arising from verrucae on the body. They larvae feed on the host plants in large numbers and march from field to field in thousands. In the area of outbreak, the entire field will appears as if cattle have grazed the crop. After an active feeding the caterpillars become sluggish in movement and on finding suitable sites (under the shades of trees and buildings), they burrow down into the soil, pupate and remain in soil till the next pre-monsoon or monsoon showers.

**Infestation Pattern**

The young caterpillars are seen in the fields of endemic areas within a week to 10 days after one or two soaking showers. The parent moths emerge in 3 to 5 weeks, with each peak extending to over 2 to 4 days, during the whole month of June and first half of July.

This is besides the daily occurrences that are not significant. Thus, there are endless, successive waves of caterpillar attack on dry land crops of the region. This process of infestation defies the known and adopted techniques- cultural, mechanical or chemical and leaves the farmers frustrated. As the pest is problematic, scientists and voluntary organizations launched a sustainable management programme to educate farmers by taking into consideration the traditional knowledge of the farmers.
**Sustainable Management**

1. **Ploughing**

Farmers do deep ploughing in the off-season to expose the pupae, so that they are killed by dry, scorching sun and hot weather or preyed upon by birds.

2. **Bonfires**

In order to attract the adults and kill them, farmers often practice making bonfire around the fields soon after dusk. Government was supplying discarded rubber tyres for burning around the fields. After 2-3 years of experience it was felt that burning tyres is not desirable on account of the pollution hazards due to emanation of sulphurous gases. Creating bonfires with cow dung pellets and farm refuse also gives good results but as cowdung has high manure content, farmers were not willing to dispense with cowdung. And, as most of village and hamlets are getting electrified day-by-day, attracting adults to light trap was working out better.

3. **Light Traps**

Installation of light traps right before the beginning of season attracts adults. Below the light traps, plastic tubs or earthen pots have to be arranged containing kerosenated water. The bulbs height must be maintained at 60-75 cms above the kerosenated water in tub/pots.

*Adult moths attraction and behaviour near light traps*

Moths start getting attracted to light from 7.00 pm onwards and continue till 2.00 am. Moths flying towards the light land near the light trap and flap their wings in quick succession in zigzag manner touching the kerosenated water. Few of them settle down quietly on the ground, which are required to be collected manually and destroyed. The moths rush in large wave like pattern of swarms on peak emergence evenings/night.
Light traps have been found to be more effective and convenient than bonfires, as they are safe and simple to operate, and have adequate effective range. On an average 8 to 10 light traps/ha are to be installed. Petromax do also help in reducing the incidence but proved to be costly affair. Light trap treatment for three seasons was found to be adequate to reduce the pest built up to a level of no economic loss to crops in the fourth season.

The light trap method is found to be successful in reducing the pest incidence and protecting the crops in the treated villages. Several crops in untreated villages were almost wiped out. Farmers are found convinced of the technology and have started adopting it in most of the areas.

4. Egg Mass Collection

Collection and destruction of egg masses laid on grasses, soil clods, underside of the leaves of host controls the pest to some extent. Spraying of pesticides on egg masses over an area within a radius of 10-15 meters from light also reduces the load. Ploughing around light trap to destroy egg masses is also a usual practice followed by farmers. Continuous and staggered emergence of moths spread over 30 to 40 days sets in a process of continuous egg laying throughout the area and it becomes difficult, requiring lot of labour.

5. Collection of Larvae

Manual killing of early instars is a most widely adopted practice. A problem encountered by the farmers is the influx of the caterpillars in the waves like pattern and at the same time there is lot of pressure on farmers for sowing of other crops and labour becomes scarce.

6. Field Trenching

Digging of “U” shape trenches (1’ deep) and later dusting with insecticides prevents the infestation by migratory caterpillars.
This process is labour consuming, costly and rendered ineffective because of the intermittent rains, which fill up the trenches. The peak demand for labour synchronies with RHC activity and therefore farmers find it difficult in adopting this way of managing the pest.

7. Vegetative Trapping

Leaves and twigs of *Jatropha* (wild castor) *Calotropis* and *Ipomoea* attract RHC and hence they should to be spread in field. The indigenous practice of vegetable trapping of caterpillars by spreading twigs proves to be very effective as one can avoid back breaking, nefarious activity of manual killing of caterpillar and saving the women from painful fatigue and other reactions.

8. Feeding Deterrents

Aqueous emulsion (0.01%) of neem and *Pongamia* oil is a very effective protection against damage by caterpillars. The washability of the oil emulsions in rainy season renders it impractical.
A Gamble on Monsoon

Md. Abdur Razzaque\textsuperscript{73} and Indrajit Roy\textsuperscript{74}

Introduction

Agriculture in Bangladesh is a gamble on the monsoon. The farmer has to coax land into giving him a good yield. The country is situated in such a corner of the globe that it either gets the benefits of a bountiful monsoon or suffers calamity of floods due to excess of rain. At other times, he may face paucity of rain. He has to prepare for any eventuality and save the crop once sown or transplant it in areas where there is enough water and not too much of it. This excess water is present in low-lying areas of the country, which are often subject to floods. Ratooning, i.e., using the previous crop shoots to raise a fresh crop is a method that the farmer often tries out. This helps him get over seed shortage.

The farmer faces several risks like floods, droughts, storms, surges, and saline water ingress. Of late the frequency and extent of floods and droughts has crossed all limits. In 1988, floods affected an area of 30,000 square miles. The eastern and southern regions experienced prolonged drought, which affected kharif-1 crops.

This paper highlights some agronomic practices devised to cope with recurring floods and droughts and suggests some strategies that can mitigate the consequences of too much or too little rain.

Deep-water rice ratooning and transplanting

In the irrigated low-lying areas rice is grown in dry season. Sometimes the Boro is followed by DWR crop and at other times the field is left fallow. Boro, DWR and ratoon pattern is being developed to reduce the risk. The land could be used in both seasons.

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The feasibility of ratoon cropping of DWR varieties, Gilamyte and BR 224-2B-2-5 was studied along with pajam at Joydebpur. The results indicated that pajam - transplanted gilamyte DWR gave the highest yearly yield of 6.82 t/ha. The yield of DWR ratoons was as good as normal DWR crop (table 1).

**Splitting tillers from mother plant in *T. aman* rice**

Each year early or late floods damage transplanted Aman rice in some areas. But farmers cannot resow in the flood-affected lands due to shortage of seedlings. Splitting tillers from standing aman crop and using them as planting material may help overcome the shortage.

Two experiments were conducted with BR11 and BR22 under early and late planted situation in farmers’ field. Results showed that the yield produced by the intact mother plant and split transplant in early-planted rice (BR-11) were poor.

**Using aged seedlings to cope with risk in early and late planted situations of *T. aman***

Aman rice is often damaged by submergence. Sometimes old seedlings are used to reduce yield loss and risk due to late planting. An experiment was conducted with 11 rice varieties using 30d and 50d old seedings. They were submerged seven days after transplanting and kept under 70 cm deep water for 15 days. It was found that 50d old seedings were more tolerant than 30d old seedings. Among the recommended varieties, BR4 has the highest tolerance followed by BR6, BR7, BR10 and BR11.

The age and number of seedlings per hill are two important factors that influence field duration and crop yield in late transplanted Aman rice. A study was conducted at Bangladesh Agricultural University to see the yield of BR 4 rice as affected by planting 40d, 60d and 80d old seedlings using 2, 4 and 8 seedlings per hill. It was found that the age of seedlings did not have a significant effect on grain. The field duration of the crop decreased with age of seedling. Eighty-day old seedlings matured at 21 days earlier than did the 40d seedlings and at 11 days earlier than 60d old seedlings.
Supplemental Irrigation in *T. aman*

Transplanted Aman is the major rice crop grown in about 4.7 million hectare. The current irrigation coverage is merely three per cent of the total area under Transplanted aman and the rest of the crop is grown on rain fed fields. During the monsoon there are sometimes dry spells causing drastic yield reductions. If the crop has moisture stress at flowering, the later rains may not be useful. Experiments showed that supplemental irrigation at the most critical growth stage can increase production by about 25 per cent (Table 6). It was observed that a ditch size requiring 4 per cent - 5 per cent area of the field with a depth of 2 m is adequate for storing enough to increase the yield season for as 50 per cent in a drought year.

Potato with minimum tillage - a potential technology

In low-lying heavy soils and non-saline tidal flooded zone, potato cultivation is restricted by humid conditions at normal planting time. In southern Bangladesh, the turn around time between transplanted Aman and potato may be reduced by 15-20 days by planting potato with minimum or zero tillage without reduction of yield (Table 7). Further experiments were revealed that significantly higher field was obtained from minimum tillage compared with normal tillage. The tuber yield was good compared to national average as well as yield level of normal planting (Table 8).

Relay planting to utilize post-monsoon soil moisture

Late draining of water from low-lying areas was a feature of the recent monsoon causing delay in Aman crop and also the rabi crop. This allows the farmers to advance dry season crops by 3-4 weeks. A lot of moisture is lost while waiting for the soil to dry. Adoption of minimum tilling technique can harness residual soil moisture for Rabi crops.

Trials were conducted at Palashbari and Lalmonirhat MLT sites to compare the performance of four tillage methods on wheat. There was no significant difference in spikelet/ m and grain yield of wheat under different tillage methods.
Aman crop was harvested at 17 and 30 days after the rabi crops were sown when trials were conducted on crop relay system. The results showed that chickpea and lentil performed well producing close to normal yield (Table 10). The performance of other remaining crops was not good due to long overlapping period and low fertilizer dose.

Linseed crop realyed with Aman rice at different dates of planting was studied at Jamalpur. November 1 sowing returned significantly higher yield than the other dates of planting (Table 11).

Trials to see the feasibility of growing different winter crop with minimum tillage in Charland of Kurigram showed that the yield and economic return was better in dilled maize compared to maize broadcast followed by one ploughing and one laddering (Table 12). Trials in Faridpur revealed that intercropping of blackgram and mungbean using zero tillage was economically better than sole maize. Economically maize + mungbean was best due to high price of mungbean (Table 13).

**Use of mulch in Sugarcane Potato Intercropping**

Potato was found to be most compatible with sugarcane under rain fed conditions among intercrops grown. Soil moisture management is vital for raising both sugarcane and intercrops. Attempts were made to compare the effectiveness of different mulch. It was found that the mulched intercrop potato yield was higher than non-mulched crops. Water hyacinth mulch gave highest yield (13.04 t/ha). Lowest yield was obtained from non-mulched treatment (Table 14).

**Technology of late Jute Seed Production for flood affected areas in Bangladesh**

Farmers get jute seed from part of the crop left in a corner of the field sown for fibre purpose. This practice takes the entire Aman season. After the jute seed crop is harvested, it is not possible to extract fibre from the plants. The crop is frequently damaged by late floods causing acute shortage of seed in the following crop season. Farmers are forced to buy jute seed at prices at exorbitant prices.
Seed was produced on an experimental basis in homestead areas with winter vegetables Farming System Research (FSR) site Kanaipur, Faridpur. It was observed that the jute seed crop with lalsak (*Amaranthus*) gave maximum seed yield (1.08 t/ha) with 9.84 t/ha of lalsak. The combination jute seed + brinjal did not perform well.

**Sojan cropping**

Delayed harvest of transplanted Aman and tidal inundation come in the way of vegetable cultivation in the coastal areas of Patuakhali. An innovative method developed in Indonesia - the sorjan method - may be a suitable alternative to get over the difficulty.

Alternate beds and furrows are required in the site. The bed size was 10 m X 2 m. The height of bed was about 1 m from the ground level so that at least 30 cm upper portion of the bed remains above flood level. Crops mentioned in table 15 were grown on each bed while the furrows served a three-fold purposes: (1) drainage of excess water during rainy season (2) reservoir of water which is irrigation source during dry season (3) provision of space for trailing creeper vegetables. The results at Labukhali indicated that most of the crops performed well and gave good yield suggesting a possibility of growing crops avoiding risk. Among the crops banana produced the highest net return followed by papaya.

**Planting dhaincha on rice bunds**

Alley cropping of dhaincha (*S. ostrata, S. aculeata* on rice bunds appears to be a promising method for protecting Aman rice in low -lying areas from invasion by water hyacinth.

**Improvement of cropping pattern**

Testing cropping patterns to improve existing patterns has been a major activity till recently. The emphasis has been mainly on rain fed situation. The overall objective is to raise total production keeping crop diversification in view. Soil fertility conditions were sought to be improved through green manure and inclusion of catch crop, etc.
The pattern of jute - radish - potato + lalsak + S. gourd was tested against farmer’s cropping pattern jute - follow - potato. The yield of jute and potato increased by 42 per cent and 36 per cent respectively in FA pattern. The alternate cropping pattern was improved mainly by the introduction of a catch crop, radish, and modern variety of jute and potato along with the recommended management practices (Table 16).

**Conservation Farming - A Technique to Protect Hill Erosion**

Prevention of soil erosion is a major consideration in hill-land agriculture. It increases on steeper slopes with the frequency of cultivation and rainfall intensity. Soil productivity deteriorates as the soil erosion increases.

Surface mulch can be effective in protecting the soil from erosion losses. In an experiment conducted at agricultural research station at Khagrachari, the researchers observed that mukhi kachu (*Colocasia esculenta*), an important vegetable crop preferred by the local people, can be grown on hill slope (10-15%) with minimum soil loss using zero tillage and surface mulch.

**Strategies to cope with the Adverse Impact of Abnormal Monsoon:**

1. **Compensatory Food Production Programme in Most Favourable Areas (MFA)**

Most favourable areas for launching compensatory production programme are those areas where flood water recede earlier and where soil moisture availability is likely to be adequate to sustain a reasonably quick yielding crop. In chronically flood prone areas, the most important crop season should be after the floods recede. In such MFA the following steps to be taken:

a. Develop a cropping strategy including the choice of varieties based on the availability of seeds.

b. Extend agronomic and water management practices that can help to enhance the yield of the crop per liter of water.
c. Introduce crop weather watch groups, which can provide timely advice to farmers on crop management.

d. Provide mobile diesel pumps to tap underground water and surface water.

e. Promote pest control measures, which can help to prevent damage from insect pest, pathogens and weeds.

2. Intensification of production programme in drought and flood free areas:

In such areas, more intensive production drives can be launched through the supply of improved seeds and fertilizer at reasonable prices. Steps should be taken to bridge the gap between the potential and the actual.

References


Annual report. 1985-86. On-Farm Research Division, BARI, Joydebpur, Gazipur.


Annexures

Table 1: Performance of rice-rice cropping pattern in DWR area, Rajbari, December 1982 to November 1983

<table>
<thead>
<tr>
<th>Cropping pattern</th>
<th>Yield t/ha</th>
<th></th>
<th>Total/Year</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boro</td>
<td>Aman</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boro-Transplant Aman</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pajam--Pajam</td>
<td>4.88</td>
<td>0.00</td>
<td>4.88</td>
<td>5</td>
</tr>
<tr>
<td>Pajam--Gilamyte</td>
<td>4.88</td>
<td>1.94</td>
<td>6.82</td>
<td>1</td>
</tr>
<tr>
<td>Pajam--BR224-2B-2-5</td>
<td>4.88</td>
<td>1.31</td>
<td>6.19</td>
<td>2</td>
</tr>
<tr>
<td>Gilamyte--Gilamyte</td>
<td>2.52</td>
<td>1.94</td>
<td>4.46</td>
<td>7</td>
</tr>
<tr>
<td>Gilamyte--BR224-2B-2-5</td>
<td>2.52</td>
<td>1.31</td>
<td>3.83</td>
<td>9</td>
</tr>
<tr>
<td>BR224-2B-2-5--Gilamyte</td>
<td>1.87</td>
<td>1.94</td>
<td>3.81</td>
<td>10</td>
</tr>
<tr>
<td>Boro-Ratooned Aman</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pajam--Short ratoon</td>
<td>4.88</td>
<td>0.12</td>
<td>5.00</td>
<td>4</td>
</tr>
<tr>
<td>Pajam--Long ratoon</td>
<td>4.88</td>
<td>0.50</td>
<td>5.38</td>
<td>3</td>
</tr>
<tr>
<td>Gilamyte--Short ratoon</td>
<td>2.52</td>
<td>2.19</td>
<td>4.71</td>
<td>6</td>
</tr>
<tr>
<td>Gilamyte--Long ratoon</td>
<td>2.52</td>
<td>1.62</td>
<td>4.14</td>
<td>8</td>
</tr>
<tr>
<td>BR224-2B-2-5--Short ratoon</td>
<td>1.87</td>
<td>1.41</td>
<td>3.23</td>
<td>12</td>
</tr>
<tr>
<td>BR224-2B-2-5--Long ratoon</td>
<td>1.87</td>
<td>1.60</td>
<td>3.45</td>
<td>11</td>
</tr>
<tr>
<td>CV (%)</td>
<td></td>
<td></td>
<td>20.1</td>
<td></td>
</tr>
</tbody>
</table>

All the data are average of three replicates.
Table 2: The influence of splitting tillers compared with intact plants on the yield and duration of BR-11

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Grain yield (t/ha)</th>
<th>Growth duration</th>
<th>Average flowering time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keeping whole plant intact (control) (S₀)</td>
<td>4.22 a</td>
<td>134</td>
<td>31 Oct.</td>
</tr>
<tr>
<td>Splitout all tillers keeping only 2 tillers in the mother hill (S₁)</td>
<td>3.84 a</td>
<td>141</td>
<td>5 Nov.</td>
</tr>
<tr>
<td>Splitout all tillers keeping only 4 tillers in the mother hill (S₂)</td>
<td>4.01 a</td>
<td>140</td>
<td>4 Nov.</td>
</tr>
<tr>
<td>Transplanting of split tillers at 2 tillers/hill (S₃)</td>
<td>3.77 a</td>
<td>142</td>
<td>6 Nov.</td>
</tr>
<tr>
<td>Transplanting of split tillers at 4 tillers/hill (S₄)</td>
<td>4.06 a</td>
<td>141</td>
<td>6 Nov.</td>
</tr>
</tbody>
</table>

CV = 17.5% D/S : 15-7-90  
D/T : 11-8-90  
D/R plant : 11-9-90
Table 3: The influence of splitting tillers compared with intact plants on the yield and duration of BR22 (Transplanted on 7 September)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Grain yield (t/ha)</th>
<th>Growth duration</th>
<th>Average flowering time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keeping whole plant intact (control) (S₀)</td>
<td>4.15 a</td>
<td>133</td>
<td>11 Nov.</td>
</tr>
<tr>
<td>Splitout all tillers keeping only 2 tillers in the mother hill (S₁)</td>
<td>2.75 b</td>
<td>139</td>
<td>17 Nov.</td>
</tr>
<tr>
<td>Splitout all tillers keeping only 4 tillers in the mother hill (S₂)</td>
<td>3.34 b</td>
<td>137</td>
<td>16 Nov.</td>
</tr>
<tr>
<td>Transplanting of split tillers at 2 tillers/hill (S₃)</td>
<td>1.44 d</td>
<td>139</td>
<td>17 Nov.</td>
</tr>
<tr>
<td>Transplanting of split tillers at 4 tillers/hill (S₄)</td>
<td>2.28 c</td>
<td>138</td>
<td>17 Nov.</td>
</tr>
</tbody>
</table>

CV = 12.3% D/S : 1-8-90
D/T : 7-9-90
D/R plant : 7-10-90
Table 4: Effect of severance of tillers on the yield components and yield of BR11 rice
grown at Quasba MLT site (Comilla)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. of panicles per m²</th>
<th>No. of filled grains per panicle</th>
<th>1000-grain weight (g)</th>
<th>Yield t/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grain</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Straw</td>
</tr>
<tr>
<td>T₁ = No severance control</td>
<td>268</td>
<td>89</td>
<td>23.93</td>
<td>3.94</td>
</tr>
<tr>
<td>T₂ = One tiller severed from one hill</td>
<td>264</td>
<td>92</td>
<td>23.93</td>
<td>3.91</td>
</tr>
<tr>
<td>T₃ = Three tillers severed from one hill</td>
<td>246</td>
<td>94</td>
<td>24.07</td>
<td>3.90</td>
</tr>
<tr>
<td>T₄ = Five tillers severed from one hill</td>
<td>240</td>
<td>98</td>
<td>24.27</td>
<td>3.88</td>
</tr>
<tr>
<td>T₅ = Seven tillers severed from one hill</td>
<td>232</td>
<td>105</td>
<td>24.40</td>
<td>3.48</td>
</tr>
</tbody>
</table>

LSD 0.05 33.05 - NS 0.24

NS

Table 5: Effect of the age of seedlings on yield of BR4 rice (T. aman) at experimental farm, 1982-84.

<table>
<thead>
<tr>
<th>Age of Seedling</th>
<th>Yield (t/ha)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>4.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>5.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>4.81</td>
<td>35</td>
<td>4.77</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55</td>
<td>4.59</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75</td>
<td>4.76</td>
</tr>
</tbody>
</table>

Table 6: Impact of supplemental irrigation on yield of T. Aman

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (t/ha)</th>
<th>Percent yield increase over</th>
</tr>
</thead>
</table>

475
<table>
<thead>
<tr>
<th>Planting system</th>
<th>BR 4</th>
<th>Pajam</th>
<th>Nizersail</th>
<th>BR 4</th>
<th>Pajam</th>
<th>Nizersail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfed</td>
<td>2.31</td>
<td>2.69</td>
<td>2.40</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Supplemental Irrigation</td>
<td>3.16</td>
<td>2.90</td>
<td>54.11</td>
<td>16.60</td>
<td>20.80</td>
<td></td>
</tr>
<tr>
<td>Continuous</td>
<td>3.65</td>
<td>-</td>
<td>3.10</td>
<td>59.30</td>
<td>-</td>
<td>25.00</td>
</tr>
</tbody>
</table>

Table 7: Yield (t/ha) of potato as influenced by different planting systems and dates of planting

<table>
<thead>
<tr>
<th>Planting system</th>
<th>Planting date*</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Planting</td>
<td>Second Planting</td>
</tr>
<tr>
<td>P₁ = Surface planting + water hyacinth mulch</td>
<td>14.79</td>
<td>12.44</td>
</tr>
<tr>
<td>P₂ = Hole planting + water hyacinth mulch</td>
<td>15.97</td>
<td>15.37</td>
</tr>
<tr>
<td>P₃ = Furrow planting + water hyacinth mulch</td>
<td>15.74</td>
<td>12.63</td>
</tr>
<tr>
<td>P₄ = Furrow planting + earthing up</td>
<td>10.70</td>
<td>9.52</td>
</tr>
<tr>
<td>Mean</td>
<td>14.28</td>
<td>12.49</td>
</tr>
</tbody>
</table>

* First planting: P₁ and P₂ on November 2 and P₃ and P₄ on November 20
  Second planting: P₁ and P₂ on November 23 and P₃ and P₄ on December 5
  Third planting: All on December 13
Table 8: Effect of method of planting and mulching on potato

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Final emergence (%)</th>
<th>Tuber yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW</td>
<td>88</td>
<td>27.96 b</td>
</tr>
<tr>
<td>SR</td>
<td>85</td>
<td>27.67 b</td>
</tr>
<tr>
<td>HW</td>
<td>94</td>
<td>32.00 ab</td>
</tr>
<tr>
<td>HR</td>
<td>97</td>
<td>33.31 ab</td>
</tr>
<tr>
<td>FW</td>
<td>96</td>
<td>32.32 ab</td>
</tr>
<tr>
<td>FR</td>
<td>94</td>
<td>34.00 ab</td>
</tr>
<tr>
<td>NW</td>
<td>95</td>
<td>30.82 ab</td>
</tr>
<tr>
<td>NR</td>
<td>98</td>
<td>36.67 a</td>
</tr>
<tr>
<td>NEU</td>
<td>96</td>
<td>27.36 a</td>
</tr>
<tr>
<td>CV (%)</td>
<td></td>
<td>9.8</td>
</tr>
</tbody>
</table>

SW: Surface planting with water hyacinth mulch
SR: Surface planting with rice straw mulch
HW: Hole planting with water hyacinth mulch
HR: Hole planting with rice straw mulch
FW: Furrow planting with water hyacinth mulch
FR: Furrow planting with rice straw mulch
NW: Normal tillage with water hyacinth mulch
NR: Normal tillage with rice straw mulch
NEU: Normal tillage with earthing up
**Table 9:** Performance of rainfed wheat under different tillage methods at MLT sites Palashbari and Lalmonirhat

<table>
<thead>
<tr>
<th>Tillage method</th>
<th>No. of Spikes/m²</th>
<th>Grain yield (t/ha)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Palashbari</td>
<td>Lalmonirhat</td>
<td>Palashbari</td>
<td>Lalmonirhat</td>
</tr>
<tr>
<td>Conventional tillage</td>
<td>197</td>
<td>114</td>
<td>1.04</td>
<td>0.99</td>
</tr>
<tr>
<td>Minimum tillage</td>
<td>188</td>
<td>192</td>
<td>1.02</td>
<td>1.00</td>
</tr>
<tr>
<td>Reduced tillage</td>
<td>217</td>
<td>212</td>
<td>1.28</td>
<td>1.07</td>
</tr>
<tr>
<td>Relay</td>
<td>201</td>
<td>199</td>
<td>1.14</td>
<td>1.05</td>
</tr>
</tbody>
</table>

**Table 10:** Performance of different Rabi crops relayed with T. aman rice at Saroil

<table>
<thead>
<tr>
<th>Crop</th>
<th>Variety/Line</th>
<th>Grain yield (t/ha)</th>
<th>Gross return (Tk/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chickpea</td>
<td>Sabur-4</td>
<td>1.02</td>
<td>11698</td>
</tr>
<tr>
<td>Kheshari</td>
<td>3968</td>
<td>0.46</td>
<td>4855</td>
</tr>
<tr>
<td>Lentil</td>
<td>Palena local</td>
<td>0.75</td>
<td>9468</td>
</tr>
<tr>
<td>Linseed</td>
<td>8119</td>
<td>0.34</td>
<td>3326</td>
</tr>
<tr>
<td>Wheat</td>
<td>Sonalika</td>
<td>0.35</td>
<td>2292</td>
</tr>
</tbody>
</table>
Table 11: Yield and yield components of linseed as affected by date of sowing and seed rate at Jamalpur

<table>
<thead>
<tr>
<th>Sowing date</th>
<th>Yield (Kg/ha)</th>
<th>Plant population n/ m²</th>
<th>No. of capsules/ plant</th>
<th>No. of seed/ capsule</th>
<th>Plant height (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 1</td>
<td>350</td>
<td>379</td>
<td>8.54</td>
<td>7.0</td>
<td>51.87</td>
</tr>
<tr>
<td>November 15</td>
<td>270</td>
<td>387</td>
<td>7.32</td>
<td>5.87</td>
<td>49.17</td>
</tr>
<tr>
<td>December 1</td>
<td>167</td>
<td>388</td>
<td>3.13</td>
<td>5.55</td>
<td>40.27</td>
</tr>
<tr>
<td>LSD 5%</td>
<td>51.29</td>
<td>NS</td>
<td>1.85</td>
<td>1.27</td>
<td>NS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seed rate (kg/ha)</th>
<th>Yield (Kg/ha)</th>
<th>Plant population n/ m²</th>
<th>No. of capsules/ plant</th>
<th>No. of seed/ capsule</th>
<th>Plant height (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>255</td>
<td>331</td>
<td>7.44</td>
<td>6.33</td>
<td>46.51</td>
</tr>
<tr>
<td>25</td>
<td>259</td>
<td>373</td>
<td>6.04</td>
<td>6.17</td>
<td>46.97</td>
</tr>
<tr>
<td>30</td>
<td>274</td>
<td>401</td>
<td>5.53</td>
<td>5.92</td>
<td>47.85</td>
</tr>
<tr>
<td>ISD 5%</td>
<td>NS</td>
<td>45</td>
<td>1.55</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>
## Table 12: Agroeconomic performance of winter crops under difference methods of planting/sowing at Kurigram, 1988-89

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (t/ha)</th>
<th>Gross benefit (Tk/ha)</th>
<th>TVC (Tk/ha)</th>
<th>Gross Margin (Tk/ha)</th>
<th>Benefit cost ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize (Broadcast followed by 1 plough and 1 laddering)</td>
<td>2.96</td>
<td>12580</td>
<td>4935</td>
<td>7645</td>
<td>2.54</td>
</tr>
<tr>
<td>Maize (Dibbling without ploughing)</td>
<td>3.34</td>
<td>14195</td>
<td>5545</td>
<td>8559</td>
<td>2.56</td>
</tr>
<tr>
<td>Mustard (Broadcast-1 plough 1 laddering)</td>
<td>0.39</td>
<td>3900</td>
<td>3492</td>
<td>408</td>
<td>1.11</td>
</tr>
<tr>
<td>Potato (Row planting with straw mulch)</td>
<td>14.6</td>
<td>29200</td>
<td>15492</td>
<td>13708</td>
<td>1.88</td>
</tr>
<tr>
<td>Potato (Furrow planting with mulch)</td>
<td>13.6</td>
<td>27200</td>
<td>14587</td>
<td>12613</td>
<td>1.86</td>
</tr>
<tr>
<td>Wheat (Furrow planting)</td>
<td>2.38</td>
<td>11900</td>
<td>5590</td>
<td>6310</td>
<td>2.12</td>
</tr>
</tbody>
</table>

## Table 13: Performance of maize intercropped with pulses in untilled soft soils after receding of flood water, FSR site Kanaipur, Faridpur, 1988-89

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Grain yield (t/ha)</th>
<th>Straw yield (t/ha)</th>
<th>TVC (Tk/ha)</th>
<th>Gross return (Tk/ha)</th>
<th>Gross Margin (Tk/ha)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sole maize</td>
<td>3.36</td>
<td>7.10</td>
<td>4559</td>
<td>20444</td>
<td>15885</td>
<td>4.48</td>
</tr>
<tr>
<td>Sole blackgram</td>
<td>0.33</td>
<td>1.12</td>
<td>2490</td>
<td>4108</td>
<td>1618</td>
<td>1.65</td>
</tr>
<tr>
<td>Sole mungbean</td>
<td>0.32</td>
<td>1.07</td>
<td>2420</td>
<td>5702</td>
<td>3282</td>
<td>2.35</td>
</tr>
<tr>
<td>Maize + blackgram</td>
<td>3.1+</td>
<td>6.80+</td>
<td>5050</td>
<td>22165</td>
<td>17115</td>
<td>4.39</td>
</tr>
<tr>
<td>Maize + mungbean</td>
<td>3.16+</td>
<td>6.81+</td>
<td>5060</td>
<td>23551</td>
<td>18491</td>
<td>4.65</td>
</tr>
</tbody>
</table>

Price:
- Maize grains : Tk 4.00/kg, straw Tk 1.00/kg
- Blackgram grains : Tk 10.00/kg, hay Tk 0.70/kg
- Mungbean grains : Tk 15.00/kg, hay Tk 0.80/kg
### Table 14: Yield and economics of potato intercropped with sugarcane under different mulch material

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield of intercrop (Tk/ha)</th>
<th>Yield of cane (Tk/ha)</th>
<th>Total variable cost (t/ha)</th>
<th>Gross Margin (Tk/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No mulching</td>
<td>10.85</td>
<td>106</td>
<td>47,000</td>
<td>1,37,654</td>
</tr>
<tr>
<td>Rice straw mulch</td>
<td>12.69</td>
<td>115</td>
<td>48,000</td>
<td>1,52,102</td>
</tr>
<tr>
<td>Water hyacinth</td>
<td>13.04</td>
<td>113</td>
<td>48,000</td>
<td>1,51,169</td>
</tr>
<tr>
<td>Sugarcane trash</td>
<td>10.76</td>
<td>110</td>
<td>47,500</td>
<td>1,46,311</td>
</tr>
</tbody>
</table>

### Table 15: Agronomic performance of the crops grown in Sorjon method at Labukhali, 1990-91

<table>
<thead>
<tr>
<th>Crops</th>
<th>Place of planting</th>
<th>Area m²</th>
<th>Sowing date</th>
<th>Harvest date</th>
<th>Yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amaranthus</td>
<td>on bed</td>
<td>4</td>
<td>8-4-90</td>
<td>8-6-90</td>
<td>33.75</td>
</tr>
<tr>
<td>Bittergourd</td>
<td>on bed</td>
<td>8</td>
<td>6-4-90</td>
<td>19-8-90</td>
<td>4.29</td>
</tr>
<tr>
<td>Indian spinach</td>
<td>on bed</td>
<td>4</td>
<td>20-3-90</td>
<td>12-6-90</td>
<td>27.5</td>
</tr>
<tr>
<td>Okra</td>
<td>on bed</td>
<td>4</td>
<td>28-2-90</td>
<td>8-6-90</td>
<td>11.82</td>
</tr>
<tr>
<td>Country bean</td>
<td>on edge</td>
<td>10</td>
<td>29-8-90</td>
<td>23-2-91</td>
<td>20.10</td>
</tr>
<tr>
<td>Banana</td>
<td>on bed</td>
<td>20</td>
<td>6-4-90</td>
<td>9-4-91</td>
<td>212500 pc</td>
</tr>
<tr>
<td>Sweet gourd</td>
<td>on bed</td>
<td>10</td>
<td>6-4-90</td>
<td>30-7-90</td>
<td>3.5</td>
</tr>
<tr>
<td>Cucumber</td>
<td>on bed</td>
<td>10</td>
<td>6-4-90</td>
<td>24-6-90</td>
<td>2.25</td>
</tr>
<tr>
<td>Lalshak</td>
<td>on bed</td>
<td>10</td>
<td>24-10-90</td>
<td>24-12-90</td>
<td>4.85</td>
</tr>
<tr>
<td>Spinach</td>
<td>on bed</td>
<td>10</td>
<td>24-10-90</td>
<td>11-12-90</td>
<td>9.43</td>
</tr>
</tbody>
</table>
Table 16: Agronomic and economic performance of jute-radish-potato + red amaranthus + sweet gourd cropping pattern against farmers’ pattern under rainfed conditions in 1989-90.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Existing cropping pattern</th>
<th>Alternative cropping pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop</td>
<td>Jute-Fallow-Potato</td>
<td>Jute-Raddish-Potato+ Lalsak + S. gourd</td>
</tr>
<tr>
<td>Variety</td>
<td>0-4 (Local)</td>
<td>Falguni-Tasaki-Dimont, Altapali + Local</td>
</tr>
<tr>
<td>Yield (t/ha)</td>
<td>1.86 - 10.12</td>
<td>2.64 8.95 27.40+12.33+30.0</td>
</tr>
<tr>
<td>Gross return (Tk/ha)</td>
<td>17226  35420</td>
<td>27060  26820  66050</td>
</tr>
<tr>
<td>BCR</td>
<td>1.21</td>
<td>2.17</td>
</tr>
</tbody>
</table>

Table 17: Agro-economic performance of cropping pattern B. Aus - T.Aman - Chickpea.

<table>
<thead>
<tr>
<th>Cropping pattern</th>
<th>Crop-I</th>
<th>Crop-II</th>
<th>Crop-III</th>
<th>Yield (t/ha)</th>
<th>Gross return (Tk/ha)</th>
<th>Net return (Tk/ha)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.Aus-T.Aman-fallow (F)</td>
<td>1.72</td>
<td>3.08</td>
<td>-</td>
<td>35234</td>
<td>11229</td>
<td>2.25</td>
<td></td>
</tr>
<tr>
<td>B.Aus-T.Aman-Chickpea (FA)</td>
<td>2.45</td>
<td>2.59</td>
<td>1.06</td>
<td>37588</td>
<td>16171</td>
<td>2.32</td>
<td></td>
</tr>
</tbody>
</table>

Table 18: Yield and economic analysis of different crops grown in the fallow period

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield (t/ha)</th>
<th>Variable cost (Tk/ha)</th>
<th>Gross return (Tk/ha)</th>
<th>Net return (Tk/ha)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lalshak</td>
<td>6.58</td>
<td>2250</td>
<td>23860</td>
<td>21610</td>
<td>9.6</td>
</tr>
<tr>
<td>Mungbean</td>
<td>0.75</td>
<td>1172</td>
<td>14960</td>
<td>13788</td>
<td>11.76</td>
</tr>
<tr>
<td>Tasaki mula</td>
<td>5.66</td>
<td>3690</td>
<td>28275</td>
<td>24585</td>
<td>6.66</td>
</tr>
</tbody>
</table>

Table 19: The yield of Mukhi Kachu and soil erosion as affected by different tillage and mulch in hill slope, 1990
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Comn yield (t/ha)</th>
<th>Dry weight of eroded soil (t/ha)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>at 90 days</td>
<td>at 105 days</td>
</tr>
<tr>
<td>Tillage level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zero tillage</td>
<td>17.0</td>
<td>14.7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9.3&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Furrow only</td>
<td>14.8</td>
<td>10.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>12.1&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Conventional tillage</td>
<td>15.9</td>
<td>24.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.0&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Mulch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface mulch</td>
<td>20.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>15.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8.4&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>No-surface mulch</td>
<td>11.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>23.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.6&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
Sustainable Practices of Crop Disease Management in Traditional Farming System of Arid and Semi-Arid Rajasthan

Arun Kumar

Introduction

The arid zone covers about 12 per cent of the country’s geographical area, and 61 per cent of Rajasthan. Eleven western districts of the state come within this zone. Agriculture is a struggle against inhospitable nature in most part of the state due to low and erratic rainfall; poor soil conditions, frequent droughts, etc. high-speed winds and crop disease complete the dismal picture.

Advances in agricultural science have brought about a welcome change. High yielding varieties were employed with higher rates of inputs like fertilizers and pesticides. This has resulted in a phenomenal increase in pesticide consumption in the last decade. Cotton, oil seeds, vegetable, species and pulses are the major pesticide consumers. This has led to environmental degradation.

There is, therefore, an urgent need for stable, resilient and efficient alternative to safeguard the ecosystem. It sounds logical to search for some traditional practices for managing crop diseases. It is necessary to document farmer’s practices, and disseminate the information to the farmers after due assessment and refinement. Traditional methods of disease management, such as prevention, protection, exclusion along with practices like fertilization and crop rotation have helped the growers to maintain plant health (Raychoudhuri, 1964 and Thurston, 1990). As little information is available on such sustainable disease management practices in literature, an attempt was, therefore, made to collect and document such practices. To start with farmers belonging to the Barmer, Jodhpur, Pali, and Jaipur districts were contacted.

Traditional Farmers’ Knowledge

75 Central Arid Zone Research Institute, Jodhpur-342 003, India
A large number of activities concerning crop diseases and their management were documented. They included a combination of religious faith, social values and beliefs. Some of these practices are discussed below:

1. **Traditional Fungicides:**

1.1 Ashes (Farmers call it 'Lichhmi’) are frequently used as a fungicide. Ash from the kitchen fire is saved to dust crops to prevent fungal infections in desert areas.

1.1.1 Ten days old pearl millet flour and ash are mixed in a ration of 1:4 and the cumin crop is dusted before flowering to avoid infection of powdery mildew in Pali district.

1.1.2 Farmers dust the ash (@50-60 kg/ha) on the growing crop of lucerne to check the growth of dodder (*Cuscuta* sp.) in Jaipur district. Presently the farmers are using a mixture of ash and common salt (1:1) for better control.

1.1.3 Ash (2-3 kg.) is mixed with castor oil (0.7-0.8 kg). This mixture is spread on the seedbed of cotton (0.01 ha) to control ‘damping-off’ disease.

1.1.4 Farmers dust the ash @ 50-60 kg/ha on mustard crop to prevent it from diseases like white rust, downy mildew and powdery mildew.

1.1.5 A spoonful of 'Hing’ (Asafoetida) powder is put on the lower rotted portion of bottle gourd vine with fine cloth bandage around it to prevent rotting.

2. **Biological Control:**

2.1 Farmers have used biological control methods by developing suppressive soils and using antagonistic plants.
2.1.1 Some farmers of Jodhpur district add copious amount of organic matter (FYM @ 10-25 t/ha) in chilli fields to encourage the microbial antagonists.

2.1.2 In Pali district, extracts of bark of mesquite (Prosopis juliflora) and Aanwal (Cassia aruiculata) is used to spray the chilli crop to provide protection against diseases like leaf-curl, powdery mildew and leaf spots.

3. **Organic Soil Amendments:**

3.1 Farmers of Jaipur district collect the leaves of 'Besharam' (Ipomoea iloba) and 'Aak' (Calotropis sp.) and stems of 'Kheenp' (Leptadaenia pyrotechnica) in a pit after cutting and chaffing. They add ash, common salt, animal dung, livestock urine and excreta of bat and birds to it.

The material is allowed to rot for 2-3 months. Completely rotted manure thus obtained is mixed with irrigation water and applied to onion, garlic, and chilli crops at the time of vegetative growth for enhancing crop vigour and protection from diseases and pests.

4. **Cultural Practices:**

4.1 *Multiple Cropping:* In arid areas, traditionally ‘mixture’ sowing is practised. Seeds of pearl millet are sown with rainy season legumes (mungbean, mothbean and cluster bean) and sesame in the ration of 7:1. Besides this some farmers also grow cucurbits (melons, Citrullus spp. etc.) in addition to legumes. This practice is used to minimise the crop losses due to onset of drought or pests and diseases.

4.2 *Fallowing:* In desert areas crops are not grown in a fallowed field for 2-4 years. Besides, agronomic benefits fallowing also helps in reducing losses from plant disease. However, the practice is becoming less popular among young farmers because of shrinking land resources.
4.3 *Crop Rotations*: Growing economic plants in recurring succession and in definite sequence on the same land is a common practice in this part of the country.

4.3.1 In some pockets of Barmer district, there are double cropped areas with sprinkler irrigation facilities. Here the farmers cultivate cash crops like ‘Jeera’ (cumin) and ‘Isabgol’ (*Plantago ovata*) in rabi season. In cumin crop, there is a serious problem of wilt caused by *Fusarium oxysporum*. Farmers are practising rotations with mustard and wheat in rabi and with pearl millet during rainy season to reduce the incidence of wilt.

4.4 *Flooding*: Flooding has been used for insects and weed management. It has been noted that fungi, bacteria and actinomycete populations decline in flooded soils. The anaerobic or near anaerobic conditions produced by flooding are known to reduce populations of many fungal, nematode and soil pathogens (Baker and Cook, 1974).

In Pali district, the cotton crop was severely affected by sooty mould caused by *Leptoxiphyium fumago* and *Vermiculariopsiella* sp. growing on leaf secretions of some insect (Kumar, 1995). An innovative farmer flooded the field even in rainy days to suppress the fungal attack. He claimed to have successfully eliminated the disease from the cotton field using this practice.

**Conclusions**

Many of the practices used by the traditional farmers are sustainable and effective. Efforts are needed to thoroughly understand the prevailing farming systems. Farmers have evolved their own system of managing diseases and pests through trial and error from the ancient time. If scientific investigations are undertaken to support their own methods (or to discard them as baseless rituals) it would indeed be useful for marginal farmers particularly in desert regions.

**Acknowledgements**
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Creativity and Innovations of Ancient Mankind in Tackling Pest Problems in Agriculture

Prof. P. Narayanasamy

Introduction

After an arduous struggle for sustenance, man took the first step to civilization by domesticating animals and plants. The latter had a much greater significance as man had to stay at a given place to reap the produce after sowing. Subsequently farm communities have developed innumerable ways of obtaining food and fibre (Ranjit Pratap Singh, 1990; Ray Chaudhury and Mira Roy, 1993; Narayanasamy, 1996). Ancient man developed several devices and techniques to grow crops and store the food produce without any pest problems. Such pest control techniques date back to prehistoric, protohistoric and historic periods.

An attempt has been made here to highlight some of the creativities and innovations relating to pest control in agriculture during the three periods.

Plant Protection in Ancient Agriculture

Plants are subject to destruction by harmful agencies. The destructive factors were known in India as ‘itis’, ‘avagrahas’ or ‘utpatats’ for which propitiatory rites were performed. Insect, bird and beasts, weeds, diseases, unfavourable climatic conditions and environmental defects were the causes that destroy plants.

Chemical and non-chemical methods were mentioned to protect crops. The former include pesticides and the latter consists of methods were also employed to ward off the pests by scarecrows. Prevention of pests by the application of formulae was, however, an important feature of the remedial measures (Ray Chaudhury, 1964; Randhawa, 1980).

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Neolithic and early chalcolithic periods do not provide ideas about plant protection. There is evidence of mixed cropping in Kalibangan during pre-Harappan period, which diverted the attention of insects from a particular crop.

The following is an account of noxious pests in different periods of history and the remedial measures taken against these hazards (Ray Chaudhury, 1964; Randhawa, 1980; Ramamurthy, 1995; Chandrakanth and Basavaradhya, 1995).

**Pre-History**

The prehistoric agricultural practices are marked by some basic ideas. The early crops comprised rice in mesolithic period and wheat, barley, rice, millets and legumes in different phases of neolithic period. Hoeing, dam and terrace irrigation and grain storage were practiced in the neolithic period.

**Protohistory**

1. **Vedic Chalcolithic Period**

The period is characterized by a limited knowledge about pest and the preventive measures. Birds were the main infectors of grains. They were driven away by din and noise. Secondly, rotation of crops, as evident in the ‘Yajurveda’ ensured warding off the pests.

2. **Iron Age**

The Atharva Veda (100 B.C.) gives details of different pestiferous agents that infest grain in the field and unfavourable natural phenomena that harm crops. Pests like borers, locusts, rodents, reptiles and natural factors like lightning and sun were encountered during this period. These grain-infesting pests were dealt by driving them away from the field.
3. Later Vedic Period

Spreading leaf after furrowing and burying several plant substances in the fields before sowing checked weeds associated with wheat plants.

Historic Period

1. Early Historic Period

A number of chemical and non-chemical substances, traps and cages were used as protective measures against crop pests. The period witnessed pests like insects, birds like parrots and hawks, rats and rodents, herds of deer, wild animals and crocodiles and natural phenomena like rains, drought and hailstorms. Crops like cereals, vegetables, roots and fruits were raised during this period.

Following are the methods of prevention and remedies taken.

a. Application of vegetable poison from *Calotropis gigantea* and secret mixture in case of insects, birds and rats.

b. Mechanical devices like traps, cages, secret pita and scarecrows for the swarms of birds, deer, animals and crocodiles were used.

2. Mid Historic Period

Special features of this period include pests, and plant diseases as given in “Vrksayurveda”, detection of numerous causes of plant diseases and their remedies, astrological forecast on crop damage under natural factors, punishment for negligence in crop protection and recognition of some plants and insect killers.
Various pest forms comprised insects (locusts, caterpillars, ants) parasites (bacteria, nematodes), birds (pigeon, sparrow, parrot) and beasts (wild animals, deer, hare, etc.).

The pests were tackled chemically by applying several pesticidal substances through vegetable and animal products. Plants like Palas (*Butea frondosa*) and Asoka (*Asoka indica*) were used as insect resistant plants.

Diseases transmitted by insects and worms were cured by (i) trimming/scraping off the affected parts followed by the application of medicines of different preparations and (ii) plastering, fumigation and several occasions spraying of medicines of different compositions. The important healing substances were Vidanga (*Embelia ribes*) and oil cake of white mustard among vegetable substances and milk and cow dung among animal products.

**Preservation of Grains**

1. **Harappa Chalolithic Period**

The Indus Civilisation granaries are characterized by their well built body of baked brick having arrangement to keep the granaries in compartments built over platforms, well ventilated to prevent pests and mildew.

2. **Mid Chalcolithic Period**

Pit silos and round mud platforms for storage characterized granaries.

3. **Mid Historic Period**
a. Granaries were stored in receptacles made of straw and leaves with the inside floor space coated with cow dung. The receptacle was sealed with cow dung and kept in suitable place, screening with a screen of straw and bamboo.

b. Seeds were preserved in granaries made of earth straw and bamboo standing on pillars. The upper storey of the house covered with lid coated with cow dung, coated with mud all over, closed and sealed with earthen rods.

c. In the later part of this period, storage of grains in well-built granaries provided with all necessary amenities for the protection of grains had been described in *Viswakarma Vastu Sastra*.

**Crop Husbandry**

a. Twin crop system (mustard and horse gram) is presumed from the diagonal and horizontal furrow lines detected in a ploughed field of Kalibangan (2450-2300 B.C.). This occurred during the pre-Harappan chalcolithic period of protohistoric times.

b. During Vedic chalcolithic and Iron Age, furrows were made in grid pattern of crop was adopted.

c. Rotation of crops was adopted.

**Conclusions**

The early man has carved a niche for himself by developing in utilizing various kinds of pest control methods to produce and preserve food for his future needs. His skills and intelligence are very much evident in the way he practiced agriculture, particularly mixed cropping, crop rotation and pest and diseases control.

At Kalibangan in Rajasthan, the archaeologists have laid bare the earliest ploughed field so far noted anywhere in the world. Ascribable to the first half of the third millennium B.C., it shows a grid
pattern of furrow marks. It is interesting to note that this pattern of ploughing continues even to this day in Rajasthan, Haryana, Punjab and Western Uttar Pradesh where mustard and horse gram are grown respectively in the two sets of furrows which is called mixed cropping. This technique keeps the pests away from the target crops as each will be unpalatable to the pest that infests a crop.

Thus, the ancient traditional farm practices and techniques have tremendous scope for us even today.

Summary

Techniques of plant protection developed the ancient period have met with modifications to curb the pests problems. It is clear that the ancient man, with his ability and skill, was successful in raising crops in the field and in storing the food grains for his future use without spoilage by the pests. A narration of plant protection practices of the yesteryears has been attempted.

Acknowledgements

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Local Wisdom in Veterinary Medicine

L.S. Chahar, R.S. Chhillar, Lakhan Singh and D.U.M. Rao

Livestock are an integral farm resource in sustainable agriculture. Farmers have over the years developed simple and working methods of treating their cattle and buffaloes for common ailments and diseases.

The pioneering effort of Professor Y.P. Singh and his student, Mr. M.R. Verma, in 1960, to document the veterinary medical practices of Gujjars (nomadic pastoralists of north-west India) is laudable.

We, in our villages, have been using some simple methods for treating a) retained placenta, b) maggot infestation of wounds, c) Indigestion/ anorexia of unknown origin, and d) foot rot, with the use of on-farm resources like colostrum milk, linseed and locally available plants (ajwain, hulhul, Lantana, aak, etc). All these practices have been in use by farmers of our villages - viz., Beri Chahar Nagla Sikarw, Garhi Vichitra of Agra district, Uttar Pradesh, India - for a long period. The practices are described here in detail along with a note on the scientific reasoning behind each practice.

A. Retention of Placenta

Retained placenta after the delivery of a calf is a serious problem in cows and buffaloes. If the placenta is not dropped within a few hours of parturition, it may result in uterine infections, leading to decreased milk yield and future breeding problems for the affected animals. Such septic uterine infections may lead to serious sickness or even death of the animal in cases of septicemia.

Treatment:

The farmers, some of which are described below, have practiced several local treatments:

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78 Veterinary Scientist, IARI, New Delhi 110 012
79 Research Scholar (Agriculture Extension), IARI, New Delhi 110 012
80 Scientist, IARI, New Delhi 110 012
1. **Plant leaves:**

Feed and animal about 2 kg leaves of pipal (*Ficus religiosa*) or bamboo (*Dendroclamus strictus*) or sugarcane (*Saccharum officinarum*), whichever is easily and locally available. It is believed that placenta will be dropped within a few hours of such feeding.

Scientific reasoning: These leaves may enhance some oestrogenic activity, besides providing energy. Oestrogen is a hormone that aids contractions, which may help in dropping the placenta. The young leaves of bamboo have been found to act as stimulant febrifuge and also used as an emmenagogue, i.e., a substance that stimulates menstrual flow (Chopra *et al.*, 1982:305). Leaves of pipal can be used as purgative and fruits as laxative and alterative (that which helps the animal to recover gradually (George & Pandalai, 1949:169).

2. **Colostrum:**

One to two litres of colostrum milk of the same buffalo/ cow may be fed to the animal. Within a few hours, placenta will be dropped. The farmers have standardized this after several years of trial and error. Colostrum has been found to possess laxative properties. It is rich in antibodies and develops immunity against many diseases when fed to the animal or the newly born calf. Colostrum has a high nutritive value and is rich in iron, calcium, vitamin B complex and energy.

Scientific reasoning: Dairy animals experience post-delivery weakness due to heavy secretion of milk/ colostrum rich in many minerals like calcium, phosphorus, magnesium, iron, etc, leading to lower blood levels of these minerals in their body. This causes general weakness of the smooth muscles including the uterine muscles, resulting in retained placenta. Feeding of fresh milk (colostrum) rich in minerals and energy may help to some extent to drop the placenta.

3. **Plant seeds:**
About 50-100 grams of the seeds of Linseed (*Linum usitatissimum*) or *ajwain* (*Carum capticum*) are boiled in two litres of water and the boiled decoction is fed to the animal.

Scientific reasoning: Linseed and *ajwain* may have some effect on uterotonics. Linseed is also an energy source. It has demulcent property of soothing irritated or inflamed mucous membrane, including that of the uterus. *Ajwain* is much valued for its antispasmodic stimulant, tonic, carminative, febrifuge and diuretic properties. It is used for increasing the excretion of urine, for expelling gas from the stomach and intestines, and also for reducing fever.

### B. Indigestion/Anorexia of unknown origin

Anorexia is a general problem in cattle and is first noticed when animal becomes off-feed. Most of the diseases/ailments begin with loss of appetite and a tendency for constipation. The animal stops rumination, leading to indigestion. Sometimes, there may be inflammation of intestine or there may be acute constipation leading to symptoms of abdominal pain.

Treatment:
Seeds of *hulhul* (*Cliome icosandra* of family Capparidaceae) is mixed with *gur* (jaggery). This mixture is fed to the animals for controlling stomach pain. It is a well-tested treatment for relieving animals from stomach pain and the resulting loss of appetite.

*Hulhul* is a rainy-season weed. The seeds are small, dark brown or black, and granular. They are reported to have rubefacient, vesicant and anthelmintic properties. They resemble mustard seeds. It is a widely distributed sticky herb with yellow flowers with a strong penetrating odour. The leaves are rubefacient, vesicant and sudorific. The seeds are occasionally used as condiment in curries. A poultice made from *hulhul* seeds is efficacious as a counter irritant in chronic painful joints.

Sometimes, the leaves of *hulhul* are used to treat toothache in people. A few drops of leaf extract give relief from toothache and ear pain.
Scientific reasoning: There may be some painkiller in the leaves and seeds of the plant. *Hulhul* is anthelmintic (ejecting or killing gastro intestinal worms), and has stomachic, anti-inflammatory and rubefacient properties.

**C. Foot Rot Control**

This is a serious problem in cattle. Lesions appear on skin immediately above the hooves, and due to pain the animal is unable to bear its weight or move. This is also the starting symptom of the contagious viral disease among bovine population, which is usually referred to as foot and mouth disease (FMD). If the ailment is timely attended, chronic laminitis develops gradually which may affect the animal for long periods. Continuous moisture/ mud on the feet of animals is a pre-disposing factor that causes and exaggerates the problem of foot rot.

Treatment:

*Use of petrol drops:*

First clean the hooves by washing. Apply 2-3 drops of petrol on the infected hooves thrice a day. This treatment should be followed for three days till the animal gets relief from the foot rot disease. It may also be equally effective in foot and mouth disease (FMD) for the healing of wounds in hooves.

Scientific Reasoning: Petrol dries off soon to form a protective layer on the infected hooves and keep the feet dry. Petrol is also a fly repellent, preventing wounds from maggot infestation and it prevents further spread of the infection to other animals. Oily surface prevents infection. Petrol has a scorching effect on the open and rotting part of the body and hence may heal the wound.

**D. Maggot/ germs infection of wounds**
Sometimes, animal’s wounds get infested with germs/maggots. The open and infected wounds attract flies which lay their eggs that hatch into maggots. These in turn feed on musculature of affected body part. In such cases, continuous bleeding from the wound is always evident.

Treatment:
Farmers of these villages, on finding the maggots on animals’ wounds, feed the animals with a few locally available plant leaves to treat them. However, heavy feeding with such leaves should always be avoided and dosage has to be specific. Many times decoction of leaves and fruits of these plants are used as a lotion for local treatment of wounds.

1. **Lantana camera**:

In such maggot infestations, about 50 grams of leaves of *Lantana camera* (family: Verbenaceae) may be fed to the animal. Germs/maggots will die.

Scientific Reasoning: *Lantana camera* is one of the most common weeds. *Lantana camera* is an American plant, which has run wild in India and growing luxuriantly throughout the country. It is a hairy, unarmed to slightly prickly shrub. The plant is found to contain a quinine-like alkaloid, lantenine, with antipyretic and antispasmodic properties. The alkaloid may also have germicidal properties. The plant is found to catch fire and burns easily even when it is green. The plant is considered vulnerary, diaphoretic, carminative, and antispasmodic. It is commonly used in treating human beings for fistulae, pustules and tumors.

Pounded leaves are applied on cuts, ulcers and swellings. A decoction of leaves and fruits is used as a lotion for wounds. An infusion of flowers is given as pectoral for children. In the Philippines, a decoction of fresh roots is used as a gargle for tooth ache (Kirtikar and Basu, 1935, quoted in WOI I:186).

2. **Calotropis gigantea**:
Leaves of *aak* or *madar* or milkweed (*Calotropis gigantea* L.) are fed to the animal having maggot/germs infestation. Then maggots drop down from the affected parts. Milkweed leaves may be fed in between bread pieces, as animals do not like Milkweed. Crushed Milkweed leaves can be tied on the infested body part of animal.

Scientific Reasoning: Milkweed or aak is a common Indian shrub bearing unscented pale purple or white flowers with spreading corolla lobes. All the parts of the plant, viz., bark, leaves, flowers, roots and milk (plant sap or latex) are used in treating several ailments. Leaves contain large quantities of white milk or sap. This sap or juice is caustic when applied to unbroken skin or mucous membranes. The milky juice is regarded as a drastic purgative. Hindu physicians consider the root bark as a valuable remedy in skin disease, enlargement of abdominal viscera, intestinal worms, cough, ascites, etc. (Chopra, *et. al.*, 1982:305). Milkweed has emetic property. Forcing *madar* juice down the throat is a common method of infanticide employed by castes among which female infanticide prevails. It is also given internally or applied locally to procure abortion.

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Technology and the Indian Artisan
S.S. Solanki81

Introduction

During the period of almost half a century, since India attained independence from British rule, the country has put in massive efforts towards modernization, aimed ultimately at raising the living standard of her teeming millions. The thrust has been focused primarily at modernization of industrial and agricultural practices. Notable gains have been made on both the fronts. There has, however, been a continuing and growing realization of one major lacuna in these efforts. The impact of modernization has by and large failed to percolate down to a prominent segment of the rural economy - the unorganized sector of artisans.82 For a variety of reasons, a majority of these artisans have continued to persist with traditional tools and practices with adverse consequences for themselves as well as for the rural economy. The implements made by these artisans fail to stand in competition with their machine-made counterparts.83 Thus, over the years, the artisans’ financial position has been declining, and they are discarding their professions in large numbers. This is imposing a serious imbalance in the rural social, cultural and economic structures on the one hand and creating a big social group seeking newer avenues of employment in the organized sector on the other. There is, therefore, obvious need for a critical look at the gamut of issues relevant to this major social and economic problem.

A look at the overall developmental processes that have been operative in India over the past 49 years reveals that a plethora of modern and appropriate technologies of special relevance to various segments of the rural sector have been developed. A basic flaw has been that these outcomes of the R&D system have by and large failed to filter down to the level of artisan in the unorganized sector. In the process, he has been largely ignored. No worthwhile efforts have been made to involve him in

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the evolutionary process and to make him a component of the newer linkages that have emerged in place of the age-old linkages that pervaded the rural environ.

Artisans and Rural Society

The artisans are an essential link in the traditional village economy of India. It was the artisan who contributed considerably to the development of techniques for making bullock carts, chaff cutters, ploughs, agricultural tools and equipment, houses, clay pottery, wells, etc. Such techniques, emanating from indigenous skills, were duly accepted by the rural masses, because the artisans had fully involved themselves in the development of traditional technologies. They received encouragement from the fellow villagers who had confidence in them and in their ability to execute the required jobs⁸⁴.

Almost every evening, the users of artisans’ technologies used to visit the artisans’ workplace and discuss with them their experiences and the modifications they needed in particular technologies. On the basis of experience and realization of the needs of users, the artisan would make the needed modification. The linkages operative in the traditional approach are depicted in Model 1.

Model 1: Linkages of Traditional Technology

This was a regular feature of the rural society in the past. For successful adoption of new technologies in the rural areas, it is necessary not only to provide financial support for S&T activities but also to establish strong links among various segments of the society. The basic lacuna has been that in almost all development programmes, the rural artisans are not given their due place. They are considered as a routine and unimportant component of the production systems. R&D institutions and central and state government agencies responsible for the generation of modern technologies and their transfer to the rural masses for their socio-economic development have the normal tendency to liaise with only resourceful and wealthy persons in the village society for the purpose of transferring modern technology.

In the currently prevalent approach, depicted in Model 2, no permanent linkages are established between the taker of the technology and its developer, once the technology is handed over the user.

**Model 2: Linkages of Modern Technology**
As a result, today most of India’s artisans are struggling for survival\textsuperscript{85}. Many have given up, and moved away from their traditional occupations. Others cling on desperately, not knowing what else to do or whom to turn to. Their skills, evolved over thousand of years, are getting dissipated and blunted. The progeny are neither willing nor able to carry on the family tradition, and a rich culture is on the verge of extinction.

There is ample scope for improving the traditional skills of artisans through the application of modern technologies. There is woeful lack of application of new technologies in rural areas, which reduces the effectiveness of science and technology in tackling the economic, cultural and social problems that stalk rural India\textsuperscript{86}.

**Signs of Change in the Rural Scenario**

Notwithstanding the dismal picture depicted above, there are indications of a new positive trend emerging on the rural horizon. Blessed with an inherent capability to innovate, a small segment of the artisan community has begun to show signs of escaping the cocoon of tradition and facing squarely the situation imposed by the onslaught of modern technology. There are an increasing number of instances in which the artisans and town technicians are taking the initiative by offering innovative solutions with the help of users for various types of problems faced by the rural community.

Broad details of five case studies conducted by the author are given below as illustration of this welcome change.

**Case 1**


Pottery has been a centuries old traditional activity in almost all villages in India. A vast majority of potters in the unorganized sector are still working manually or with the traditional potter’s wheel for manufacturing pottery items and other articles needed in or outside the village. The traditional potter’s wheel requires extensive manual labour and has a very low production capacity. Many organizations and agencies in both public and private sectors have made efforts to improve the traditional potter’s wheel. As a result, some improved versions of the wheel-electrical and non-electrical-have been developed and have been adopted by some resourceful potters in the villages. However, the improved wheels have by and large failed to reach the poor and needy potters. There are three reasons for this. Firstly, being costly, they are beyond the purchasing capacity of most of the potters. Secondly, it is difficult for the village artisans to get them repaired in the villages and thirdly, in most of the villages electricity is not available most of the time.

The author got an opportunity to visit the workplace of a small entrepreneur potter at Thiruvananthapuram (Kerala). He was excited on seeing four electrically operated wheels in the small work shed of the potter. In response to the enquiry as to how and from where he had acquired these wheels, he informed that initially he got two improved wheels made by one of the recognized firms through Khadi and Village Industry Commission (KVIC), but he faced a lot of problems with these wheels, particularly for their repair and maintenance. No mechanic/ artisan in the area possessed the capability to repair the wheels when something went wrong with them.

Further, the firm, which manufactured the wheels, did not allow the potter entrepreneur to get them repaired by a local artisan or technician. It was incumbent on the potter entrepreneur to report to the concerned firm for getting the needed repairs or adjustments done. He had to wait for months for the firm to send someone to repair the wheels. This difficulty prompted him (entrepreneur) to approach the local artisans and technicians to enquire whether they were in a position to manufacture a wheel of the improved type for him. Fortunately, the artisans and technicians gave a positive response and agreed to make a prototype wheel to his satisfaction, if some finance was made available to them. On getting the finance, they took a month to prepare a model of the wheel and handed it over to the potter for testing. After testing the wheel, he felt the need for some modifications as per his needs. The local artisans put in hard work to effect the needed modifications to the satisfaction of the potter.
entrepreneur. The final version of the wheel is giving satisfactory performance. It is low cost, has high productivity and can be manufactured and repaired by local artisans in the villages or nearby towns.

Case 2

During the past few decades, Kirloskar diesel engine has become increasingly popular in rural areas for irrigation purposes. The present cost of the engine is about Rs.20,000. Most of the farmers make use of this engine for irrigation purposes for only two or three months in a year and in the remaining months it remains idle. The farmers need transport facilities to take the surplus agricultural produce from the field to home and then to the local market place (mandi) and also to transport seeds, fertilizers and agricultural tools from the towns to the village. For this purpose, the big farmers have to have a bullock cart or tractor for cultivation and transport purposes. Small and medium sized farmers cannot afford to make such an investment. How to overcome this difficulty was a problem for the village artisans and the farmers.

In 1972-73, an enterprising blacksmith in Rohtak district of Haryana came up with a solution for the above problem whereby the Kirloskar engine could be used for both irrigation and transportation purposes. With help from technicians in the nearby town and after frequent discussions with the farmers, he devised a system for fitting the engine with a trolley. The farmers readily accepted this innovation, after demonstration. The total cost of this motorized trolley, including the cost of the engine, is around Rs.40,000. Many villagers in Haryana, Western Uttar Pradesh, Punjab, Bihar, West Bengal and Rajasthan are now using the motorized cart. This motorized trolley has been given different local names by the artisans and the villagers - 'JUGAD', 'MARAUTA', 'SKY LAB', etc.

Techno-Economic Feasibility of 'JUGAD'

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87 Krishnan, S.: Entitlements and Enablements of Traditional Artisans: The Case of Delhi Potters; Jawaharlal Nehru University, New Delhi, 1987.
At present, hundreds of village artisans as well as town technicians in the above-mentioned states are engaged in the fabrication of this device without seeking help from R&D and financial institutions.

Some of the farmers, artisans and town technicians were interviewed to ascertain the utility and techno-economic feasibility of the artisan-invented 'JUGAD'. Many of the farmers who bought the JUGAD 10-15 years back told that they never faced any technical problem. In fact, they themselves repair it when they face any problem. This motorised ‘JUGAD’ can transport at one time 50 people or 20 quintals of weight on a kucha or pacca road.\(^88\)

Ministry of Surface Transport some time back asked the ‘Rail India Techno-Economic Service Organization (RITS)’ to study the techno-economic and environmental issues concerning ‘JUGAD’. RITS, in its report, mentioned that JUGAD is the cheapest multipurpose vehicle for the rural areas. Additionally, it is less pollution and noise generating in comparison to tempos. RITS has recommended that JUGAD should he recognised by the government and included in the list of motorised vehicles for registration purposes.

**Case 3**

The tractor industries manufacture tractors conforming to specific standards. These are normally made without taking into consideration identified local needs and demands, which depend upon soil conditions and the types of crops grown in a particular region. As a consequence, the farmers do not find the tractors purchased from the manufacturers suitable for meeting all their specific requirements. To overcome this problem, some enterprising local artisans and technicians came forward to help the farmers by effecting some modifications in the factory-made tractors to meet their needs.

Such modifications can be seen in the tractors being used in many districts of Haryana, Punjab and Uttar Pradesh. Here is one example. Modification in the tractor is necessary when the farmer grows

\(^88\) *The Economic Times*, New Delhi, 28th September, 1994.
paddy, sugarcane and some other similar crops, which require a lot of water in the field. To plough this type of field with the tractor is an arduous task, as the tractor begins to get stuck in the muddy ground and its movement is retarded. To overcome this problem, through collaborative work, the farmers and the local artisans have devised an attachment in the form of an iron cage wheel. Two iron wheels are attached to the back wheels of the tractor in such a manner that they stay about two inches above the ground level when not in use in fields. They prevent sinking of the tractor wheels in muddy land, and help the tractor to move forward without interruption. A good number of farmers have gone in for this attachment whose cost is reasonable. The attachment is readily available in the villages and nearby towns.

Case 4

The threshers available in the market are fit to be used for threshing only one particular type of crop. This has been posing problems for small and medium level farmers growing multiple crops. The farmers have to buy a separate thresher for each type of crop, which is beyond the financial capacity of most of them. In this case too, the local artisans and the town technicians have come up with an indigenous solution. Separate attachments have been designed, which, when fitted to the same thresher, allow efficient threshing of all kinds of crops and the farmer is not required to spend much for acquiring these attachments. The artisans are also available on site for aiding the farmers in their fields in this respect. This modification has been accepted by a large number of farmers in Haryana, Punjab, Delhi, Rajasthan and Uttar Pradesh.

Case 5

In the modern era, most of the villagers, particularly the milkmen and small farmers, need some mode of transport to carry milk and vegetables to the local markets and nearby towns every day transportation by the commonly used petrol-driven vehicles, such as motor cycles and jeeps, is a costly affair. As such, most of them have no option but to sell their produce to the middlemen, who corner a major chunk of the profit. In this case too, some local artisans and technicians have come up with an ingenious solution by developing the expertise to so convert the petrol engine as to permit it
to be run on diesel. The cost involved is not excessive, but the financial benefit emanating to the villagers is substantial; an additional bonus is the increased mobility of the villagers.

The Issue

Historical research reveals that most of the technical and social innovations in any country were based on prior experience. The Indian rural artisans have a good technical knowledge base\(^9\); they liaise with users and then effect transformations at village and town levels. These inventions were made by the rural artisans to fulfill the needs of the people. Rural people adopted them without the intervention of any government or non-government organization and without seeking any subsidy.

Today, thousands of rural artisans, technicians and villagers earn their bread and butter from these appropriate technologies. If the government is seriously interested in solving the unemployment and economic problems of rural India, then such types of activities should be encouraged rather than stalled.

Implementation Strategy

The above case studies are illustrative of the change that is taking place in rural India slowly but surely. Many more such innovative implements and attachments are being developed through the collaborative efforts of the artisans and the ultimate users of these products. It is also evident that the process of adaptation of modern technology to suit the conditions prevalent in rural India has begun on a modest scale. The insight provided by these case studies will help in the formulation of a strategy for blending the traditional and modern technologies in the context of local requirements. With the benefits of the process becoming obvious, there is no doubt that in the years to come this trend will be picked up by the entire village community. It would be desirable if scientists from the R&D wings take serious not of such instances and begin to render assistance to local artisans in developing sophisticated and efficient gadgets which could be of value to the farmers in the performance of their farming and related day-to-day activities efficiently and at low cost. This will at

\(^9\) Ibid, 2
the same time help in removing the drudgery and fatigue, which overtakes them while working in the adverse weather condition prevailing in summer and winter.

It would be appropriate if in India artisans and craftsmen were exposed to new technologies first before they are transferred to user groups in the villages. This calls for effective liaison with R&D agencies. Attempts to pass on such technologies to the user groups directly have failed to deliver the goods in the past; hence it is time to make a serious attempt to establish close linkages between craftsmen and the user groups to ensure smooth transfer to the people. Successful transfer of modern technologies and its benefits to the rural masses can be ensured only if the R&D institutions and central and state agencies first establish linkages with artisan groups in villages. These groups require technical training, financial resources, raw materials and improved tools and techniques pertaining to the particular technology. The artisans, after acquiring training, tools and raw materials must go back to their native places and pass on the technology to the user groups. In this way, the transfer of technology will be more effective than its being done through non-government organizations (NGOs) and central or state government agencies. The basic philosophy involved here is that the artist is born and brought up in the village and his language and culture are those of the user groups. Secondly, if something goes wrong with the technology the user can approach the artisan immediately in the village itself and ask him to repair or modify the technology at short notice. Through this approach, depicted in Model 3, modern technology can play an important role in the improvement of the socio-economic conditions of the rural masses and in generating employment in the villages.
Model 3: Linkages of Modern and Modified Technologies
Organic Farming as an Incentive for Innovations

S. Vaheesan

Introduction

Traditional knowledge and the methods used in agricultural practices are not given serious consideration by the influence of the methods and practices of the conventional farming and the green revolution. Even though traditional methods have strong basis and the potential for large-scale use in commercial agriculture, the present day conventional farmers give it very less priority. In this context we could see that there are no proper incentives for the grassroots inventors who are often peasant farmers operating in small scale in rural areas.

Integrated Pest Management (IPM) is found to be a main slogan taken forward by some multinational companies amidst environmental concerns. They use IPM as a tool to promote the sales of chemicals since it does not totally preclude the use of agro-chemicals. This is also due to the pressure from various environmental lobbying groups in the world whose action may cause banning of certain chemicals.

Organic farmers in Sri Lanka solely rely on Alternative Pest Management (APM) for their pest and disease problems in the field. The contribution made by these farmers for better management of natural resources and environment was not given serious thought to assist, support and upgrade their innovations. The absence of incentives for ecological farmers may be the best example here. The influence of green revolution and modern technologies has left little room for traditional technologies for their wide exposure.

Context and objectives

90 Natural Resources and Environmental Policy Project, International Resources Group Co. Ltd., 1, Gower Street, Colombo 05, Sri Lanka
This paper studies a technological innovation of an organic farmer to control wild boars, which has influenced the other farmers to a considerable extent.

This study included two villages and an organic farm operated by a Non Governmental Organisation (NGO) called Gami Seva Sevana (GSS) in the mid country area of Sri Lanka to assess this method with the existing methods practiced for the same purpose.

In this area organic farmers use traditional knowledge based methods in producing pesticide free vegetables. Organic farming being an ecological agricultural practice is an incentive for the farmers to use their own, innovative approaches because it precludes the use of agro-chemicals and synthetic fertilizers. This paper also illustrates that the organic farming and other sustainable agricultural practices as incentives for traditional knowledge based technological and grass root innovations though there is no established reward system for innovators.

**Approach of the study**

Methods used in this study were farm visits, discussions and observations in relation to the techniques and methods used to control pests and diseases especially the wild boars. The device developed to chase wild boars was given special attention since it was found to be effective by farmers themselves compared to other existing methods.

**Brief description of the existing methods**

Existing methods are:
1) Firing Crackers
2) Electric fencing
3) Some chemicals as repellents
When explored the shortcomings, disadvantages or suitability of these methods under local situations, it was found that the first method seems to be disturbing. It also chased away the diversity of birds, which feed, on the insects of the crop plants. The second method is expensive and cannot be afforded by an average farmer because of the expenditures involved and the need of electricity for its operation. Organic farmers do not use the third method because it involves the use of chemicals.

Illustration and justification of the method

The device has been developed by a practicing young organic farmer to control the problem of wild boar, which has become a destructive pest on vegetable crops, especially on tuber crops. Farmers from their experience revealed that compared to other methods used this would be the more effective and easier to adopt for local conditions.

The device has been developed using the locally available materials in his farm, which are commonly called "wastes". The device has two main components (see annex.); the scarecrow (made of Regifoam), and a wheel (made of wood). Empty tin fish tins are cut into halves. The halves with closed bottom are fixed on the periphery of the wheel at regular intervals. Another round shaped plastic wheel (lid of an empty plastic paint tin) is fixed to the axil (PVC pipe) of the wheel at one end. Water hose is connected close to the tins. The water falls as drops on a tin and collects in it. When a certain amount of water gets collected in the tin, the wheel rotates through a complete circle causing the rotation of the plastic wheel. This plastic wheel is connected to the scarecrow by about 2m long steel wire. While the main wheel rotates it causes the second wheel to rotate in the same direction causing the hanging scarecrow to swing side to side on its vertical plain. This results in a periodic movement of the scarecrow. Changing the flow of water would change frequency of the periodic movement. Water source is usually kept half open to get drops from the source.

The device is operated only during night since the destruction caused by the wild boars is high in the night. The water coming out from the device is directed to vegetable plots to prevent water wastage. The time required to water some of the vegetable plots the following day could also be saved. During night boars are successfully kept away from the vegetable plots by the movement of white scarecrow
and also by the characteristic rhythmic sound created by falling water drops on the tin containers of the wheel.

The interesting aspect of this device is that the cost involved in making this device is very low. This implies that even a poor farmer could afford to make and keep the wild boars away from his plots.

**Conclusion**

The innovation illustrated in this paper shows that how the indigenous knowledge based method could be developed into a technological innovation by grassroots farmers, which is competitive with existing methods.

Use of scarecrow is an indigenous knowledge based method. This is used not only to chase away wild boars but also to chase away some birds that feed grains of matured crops. This device facilitates swinging of the scarecrow rather than leaving it static. Since it had earlier been used in its "primitive form" (static scarecrow) it is found to be economically feasible and socially acceptable. When farmers in this area were struggling to find an effective controlling measure to avoid serious crop loss, this innovation would have been very timely.

**Acknowledgements**

The author would like to acknowledge the Coordinator, Mr. Ranjith de Silva, Gami Seva Sevana, Galaha, Sri Lanka and Mr. Nimal Kumaratunge who designed the device for their cooperation and assistance during the study.

**Annexure: Diagram of the device**
Water source

Tin (fixed on the wooden wheel)

Plastic wheel

Wooden wheel

Axil of the Wheel (Made of PVC pipe)

Wooden stand

Steel wire

Scarecrow
Substitution of Organic Manure Produced from Municipal Waste for Chemical Fertilizers

Madhu Verma and Kulbhushan Balooni

Municipal waste if converted into organic manure can solve the problem of disposal. This case study deals with the use of organic manure in place of chemical fertilizers in Sehore and Hoshangabad districts of Madhya Pradesh. The manure is produced in a plant at Bhopal, which can process about 100 tonnes of garbage a day to yield 30 tonnes of organic manure. In the last three years, this unit has generated awareness among farmers in the use organic manure. The demand has encouraged the authorities to establish another unit at Gwalior. The sample farmers revealed that organic manure has boosted agricultural production and improved soil condition. Some constraints were also identified. An attempt has also been made to look into the economic aspect of the use of organic manure.

1. Introduction

1.1 Costs and Benefits of Green Revolution at a Glance

Soil degradation, disparities in regional productivity and environmental hazards caused by chemical fertilizer have to be kept in mind by the planners for sustainable management of resources. The shrinking of natural resources and the urgency to meet the food needs of growing population are causing concern. Agricultural scientists naturally look for better options. In the words of Dr. M.S. Swaminathan, “In a populous country like India, where the per capita availability of land and water resources is going down, the need of the hour is a vertical growth in food grain productions without endangering the ecological assets.” Therefore, to meet the food requirements of the growing

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population, there should be another green revolution with a difference or a new Green Revolution or a ‘recycled’ Green Revolution.94

The gains of the Green Revolution, which averted a major food crisis in the sixties, were confined to resource rich endowments.95 But due to intensive agriculture, the biological potential of soil has declined and the yields in such areas are nearly stable. There is an utmost need to prevent further deterioration through environmentally sound techniques of agriculture.

Exhaustive cropping has weakened the health of soil by excessive mining of native fertility and leaving hardly any crop residue, which is needed to maintain optimum level of organic matter. Indiscriminate use of pesticide has led to pest resurgence, pesticides resistance, and pollution of environment and pesticide residues in food chain at toxic levels. Research base for correcting these negative effects was not adequately developed as a part of the Green Revolution.96

Only in a few isolated cases, enterprising farmers and private institutions promote safe and highly productive natural farming methods. The Madhya Pradesh State Agro Industries Development Corporation (MPSAIDC) has taken the lead in providing solutions to the management of solid waste of the city and harmful effects of chemical fertilizers. Its organic manure unit in the Bhanpura locality of Bhopal collects solid waste of the city and converts it into organic manure. It then sells organic manure to farmers through its market channels.

### 1.2 Importance of Organic Manure in Agriculture

The number of organic farmers has been steadily increasing but there has been no commensurate record of organic farming activities within the country.


The importance of organic manure as a source of humus and plant nutrients to raise the fertility level of tropical soils has been recognized. The organic matter content of such soils is low due to high temperature and intense microbial activity. Soil humus has to be replenished through periodic addition of organic manure for maintaining soil productivity. Fossil fuels are costing more and chemical fertilizer supply at reasonable price is declining. This shortage in artificial manure can be met through organic manure. Organic manure from rural and urban wastes would not only provide plant nutrients and humid materials but also lead to hygienic disposal of organic wastes which otherwise may cause pollution problems. Moreover, during recent years the concept of integrated nutrient supply involving organic and inorganic fertilizers has developed to meet the growing need for nutrient supplies fro high-yielding varieties under conditions of intensive agriculture(s).\textsuperscript{97}

Traditional agriculture in India is among the oldest and one of the most advanced in the history of the world. Organic farming is native to our country. Before the Green Revolution, everyone ate food raised on organic manure. That was around thirty years ago. The need is once again felt to revert to traditional and indigenous modes of agriculture and organic manure is an important component of the “New Green Revolution”.

Manure is useful both for agricultural and horticultural crops. It improves soil fertility, soil texture and water retention capacity besides increasing production. Manure, which contains organic matter and various microbes together, hold the key for soil productivity. Some of the important benefits are:

(i) Improves soil structure and better filth;
(ii) Better soil aeration and water percolation, reducing soil erosion,
(iii) Increases water and nutrients holding capacity,
(iv) Provides reserve for plant nutrients,
(v) Helps in supply of growth promoting substances,
(vi) Contributes to better taste and flavour of produce,

\textsuperscript{97} Gaur, A.C., Neelkanth S., Dargan, K.S. "Organic Manure." Published by Indian Council of Agricultural Research, New Delhi. 1980. P V.
vii) Produces soil organic acids to make phosphorus soluble and other micro nutrients to make them available to plants,

(viii) Prevents nutrient loss and improves fertilizer usage efficiency,

(ix) Minimizes the effect of toxicants,

(x) Serves as major food source for microbial population thus keeping the soil live.

1.3. Recycling of Municipal Solid Waste for manufacturing Organic Manure

The manufacture of organic manure will reduce land requirement for disposal of solid waste and reduce health hazards due to environmental pollution.

In Bhopal, 480 tonnes of garbage and solid waste is generated every day out of which Bhopal Municipal Corporation removes only 400 tonnes. Pick-up trucks remove garbage once or twice a week. Large areas of the city are always littered with garbage that attracts pigs, cattle and dogs and also provides breeding grounds for mosquitoes and flies.

The practice of dumping solid waste near some congested areas poses a grave health hazard to people living nearby. Further, the land filling sites available close-by have already reached to their maximum capacity.

The Bhopal plant set up in 1986 produces manure through biotechnology method. The Municipal Corporation receives a royalty of four per cent of the finished product. The plant converts 100 tonnes of solid waste a day into 25 tonnes of organic manure. The capacity utilization declines during the monsoon, as solid waste has to be dried in sunlight after culture treatment. The product is ‘Celrich’ and is packed in 50 kg HDPI bags and in five and one kg plastic bags. Following the success of the unit, the MPSAIDC is setting up another unit at Gwalior With technology provided by Excel Industries limited, a pioneer in agro-chemicals and industrial chemicals. Excel has developed a cost-effective technology for converting solid waste into organic manure by aerobic composting. The

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The following flows diagram shows the process involved in converting garbage into eco-friendly organic manure.

Source: Leaflet on 'Management of Urban Solid Waste', Excel Industries.

1.4 Objectives of the study

The study is an attempt to assess the acceptability of organic manure by the farmers. It also tries to analyze the impact of use of organic manure on the productivity of cereals and vegetables in M.P.

2. Research Methodology
Both primary and secondary data were collected for the study, the latter from the Organic Manure Plant at Bhopal and Excel Industries Limited, Bhopal. Purposive sampling techniques were used to select farmers for primary data. A list of farmers using organic manure in the State was collected from the Organic Manure Plant. Sehore and Hoshangabad districts were selected for detailed study as a large number of farmers are using organic manure.

Twenty farmers in each of the sample districts were selected for in-depth study using simple random sampling techniques (Table 1). In Sehore, sample farmers were spread across seven villages and in Hoshangabad, across villages. Besides, progressive farmers from Raisen districts were also interviewed for this study. A pre-tested questionnaire was used to collect data from the sample farmers. The data for this study was collected over a period of 5 months (August - December, 1997).

For this purpose of the study, the sample farmers were grouped into the following four categories according to the size of their land holding:

<table>
<thead>
<tr>
<th>Category</th>
<th>Land holding (Acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marginal</td>
<td>Less than 2.47</td>
</tr>
<tr>
<td>Small</td>
<td>2.47 to 4.94</td>
</tr>
<tr>
<td>Medium</td>
<td>4.94 to 9.88</td>
</tr>
<tr>
<td>Large</td>
<td>More than 9.88</td>
</tr>
</tbody>
</table>
Table 1: List of sample villages and number of sample farmers

<table>
<thead>
<tr>
<th>District</th>
<th>Village</th>
<th># of sample farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sehore</td>
<td>Nugaon</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Bapta</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Lusalia</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Nanakpur</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Atsalia</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Godi</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Hakimbad</td>
<td>1</td>
</tr>
<tr>
<td>Hoshangabad</td>
<td>Baboi</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Bankhedi</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Bomarai</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Bhatti</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Chatarkheda</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Chutlaya</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Daloria</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Jasaiapur</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Total number of sample farmers</td>
<td>40</td>
</tr>
</tbody>
</table>

3. Results and Discussions

3.1 Profile of Sample Farmers

Table 2 shows profile of sample farmers who use organic manure. The sample farmers belonged to medium and large farmers according to their land holdings. However, there were no sample farmers in the marginal and small categories. The average land holding was 8.88 acres and 11.28 acres respectively of irrigated land in Sehore and Hoshangabad.

Table 2: Profile of sample farmers

<table>
<thead>
<tr>
<th>Category of farmers</th>
<th>Number of farmers</th>
<th>Land holding (acres)</th>
<th>Education (literate)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sehore</td>
<td>Hoshangabad</td>
<td>Sehore</td>
</tr>
<tr>
<td>Medium</td>
<td>14</td>
<td>12</td>
<td>90.00 (6.42)</td>
</tr>
</tbody>
</table>
The Hoshangabad sample farmers were all literate while whereas in Sehore only two belonging to the large farmer classes were illiterate. The high percentage of literacy was one of the factors for the use of organic manure. They came to know about the importance of organic manure through pamphlets distributed by MPSAIDC and Department of Agriculture.

### 3.2 Substitution of Organic Manure for Chemical Fertilizers

The sample farmers buy Celrich from dealers, who in turn procure it from MPSAIDC. The dealers also sell chemical fertilizers.

The Sehore farmers were using Celrich for raising soyabeans and onion. Out of 20 sample farmers, 14 and 6 farmers have at least once used the manure for soyabeans and onion respectively. All farmers in Hoshangabad district were using organic manure for growing bottle gourd, ladyfinger, chillies, tomato, cauliflower, cabbage, etc.

The farmers have not fully substituted organic manure for chemical fertilizers. The substitution rate by the sample respondents is shown in Table 3. The quality of organic manure and fertilizers applied by sample farmers for the agricultural production has been converted into monetary values using market prices (1996-1997 prices). This has been done to present the data in an impeccable manner. Further, the substitution is calculated on the basis of per acre of agricultural land.

<table>
<thead>
<tr>
<th>Large</th>
<th>6</th>
<th>8</th>
<th>87.60 (14.60)</th>
<th>132.00 (16.50)</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>20</td>
<td>20</td>
<td>177.60 (8.88)</td>
<td>225.60 (11.28)</td>
<td>12</td>
<td>20</td>
</tr>
</tbody>
</table>

Figures in parenthesis are average values corresponding to the total number of farmers.
<table>
<thead>
<tr>
<th>Category of farmers</th>
<th>No. of farmers</th>
<th>Agricultural crop</th>
<th>Agricultural production</th>
<th>Substitution of organic manure for chemical fertilizers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>With organic manure and chemical fertilizers</td>
<td>With chemical fertilizers in the preceding season</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Value of organic manure used</td>
<td>Value of chemical fertilizers used</td>
</tr>
<tr>
<td>District Sehore</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>12</td>
<td>Soyabean</td>
<td>390.50</td>
<td>72.50</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Onion</td>
<td>520.00</td>
<td>33.50</td>
</tr>
<tr>
<td>Large</td>
<td>4</td>
<td>Soyabean</td>
<td>325.00</td>
<td>52.75</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Onion</td>
<td>485.25</td>
<td>60.50</td>
</tr>
<tr>
<td>District Hoshangabad</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>12</td>
<td>Vegetables</td>
<td>1040.00</td>
<td>156.50</td>
</tr>
<tr>
<td>Large</td>
<td>8</td>
<td>Vegetables</td>
<td>916.75</td>
<td>223.50</td>
</tr>
</tbody>
</table>

Note 1: vegetables include bottle gourd, ladyfinger, tomato, chilli, cauliflower, cabbage, etc.

2: All the figures represent average value per acre for the respective category of farmers and agricultural crop.

Table 3 reveals that the substitution of organic manure for fertilizers is in the range of 80 to 93 percent. The highest was for onion by medium category sample farmers in Sehore. The substitution rate for soyabean was 84 per cent and 86 per cent for medium and large category farmers in Sehore respectively. The substitution rate for vegetables was 86 per cent and 80 per cent for medium and large category of sample farmers respectively in Hoshangabad.
Marginal difference was found in the market value of organic manure for vegetable production and fertilizer used for the production of the vegetables in the preceding year by sample farmers in Hoshangabad (the sample farmers were paying less money in the former case). However, the same was not true for the cultivation of soyabean and onion by sample farmers in Sehore.

**Pesticide Use**

Substitution results in the decrease of pest attack. Majority of the sample farmers (28) did not use any pesticides, or applied them in low proportion. However, rest of them applied them in low proportion compared to the preceding agricultural season when chemical fertilizers were applied.

**Increase in Production**

Table 4 shows the difference in production using a combination of organic manure and chemical fertilizers, and chemical fertilizers alone in the preceding agricultural season for the same crops. The sample farmers revealed that there was increase in agricultural production using organic manure. The change in output in items of monetary value for soyabean, onion and vegetables was found to be 9.13 per cent, 2.53 per cent and 14 per cent respectively.

Maximum difference in the production using organic manure and fertilizers was found for vegetables (Table 4). This was mainly organic due to better size and colour of vegetables got using organic manure. However, increase in the agricultural output can not be wholly attributed to use of organic manure by sample farmers. Some increase in production may be due to change in climatic conditions or some other unexplained factor.

**Table 4: Changes in Agricultural output using organic manure (Rs. per acre at 1996-97 prices)**
Agricultural crop

<table>
<thead>
<tr>
<th>Agricultural crop</th>
<th>Agricultural output</th>
<th>Difference between 1 and 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Using a combination of organic manure and chemical fertilizers</td>
<td>Using chemical fertilizers in the preceding agricultural season</td>
</tr>
<tr>
<td>Soyabean</td>
<td>7351</td>
<td>6735</td>
</tr>
<tr>
<td>Onion</td>
<td>16205</td>
<td>15810</td>
</tr>
<tr>
<td>Vegetables</td>
<td>41225</td>
<td>36155</td>
</tr>
</tbody>
</table>

Note 1: Figures in parenthesis represent percentage change between 1 and 2

2: All the figures represent average value per acre for the sample farmers

Consistency in the use of Organic Manure

Only 28 farmers out a sample of 40 farmers in both the districts used organic manure only once (Table 5). They stopped using it in subsequent agricultural season. There were five farmers in Sehore and seven in Hoshangabad, who used it more than once.

Table 5: Consistency in the use of organic manure by sample farmers

<table>
<thead>
<tr>
<th>Category of farmers</th>
<th>Used organic manure only once</th>
<th>Used organic manure more than once</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sehore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Large</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Hoshangabad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Large</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>All</td>
<td>28</td>
<td>12</td>
</tr>
</tbody>
</table>

The reasons for inconsistency in the use of organic manure are explained in Section 3.5.

The sample farmers were asked about the various benefits of using organic manure vis-a-vis chemical fertilizers. All the farmers in the study areas said that organic manure increased soil fertility. Various benefits of using organic manure have revealed by the sample farmers are shown in Table 6.
Table 6: Benefits of organic manure use as revealed by sample farmers

<table>
<thead>
<tr>
<th>S.N o.</th>
<th>Various benefits of using organic manure vis-à-vis chemical fertilizers</th>
<th>Number of sample farmers revealing the benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Sehore</td>
</tr>
<tr>
<td>1</td>
<td>Increase in soil fertility</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>Decrease in insect/ pest attack</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>Less irrigation required</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>Residual effect in the subsequent crops</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>More growth (increased length of plant and biomass production)</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>Increase in fruiting</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>Increase in grain/ fruit size</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Colour and taste of grain/ fruit is better</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Less production of wastage in the environment</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
<td>Better environment for the future generation</td>
<td>3</td>
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Majority of the farmers revealed that the incidence of insect/ pest attack decreases in case of organic manure. A few revealed that organic manure requires less irrigation. Twelve sample farmers in Sehore and 15 in Hoshangabad said that organic manure had residual affect in the subsequent crops.

The use of organic manure resulted in increased plant growth and marginal increase in production, according to most farmers. They also told us that organic manure led to increased fruiting; increased length of grains/fruit; and better colour and taste of the grain/fruit. A few farmers said that organic manure resulted in better environment.

3.4 A Case of Progressive Farmer using Organic Manure
A progressive farmer, Shri Nasir Ali from Raisen district of Madhya Pradesh (having 30, 15 and 18 acres of agricultural land, respectively in village(s) Chiklod, Goharganj, and Mathegaon) has using organic manure procured from M.P. State Agro for the last two years.

He has been applying Celrich in his wheat and sugarcane fields during Rabi season and for the cultivation of pulses during the lean season. He supplemented organic manure with bone meal, Di-Ammonium Phosphate (DAP) and Urea in very low proportion. He is gradually switching over to pure organic farming. He also applies manure to oranges, banana, guava, mango, cherry, ber, peach, and almond.

Shri Nasir Ali revealed that organic manure has boosted the agricultural production by 20 per cent besides raising horticultural yield. He further revealed that the use of organic manure has resulted in:

- low water requirement by the plants;
- quality of agricultural produce is better in terms of taste, colour, and nutrients content as well as its weight; and
- has residual effect on subsequent crops.

### 3.5 Hurdles in Promotion of Organic Manure Use

The problem found during promotion activity of organic manure were traced at two levels, i.e, at farmers level and at dealers level.

(A) Problems at the farmers’ level

- Lack of knowledge among them regarding quality and method of using organic manure due to improper extension activity by the government
• Irregular or total lack of supply of the organic manure. It was only supplied once from the society. That too was two years ago and since then the society has not made any efforts to procure organic manure.

• Indifferent attitude of the big farmers, as they are satisfied with their earnings and do not want to change the set technology that they have been following over the years. Further they are dependent on their servants see increase in their work load if their owner switch over to nature based manure (procurement & application)

• Farmers do not want to take risk as they are uncertain about the output and are unable to bear income loss in case of failure.

• Despite taking risk of switching over to organic manure, they have to complete with chemical fertilizer based crops as there is no price differentiation and there is no appreciation of their efforts.

(B) At dealers’ level

• Irregular supply from MPSAIDC.
• Lack of proper storage facilities.
• Many a times the manure has pieces of glasses in it which discourages farmers to adopt it as there is apprehension of getting hurt while using it.
• The appearance of the manure resembles that of soil. Thus, many a time they find difficulty in convincing farmers in adopting it as they are accustomed to using refined manure.

3.6 Conclusions

Definite conclusions and generalizations based on a single case study are not possible. However, the following propositions can be made based on our case study:
• Sample farmers have substituted organic manure for chemical fertilizers by 80 to 90 per cent. Only medium and large farmers were using organic manure.

• The sample farmers are aware of the negative affects of chemical fertilizers. They also revealed that use of organic manure would help increase agricultural production in the long run by improving soil conditions.

• The farmers said that organic manure promotes better growth of agricultural crops and the incidence of insect/pest attack is less. There is also a marginal increase in the agricultural production.

• The farmers were not consistently using organic manure, as its supply is irregular and meagre.

• The government should also provide subsidy on the lines of the chemical fertilizers.

• The Government of India can set up organic manure plants in different parts of the country using municipal solid waste as raw material.

• Private companies like Excel who have requisite technical, financial and managerial expertise can play an important role in promoting organic manure production from municipal solid waste by helping Government of India in this endeavour.

Annexure

Analysis Report of Celrich Organic Manure

1. Physical
   Appearance : Dark brownish black coarse powder
Odour : Free from foul smell
Bulk density : Moist 0.98 (g/cc)
            : Dry 0.89 (g/cc)
Moisture (%) : 11.85

2. Chemical

pH : 6.8
E.C. : 2.45 mmho/cm
Organic Carbon : 0.85
Available Phosphorus : 1.38 %
Available Potash : 1.18 %
Calcium : 2.15 %
Magnesium : 0.80 %
Sulphate : 0.41 %
Iron : 65.48 ppm
Zinc : 95.00 ppm
Manganese : 13.00 ppm
Copper : 78.6 ppm

Molybdenum and Boron are also present in sufficient quantities with reference to agricultural crops.

3. Others

• Direct manure value is about 3-4 times more than normal cow dung.

• Almost a complete plant food, suitable for agricultural crops and also good for improving physical properties of soil.

Source: Water and Land Management Institute, Bhopal.

Raising Grass in Banni Region

R.S. Pathan\(^{99}\)

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\(^{99}\) IFS (Retd.), Baroda
Introduction

The Banni region of Kutch is vast, degraded grassland lying between 23°19' N and 23°52' N and 68°56' W and 7°32' W. It was once acclaimed as the largest grassland in Asia. In older times, it used to be served by the Saraswati River, which became a subterranean stream in the post-Rig Vedic period. The arid region poses a daily challenge to the people who are mostly herders and depend on dairy products like milk, butter, etc., for their economic well being. Providing grasses and fodder for their herd is a constant problem. In the drought-prone region, it is common for them to migrate in search of pastures.

With a never-say-die spirit some of the inhabitants devise ways and means of warning off nature’s blows and provide enough forage for their animals. This paper deals with four such innovators Alambhai Mutwa of Dhorado village, Dana Teja Harijan and Gulam Raysiputra, both of Bhiandiara village and Bhachal Jusab Haleputra of Reldi village.

Alambhai Mutwa is an innovative herder and farmer. He is growing grass in a one-hectare plot for his mare, her filly and two buffalo calves by partially resurrecting the ecological scene in what is called the continent’s largest grassland before degradation set in 30 years ago. He does not enclose the area with thorny plants. Rather, he allows the animal dropping to fertilize the soil. He permits the animals only for four to five hours a day to browse on the new shoots after the grass is harvested. This way he collects 5,000 kg of grass a year, sufficient for eight months for three grown-up animals.

Dichanthium is the main species of the grass grown. The farmer clears *Prosopis juliflora*, a competing weed, at the beginning of the monsoon. The stored grass is used for stall-feeding. The plot had 12 babul trees (*Acacia nilotica*), which died due to the continuous droughts of late eighties. Fifteen seedlings of *Prosopia spicegern* have naturally grown and Alambhai carefully nurtures them.

Dawa Teja Harijan and Juma Gulam Raysiputra and Bhachal Jusab Haleputra also maintain one to two hectare grass plots. The grasses belong to a different species to the one grown in Alambhai’s plot. *Sporobolus helvolus, Digitaria sanguinalii, Eragostis minor* and *Deshmostachia pinnata* are
grown in the three plots. The owners too follow Alambhai’s practices like removing weeds, fencing, etc. They get an average yield of 4,000 kg per hectare.

What gives hope to this perennially drought-prone area is the innovative technology to grow grass for its herds. The farmers have evolved a technique to conserve fresh water for their use in the sub-soil after the rains. They dig a well to a depth of 20 to 25 feet and line it with square frames of *Prosopis* branches, with grass layers in between. The farmer prevents the soil from caving in and the grass filters the water moving in from the surrounding areas. The well gets filled up with soil during rains and when water is required the soil is removed and water oozes in from sides. As the specific gravity of fresh water is less than saline water it floats on the saline ground water, people can use it for two to three months.

Banni suffered an ecological disaster when dams built upstream arrested sediments and water from the rivers draining 3,000 sq. km. of the area. The introduction of *Prosopis juliflora* in the mid sixties reduced the soil moisture and soil nutrients needed for grasslands. Salinity and *Prosopis* weed invasion prevented the spread of grasslands. The government owns the grasslands. Government efforts to improve the grasslands through the Banni Development Agency have not been successful to the desired extent.

The ecological degradation has resulted in the proliferation of the buffalo at the expense of the cow, which migrates often, especially during droughts. The pastoral life is yielding place to labour, charcoal manufacture, and collection of gum pods and honey, from *Prosopis juliflora*.

Grasslands provide important life support system for inhabitants in arid zone. Most current management practices aim at ensuring the stability and productivity of nutritive grasses. They in turn require community support. Salt tolerant coarse grasses are taking over sizeable tracts of Banni. *Prosopis juliflora* has invaded favourable sites. The area is not able to sustain 25,000 heads of cattle and an equal number of people. This has happened within a span of 30 years. Both the government and the people have to devise ways of arresting the ecological degradation. The techniques adopted by Alambhai and other may provide guidelines for evolving new strategies on a wider scale.
Banni rangeland

The Banni Rangeland with which the paper deals forms part of Kutch, the largest district (45,652 sq. km.) of the state. The harsh climate has caused the people of Kutch to be entrepreneurs and made them stay at homes. The region has low rainfall (325 mm), high aridity with evapotranspiration rates of 1897 mm/yr. (ICRISAT), high coefficient of variation (more than 60 per cent), soil moisture retention capacity less than 90 days and moisture index of (-) 81 (ARPU). The Great Rann, the Little Rann, the Banni pastures, undulating hills of central range of mainland and the sea coasts are unique features of the district.

Banni pastures

The Banni region extends 100 km from east to west with an average width of 30 km. The area measures 3040 sq. km., of which approximately 80 sq. km. is marshy. The area is landlocked between Greater Rann in North and the Kutch mainland in south. Indus, Luni, Banas and Saraswati rivers used to drain the area in recent geological times. Banni represents one such big river mouth with alluvial deposits. The subsurface being seabed, the soil in 99.5 per cent of Banni is very deep, and water highly saline. The rainfall is lower than Kutch mainland. It is erratic, very low and ill distributed. The climate of the area is arid, with maximum 45 °C in summer to lowest of 10 °C in winter. January to March is marked by heavy dew and thick fog in early morning.

The ground level varies between 1.5 to 4.5 m above MSL. The run-off gets collected in natural depressions. Sweet water occurs at shallow depth of 3 to 10 m in many villages at Banni in the form of thin lenses of sweet water floating above saline or brackish water. This sweet water is skimmed from open wells (Virda) of 1 to 2 m diameter and 3 to 10 m in depth. Drinking water is transported through pipeline and supplied to the villages. The flat topography and absence of any defined basin (or storage site), poor permeability makes the area one of the best pasture lands of the world.
Vegetation

The common grasses growing in this area include Sporobolus glamifluis, Sporobolus helvolus, Desmotachiya bipinnata, Cynodon dactylon, Elucine compressa, Dectyloetanium sindicum, Eragostis minor, Degrata sanguinalii, etc. Dichanthium annualatum, the most preferred species of grass, is now confined to a few sites. Prosopis juliflora is most prominent species these days. Pseuda fruticosa grows abundantly in saline areas. Tamarix dioica confines to saline sallow depressions. Prosopis juliflora is the dominant tree species. Its density varies between 200 to 6000 trees/ha. Prosopis grows easily and deprives grasses of their moisture and nutrients. Prosopis is invading the grasslands at the rate of 2673 ha. per year (ISRO). Pseuda futicosa (a shrub) is second most important species (density 4000 to 7000 ha.).

Socio-economic status

A population of over 20,000 people is scattered in 46 villages of Banni. Most of these are Banni-Muslims descended from eighteen distinct clans. The village composition is homogenous, as each clan prefers to live as a single community in one or more villages. Jats occupy 10 villages, Haliputra 9, Mutwa 7, Pathan 3, Node 3, Raisputra 2, the remaining inhabit at least one village each. Marriages take place within the clan. The social control, through traditional institutions, is persistent. Two non-muslim communities, viz., Harijans and Vadhas live amicably in most villages, and follow generally the same profession.

Issues

The productivity pattern of grassland is undependable as it depends on erratic rainfall. In normal years, the cattle have access to all surrounding areas. Monsoon is the active month when local as well as large number of migrant sheep and goats pound the surface and nib the tender grass. The productivity is estimated to vary from 200 kg/ha to 1000 kg/ha in normal years. It is estimated that Banni can feed 25,000 cattle. Local animals face shortages because of immigration of cattle. Migration and immigration is becoming reciprocal.
The ecological degradation has affected the lifestyle of the people. As cattle rearing is no longer profitable, they are taking other profession and started settling on the fringes of urban centres and subsist on manual labour. An average household of Banni earns Rs.5000/- from sale of milk, Rs.70/- from wool, and Rs.1, 300/- from sale of animals each years (1987 data).

The northern part of West Banni is under the effect of salinity ingress (61611 ha. per year (ISRO)). The tides from sea engulf sizeable portion of Banni. Some two villages have shifted and six more villages are under threat.

**Technological concepts of Pasture Development**

Scientific management of grassland aims at maximum herbage production to meet the forage requirements besides maintaining the fertility of soil. The younger plants are more nutritious and palatable. Thus, the requirement of grassland and those of grazing stock are antagonistic. One animal per hectare is normally considered adequate for sustaining a grassland. Normally, to provide rest to recoup the vigour of grazed lands, the practice of deferred the rotational cropping is recommended. A part of the area remains closed for a whole grazing season, or short period of growing season or both.

**Local Organizations**

The Animal Husbandry Department of the state has provided Banni Development Authority to care for the health of the cattle. The agency, apart from veterinary care, takes up plots of 40 ha. Each, provide the enclosure and broadcast seeds of nutritive grasses. The grass grown is collected and supplied at a no-profit/ no-loss basis during scarcity. The operation is carried out through village panchayats. Attempts have been made in the last 10 years to develop some 125 plots. The reactions and results of the programme are mixed.
The Banni Development Corporation has set up Kutch dairy near Bhuj, the district Head Quater, with 10,000 litres a day initially, which has now gone up to 60,000 litres. The dairy in turn has set up 33 milk co-operatives in Banni. Some 20,000 litres of milk from Banni reaches the dairy. Now the situation is changed due to various market and environmental forces and the receipt from Banni is reduced to 5000 litres a day. Most of the milk co-operatives have closed and the future of the dairy itself is uncertain.

**Village Panchayats**

The local panchayats in Banni are mostly group panchayats. The members are generally illiterate. Personality conflict is the common weakness of the programme. No external NGOs have struck roots in Banni. The traditional institutions in Banni are quite strong.

**Options for Development**

Land is the main resource and ownership vests with the government. The people have only grazing rights. Farming is not permitted and it is not remunerative. The people are static to semi-nomadic. Though they are settled in villages, they move out to nearly interior and camp intermittently to ease pressure on fodder resources.

Tanks to harvest surplus surface water are the main features of development plan. Salt-based industry is a possibility. Products from the units can include common salt, gypsum, potassium chloride, bromine and magnesium chloride. Concentrated brine from industries may adversely affect pasturelands and it deserves careful study. A large area of Banni has come under woodland, thanks to *Prosopis juliflora*. Collection of gum, pods, honey and charcoal manufacture have helped the local economy. The fuel wood problem has been eased. The Gujarat State Forest Development Corporation procures gum, honey and organizes manufacture of charcoal, mainly from roadside trees. There is unauthorised manufacture of charcoal in the Banni area.
Prosopis invasion is both a boon and a curse. Grass is needed both for ecological and economic reasons. Grass sustains cattle and dairy products have a beneficial effect on the economy. If Prosopis spread is not arrested in time, it may ruin high grade pasturelands. Grazing is scientifically regulated and people encouraged to evolve a controlled system to sustain pastures. Regulated grazing in bad years, however, is not possible and droughts recur in a three-year cycle. Keeping this cycle in view, the growth of grass could be maximized in good years, and forage required for lean years can also be taken care of.

Local Initiatives

Banni like other wastelands in the state suffers from no-management practice. Land and water are important resources and grasses, shrubs and trees are the products. In the absence of plan for development, not only the resources are lost but land and water too get deteriorated.

People like Alambhai Mutwa of Dhordo, Dana Teja and Juma Gulam of Bhirandiara, and Bhachal Jusab of Reldi, have evolved the strategy to raise where grass in enclosed plots.

The innovations of these people can be replicated. The increased productivity of these plots suggests the potentials of the innovated system.

Experience elsewhere

No in-depth study on pasture management in the arid area of India appears to have been carried out. The experiences in Africa provide good lessons. Sub-Saharan and surrounding region is a semi-arid region. It has been recognized that the highly variable rainfall in semi arid and arid areas results in a “Constant disequilibrium” or “Permanent transition” of rangeland vegetation (Behrike, 1993). There is need for local level planning. Its possibility is great in pastoral sector. But natural resources in arid areas are highly variable and there are more groups who use the same resources at different times. There is bound to be friction between disadvantaged groups like poor herder, pastoral women, etc., and better off sections who corner the best plots for their use.
Pastoralists have to be told about the effect of certain actions like selling land. There is an interesting example from Mali in West Africa where herdsmen were encouraged to draw up a plan of action, implement their plan and evaluate the results and plan for further activities. This process approach demanded firm but flexible commitment from donor over a period of more than 10 years (Marly, 1990).

In Ferlo region of northern Senegal, a method of pastoral resource management based on the principle of sustaining balance between available pasture and stocking rate in privatized enclosed area, was introduced in 1981. The system was monitored for 12 consecutive years in order to check the environmental and socio-economic impacts. Individual plots of 200 to 1000 ha. Were enclosed. A trough for drinking water was provided in each plot and connected with underground pipeline. A total of 24 families were settled in the area with their herds. The stocking density is 10 ha. Per TLU, i.e., 20 cattle, 20 sheep and 10 goats and 500 ha. of pasture is theoretically available per head. The allocation of private plots gave them exclusive rights to use the water and pasture.

From 1989, the scheme allocated plots on collective basis to families who were already residing. Initial success was encouraging. As the region being drought-prone, there was wide variation in available forage from one year to another. The biodiversity and health of grass outside the enclosed area was better compared to closed area. The regeneration of the Savannah outside was better. Contrary to expectation, the herds in enclosure turned out to be poorly prepared for normal condition of communal grazing and transhumance. Mortality rates amongst young animals are high. Female fertility too is affected.

In the process of allotment of plots the influential herdsmen and their clients, managed to appropriate the scheme in their favour. Even in the collective allotment of plots, the well off people manipulated their entry. Relations between those within the enclosure and those outside remained strained. During low rainfall year, the animals from enclosure have to migrate to community areas. The requirement of area for grazing in lean year is more and proportionate to biomass availability. It is recognized that physical mobility, economic flexibility and optimum management of inter/ intra
imbalance would seem to be essential conditions for pastoral success in non-equilibrium system. Ferlo experience has brought out that the concept of controlled plots would be more successful if such plots are identified, marked and enclosed voluntarily by individual or community.

**Conclusion**

The environmental and biotic influences on the Banni grassland of Kutch are much severe. There is need to draw up the pasture management plan for the area. The tract has high potential in establishing self-sufficiency of fodder, both during normal as well as draught year. There are in-situ innovative examples. The experiences there from can be extended to community, group or individual level. The pastoralists of Banni can contribute significantly for the health of this unique pastureland.

**References**


Annexure: Map of Kutch
Communal Tenure, Motivation Dynamics and Wildlife Management in Zimbabwe

Elias Madzudzo

Introduction

Wildlife in Zimbabwe’s communal lands is based on ecological units, which do not conform to the administrative boundaries. Livestock and arable-based production and income, however, are privatized to the household even under communal tenure. This influences the costs the households are willing to bear in the production process. This makes it difficult to define a wildlife producer community.

This article deals with wildlife revenues in the Bulilimamangwe and Tsholotsho Districts’ CAMPFIRE (Communal Area Management Programme for Indigenous Resources) Programmes. It focuses on wildlife as an alternative land use option and income for communities living with, or close to, the natural resource. The distribution of benefits from wildlife use is on a community, defined geographically. This procedure neglects those groups who bear the cost of wildlife management. Consequently, the viability of wildlife management in the communal lands is negatively affected.

There is no consensus on the definition of the term community (Hillery, 1995, Cousins, 1993). It could be a unitary term for geographical units or sets of units like village, ward or district. In some cases, community is used as an analytical category like hunting community, San community or wildlife producer community. How do we define a wildlife producer community in a communal area setting? To answer this question, we need to analyze the ‘community’ in terms of wards and villages.

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101 Owners of land held under private tenure have readily taken up wildlife as a land use option because they are deemed producers and, therefore, the sole appropriators of wildlife benefits.
Communal areas are defined up into administrative units. Six or seven villages will make a ward. These units have clear boundaries, determined on the basis of land area or household numbers. The people in these units may be referred to as communities. This is regardless of other characteristics like resource endowment among the inhabitants, self-sufficiency or effects of wildlife. Community used here to refer to villages and wards is not analogous to Redfield’s (1955) ideal type of the ‘little community’.

Having noted what community means when one refers to a village or ward, let us look at wildlife as a natural resource in communal areas.

Wildlife can be costly in the communal areas due to damage to crops and livestock (Hawkers, 1992). In Bulilimamangwe and Tsholotsho, elephants and hyaenas pose the greatest problem. While elephants destroy crops, the latter attack cattle, donkeys and goats. These costs are not borne on a ward wide or village wide basis but as communities, i.e., as analytical categories, in villages and wards. The cost of living with, or close to, wildlife differs from household to household. In this paper, the examples of two communities (identified on the basis of the costs they have suffered from wildlife) are cited. Opportunity costs arose when users had forgo their range in favour of wildlife. The range could have been used for, *inter alia*, houseland, arables, pastures, hunting or gathering. The losers are communities, but do not necessarily conform to the spatial boundaries of village or ward.

Wildlife can be a cost as well as a benefit. In areas where CAMPFIRE is being implemented, benefits are largely monetary. These include tourist revenues provided by hunters and photographers. The revenues can either be distributed to households or used to finance community projects. However, which definition of ‘community’ is considered when these benefits are distributed; and how effective is the current definition of ‘producer community’ in motivating communities to bear the costs of wildlife?

The problems of defining a wildlife producer community are discussed here. It is concluded that there is need for CAMPFIRE to go further and differentiate the villages and wards in terms of their
relationship to wildlife. The ward may not seem to be very relevant while dealing with CAMPFIRE and wildlife as a resource. Only by paying attention to those who actually pay the costs of living with the wildlife that CAMPFIRE can effectively establish a link between cost and benefit. Those who bear the cost appreciate the value of wildlife as a source of income equal to or better than arable agriculture or livestock production. The goals of CAMPFIRE and the study area are given in the following section.

Methods

The author in two districts of southwestern Zimbabwe collected data for this article. Focus was on those districts implementing community based wildlife programmes. Several methods were employed including participant and direct observation, and unstructured interviews with key informants. Secondary data on revenues from wildlife was also used.

Background to CAMPFIRE and the study area

CAMPFIRE is a community-based project launched in 1990, which treats wildlife as a viable and alternative land use option in ecologically marginal areas. Those living with or close to the wildlife, and thus paying the costs of doing so, will benefit from wildlife use (DNPWLM, 1984, 1990). These are the “relevant populations” that is the target of CAMPFIRE.

‘The “relevant populations” are those who live within the microenvironments which sustain the natural resources concerned, who pay the price for their sustained maintenance, who must reap the benefits from these investment, and who at the smallest viable operational level, have the capacity to manage the resources. (This) reflects…a recognition of the dynamics of economic motivation which necessarily impose themselves on rural populations under subsistence conditions and seeks to restore a localized custodianship which can give scope to the fusion of ecological responsibility and community interest which characterizes traditional African culture.’ (Murphee, 1900 p.3)
Bulilimamangwe and Tsholotsho district are in South Western Zimbabwe. Both share their western boundaries with the Hwange National Park. The Nata river separates them. Elephants and other wildlife move between the two districts and the Hwange National Park (Murphree, 1989: p.4). In 1990, under the CAMPFIRE project, these districts conducted a joint hunting programme and shared the revenues. In 1992, Tsholotsho Rural District Council felt that revenues sharing did not reflect its greater wildlife resources.

Consequently Thsolotsho pulled out of the joint venture to begin its own separate safari operations in the southern part of the district. Tsholotsho’s withdrawal is important for the argument that wildlife production is not uniform across the environments suggested by physical boundaries. Those who feel that they contribute more to wildlife production expect to be rewarded accordingly. This argument is central when we deal with the populations within the microenvironments mentioned earlier.

Seven wards - Makhulela, Ndolwane, Huwana, Gala, Bambadzi, Hingwe and Madlambudzi have been selected for CAMPFIRE programme. On the basis of their claims to dry season grazing in the area designated for wildlife. The agro-pastoral Ndebele and Kalanga ethnic groups dominate the wards. Conspicuously absent in this selection was the mention of the minority San Bakwa group as major users of the area.

Prior to the introduction of the CAMPFIRE programme in Bulilimamangwe in 1990, an ethnic group, the San, led a nomadic existence with hunting and gathering in the proposed wildlife project area. To facilitate safari hunting, the Rural District Council requested the San to keep out of the project area and not to hunt wildlife. A San settlement was set up at the edge of Makhulela ward and the group was encouraged to take to farming. They, however, lacked draught power, ploughs or seed. A non-governmental organization, Redd Barna, provided them with a tractor. San fields were nearest to places of wildlife incursion and away from the area where the rest of the fields were in the village (Madzudzo and Dzingirai, 28-35).

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102 However, our research on grazing has demonstrated that only a few large herd owning households in far less than the mentioned wards normally use the area. (Madzuado and Hawkes, 1996)
In Tsholotsho, the lowest unit of settlement is a *line* made up of a number of households. There is neither a fixed number of households that make a line nor a fixed number of lines to make a village. Resources like grazing, arables, and water determine the limit to the number of households belonging to a line. Each line has its *sabuku* (kraalhead). Six villages make up a ward. Each village has a village development committee and each ward, a ward development committee ((WADCO)). The chairman of the (WADCO) is the councilor. Eight wards were selected for the CAMPFIRE programme in Tsholotsho on the basis of perceived wildlife presence and activity. Four of these wards make the northern section, namely wards 2, 3, 4 and later 9. The Southern section includes wards 1, 7, 8, and 10. This southern section was the one previously run as a joint project with Bulilimamangwe.

An electric fence is being set up parallel to the Hwange National Park foot and mouth disease boundary fence, in Tsholotsho to act as a buffer zone between the communal area and the Park to facilitate safaris. The fence may protect livestock and crops from wildlife (see map).

**Wildlife benefit distribution in Bulilimamangwe**

Bulilimamangwe council gets 15 per cent as levy, 35 per cent for project management while 50 per cent goes to CAMPFIRE wards as safari revenue. Each ward receives an equal amount of money out of 50 per cent. Ward committees decide on the utilization of the revenues. The revenue is not large enough to be distributed as household dividends. The highest amount the wards got was Z$ 20,000 in 1991. Each ward has at least 800 households. Instead, the money has been used for ‘community’ projects. Below a brief account is given of how Makhulela ward used its revenues in 1993.

In Makhulela ward, the councilor bought fences for each village. The fencing in one village was, however, stolen. A wildlife committee member replied when asked as to why it happened, “You know that government property is always stolen.” He did not make a distinction between other government and CAMPFIRE projects. The fact that the revenue from the use of wildlife are
distributed to every ward regardless of cost, has weakened the link between wildlife management and benefit in this ward. The same applies to other wards in the district.

When Makhulela village received the allocation for fencing, this was used to fence the fields of the Kalanga and Ndebele. No fence was put up around the San fields. The San, in protest, refused to participate in the erection of the fence as requested by the councilor. They argued that the fence was not going to benefit them. The councilor felt that the San were not co-operating in community projects. He said that was a symptom of a dependence syndrome among the San. They were used to receiving handouts from donors without making any effort.

Later, the San kraal head asked the councilor for a share of the ward revenues for buying donkeys. The councillor and other Kalanga and Ndebele present at the meeting opposed this. The San argued that the revenues were for the ward that included the San. The San were asked to come to the meetings and lobby for projects for their area. They rejected saying they were not given an opportunity to air their views at meetings. As a result, the San were not benefited by any project despite their giving up the use of the wildlife area. As one respondent commented:

‘(In the past) The San were not serious about ploughing since there was abundant wildlife for meat. The meat would be exchanged for grain from the Kalanga people. The San are not showing signs of changing from their old ways although hunting has been restricted. They are beggars without the meat. Some try to carve stools but their lives are now worse than before.’

**Distribution of wildlife benefits in Tsholotsho**

It is my intention to show that, as in Bulilimamangwe, the distribution of revenues from wildlife in Tsholotsho does not adequately consider who pays more for living with wildlife. Unlike in Bulilimamangwe, revenues are not uniformly distributed to the participating wards in Tsholotsho. The ward where an animal is shot is regarded as the ward, which produced the animal. It, therefore, gets a larger share of the wildlife revenue (see Table 1). However, although Tsholotsho district rewards each ward differently, this is not adequate. There is no attempt to share the benefits in terms
of incurred costs of living with wildlife. The benefits are utilized collectively at ward level. I show this by way of a case study of the relocation of Lubanji line.
Table 1: Wildlife Revenues

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<th>Ward</th>
<th>Revenues received in 1992 (Z$)</th>
<th>Revenues received in 1994 (Z$)</th>
<th>Revenues received in 1996 (Z$)</th>
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<tbody>
<tr>
<td>1</td>
<td>91250 (50)</td>
<td>42179 (31)</td>
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<td>10</td>
<td>16666 (9)</td>
<td>24679 (18)</td>
<td>24000 (9)</td>
</tr>
</tbody>
</table>

Source: Adapted from Tsholotsho Rural District Council, CAMPFIRE Manager’s Annual Reports, 1992, 1994, and 1996.

Note: Numbers in brackets are percentages of revenues received by the respective ward. The northern or southern wards are considered separately. Percentages do not always add to 100 because of rounding error.

Ward 9 only became a CAMPFIRE ward in 1993 after a stray elephant was shot in the area.

In Tsholotsho, it has always been wards 1, 3 and 7 that earn the highest revenues. These wards have a common boundary with Hwange National Park (see map) making for a greater amount of wildlife movement into the wards. Consequently, most of the hunting is done in these wards. Ward 2 is far away from the Hwange National Park boundary. The councillor for the ward requested the diversion of the electric fence trace line to take up more land at the point it passes through the ward. This has necessitated relocating the people of Lubanji line who were now enclosed in the buffer area.

**Individual cost versus ward benefit in the relocation of Lubanji Line**

Labanji line inhabitants in Zamazama village, Ward 2, were asked to move to Vusani line to make way for the wildlife buffer area in Tsholotsho North area. Officials from the Rural District Council, Ward 2 Wildlife Committee, a non-governmental organisation (Zimbabwe Trust) and the ward councillor, approached the people of Lubanji in July 1993 to inform them that their line had been enclosed in the proposed wildlife area. The inclusion of the line would mean the area would be enclosed by the electric fence. At this point of time the clearing of the trace line for the electric fence was already in progress. It was pointed out that the people of Lubanji line were free to continue...
staying in the line. It was also pointed out that there would be increased wildlife presence in the area posing a threat to the local inhabitants. Problem animal control would not be guaranteed. Those who wished to be moved had to choose a place with the possibility of a borehole, for domestic and livestock water supply would be dug.

The residents of Lubanji agreed to move out of the area but wanted to stay till next cropping season. However, the people later went to the headman of the area, Umlisa, to ask as to why they were asked to vacate their area when they were living in a communal area where forced removals were not supposed to take place. The headman said he had no knowledge of the relocation. He pointed out that headmen were no longer in control of setting people, as the councillors and the village development committees had taken up the role. The headman then referred the people from Lubanji to the chief nduna of the area, Muswigana. The chief also pointed out to the people that he was not aware of the relocation and that he had no powers over land and settlement in the area.

It is clear that Lubanji residents, barring one, did not make a request to move out of their line to make way for wildlife. Two others did not like the idea of moving but saw some advantages in moving. However, these persons did not give CAMPFIRE related advantages for the move. Among the reasons given were that children would be travelling a shorter distance to school, and the line would be close enough for the councillor to come and give details of food assistance. Furthermore, some felt that they would be under their chief Mswigana and not Siposo as was the case at the present moment (apparently, a consequence of administrative aloofness shown by a failure to take into account allegiance to chiefs when marking out the ward boundaries). However, the rest of the respondents expressed negative sentiments about relocation. The option to remain in Lubanji was given by the officials and the use of direct force was not overtly mentioned.

Over the past two years, the people of Ward 2 (where Lubanji line is) had received revenues from wildlife use of $30 and $17 per household. The people of neighbouring Ward 3 got $100 per household. When we asked those in Lubanji line whether they did not realize that through relocation

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103 Some of the people in this line came to Lubanji before independence, in 1970, having been evicted from Nyamandlovu because that area was a commercial farming area.
their ward would earn higher income, they said that increased income would benefit the ward as a whole and not a particular line. ‘Even those who have never seen an elephant will also benefit because they are members of the ward...’, said some of the respondents. This example impinges on the empowerment rhetoric associated with CAMPFIRE. It suffices to say that this demonstrated the unwillingness of the line to sacrifice on behalf of the rest of the ward because they were aware that the whole ward would equally share the benefit from such a sacrifice.

Conclusion

At present the producer community in Bulilimamangwe and Tsholotsho is defined in terms of wards. Consequently, the benefits deriving from the utilization of wildlife are shared equally among the villages within the ward. However, wards have been criticized as being more of an administrative convenience than a reflection of social relationships. The above discussion then illustrates the need for CAMPFIRE to go further and differentiate beneficiaries in terms of the costs they undergo in wildlife management. While the spatial conception of the ward may be convenient for other purposes, it does not seem to be entirely useful for identifying CAMPFIRE’s “relevant populations” regarding the devolution of revenue. In other words, the term ‘community’ does not imply ward when one is dealing with wildlife issues in Bulilimamangwe and Tsholotsho. It is by a differentiation between producing and non-producing villages and lines that those living with the wildlife might readily understand the concept of CAMPFIRE and wish to protect their natural resource. Such and effort will be successful in establishing a clear link between producer (defined by cost) and benefit.

Having said the foregoing, a caveat needs to be pointed out. One is aware of the problems, which might be encountered in an attempt to appropriately define the concept of a producer community, especially in Tsholotsho. For one thing, this means denying interior villages or households of revenue, which they are now used to. This might provoke resentment and lead to other villages or lines taking retaliatory measures to destroy the resource.

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Annexure: Map
Understanding Farmers’ Communication Networks: Combining PRA with Agricultural Knowledge Systems Analysis

Ricardo Ramirez

Farmers get information in various ways to enrich their knowledge base. But few people ever bother to find out how they gather information and spread what they have gathered from others. It is however, necessary to understand the patterns of information exchange.

This paper deals with farmers’ communication networks and analyses the major linkages in a farming system. The networks are studied from bottom-up. The major linkages identified were analyzed through semi-structured interviews.

The first study was conducted late 1993 in the Philippines. The approach has since been tested in Ethiopia in 1994, which combined RRA and PRA tools. The approach was also incorporated in Peru in early 1996 into a stakeholder analysis workshop following the Rapid Appraisal of Agricultural Knowledge Systems (RAAKS) method. A comparison of the different experiences as applied in the three countries is provided with emphasis on the conditions for use and possible outcomes in each context.

Preface

A group of farmers gather around a wooden table in Mamala I, a village in Quezon province (Philippines). Researchers asked for the meeting to learn about farming. The farmers start drawing a map of the barangay (community). They discuss the detailed locations of fields and roads, farms and crops. Each one insists on including the exact location of their farms and homes. The researchers ask

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The Philippines study was conducted by an FAO team. The consultants included: T. van Poelje, N. Quebral, M. Bostroem, V. Cardenas, N. Ranaweera, R. B. Singh, D. Carandang, and R. S. Singh. The Ethiopian work was done by A. Carloni, the staff of CISP, Ethiopia, and the people of Lemu Chemeri, Arsi, Ethiopia. The Peru inputs were supplied by the GINCAE and GIAREC working groups collaborating with IL EIA, Edith Fernandez-Baca, Norma Canales, Sonia Salazar, Maria Fernandez and Paul Engel.
the group to mention what has changed over the last ten years by way of crops and brought about the new ideas and innovations? Anecdotes emerge along with names of farmers, vendors, extension workers, institutions and organizations that over the last decade has shaped and influenced farming in the area. From this a network of knowledge and information emerges.

Now it is the turn of researchers to draw. They draw the pictures of those who work at the village, municipal and regional level; they also show their relationships. Each drawing and linkage are discussed and confirmed with the group. Thus an information network is evolved. The map is useful both for farmers and researchers. By “reading” the map, problems like cabbage pests and possibilities like the pineapple contract production emerge.

The researchers take photos of the linkage map and leave it with the farmer group and go to meet the other actors for further linkages.

1. Introduction

Farmers use multiple sources to enrich their knowledge base. Farmers and farmer groups are stakeholders in a rural community like municipal authorities, public servants, etc. These stakeholders have different interests. The stakeholders interact constantly seeking to negotiate and create opportunities to fulfil their needs and pursue their interests. This leads to generation of information. Much of the information travels freely, but some may also come at a price. Some argue that they constitute part of a broader system: an agricultural knowledge and information system (Roling, 1988).

We need participatory learning tools that shed light on the actors, the roles they play with regard to specific objectives, and the linkages and communication network they use.

2. Agricultural knowledge and information systems
Agricultural knowledge and information systems (AKIS) were developed in the late 1980s by researchers at Wageningen Agricultural University in the Netherlands. It is a two-way flow of information and knowledge among the researchers, dissemination and utilizer sub-systems; the latter play equally important roles in the systems. The utilizer sub-system is a source of information and knowledge that feeds into the other two. The sub-system must have a demand capacity for it to be equal to the other two. The best extension systems in the world develop when farmers are able to lobby for the technical assistance (Roling, 1988). The opposite process, whereby extension systems conceivably strengthen farmers’ production systems through technology, is more a myth of the transfer of technology (TOT) model than an observable reality. In the AKIS perspective, the two-way exchange of information is crucial for effective generation and transfer of relevant technology. But the change from disseminating to facilitating requires staff with fundamentally different attitudes, skills and knowledge. The facilitator can be described as a broker of information demands and supplies. The model is aimed at supporting decision-making, problem solving and innovation in a given country’s agriculture (Roling, 1990).

Network analysis reveals those people who are regularly used as sources of advice and information and those who are not well connected to establish networks (Garforth, 1993). Roling (1990) suggests eight different research methods to study an AKIS:

i) Comparative analysis of two systems;
ii) Comparing the formal and the actual system;
iii) Linkages matrix;
iv) Tracing one successful innovation back through the system;
v) Comparing the ideal theoretical system with the actual;
vi) Analyzing the transformations (research findings into recommendations, messages, etc.);
vii) Participating in linkage events; and
viii) Assessing corporate ideology.

The above choices could easily remain research-controlled with a limited participation by different stakeholders. However, there are options, which allow the model to become operational. “Rapid
appraisal of agricultural knowledge systems” (RAAKS), a methodology pioneered by Engel & Salomon (1994) provided a concrete starting point and an operational method with steps to follow.

However, the nature and structure of an AKIS are not static. The extension organization is only one among the many actors in the AKIS and, therefore, the role of a field worker and the organization must be flexible enough to exploit the strengths and may be overcome some of the weaknesses of an existing AKIS (Christoplos & Nitsch, 1993).

The project team in the Philippines borrowed heavily from RAAKS but tried to make the process visual and, therefore, accessible to farmers. Following a growing trend of participatory analyses, this study explored network analysis from the user perspective. The work described here by the research teams in the Philippines, Ethiopia and Peru all focused on mapping the AKIS from the farmer level up.

3. Summary of the approach

The approach follows three stages: (i) mapping of actors and linkages, (ii) analysis of linkage performance, and (iii) action plan to modify roles and improve linkages. The experience in the Philippines reached the last stage, while those in Ethiopia and Peru were limited to the first stage. However, the Peru experience was unique in that representatives of grassroots organizations and farmers representing rural communities were involved in the training workshop on the use of RAAKS; whereas in the Ethiopia case only NGO staff were trained.

Stage (i): Mapping of actors and linkages

The first stage begins with a mapping exercise done with farmers as is customary in rapid rural appraisal (RRA) and in participatory rural appraisal (PRA).
Box 1: Activities followed during Step (i)

1. Identification of farmer group & presentation to farmer group of study goals;
2. Farmer group draws community map highlighting major production systems, enterprises, infrastructure and tenure;
3. Ranking of major enterprises;
4. History of innovation: description of the major changes for each enterprise in the last 10 years and identification of the actors responsible for each major change;
5. The research team draws a linkage map; for each linkage, the farmer group verifies each actor/linkage drawn;
6. Verification and discussion with farmers on the basis of the linkage map; and
7. The research team follows up the leads identified from the farm level and interviews tradesmen, input suppliers, private and public technology transfer workers, municipal officials, researchers, etc.

The history of innovation exercise serves as the basis for identifying changes in the production systems over the time period identified (10 to 30 years). Each change is written in, indicating the source (name of person or institution) of the new information item, seed variety, input or technique, and the approximate date. This identifies major actors at the community, municipal, and regional levels.

A 30-year timeframe was chosen for Ethiopia to assess the impact of the last two major political transformations that have affected rural policies directly. Two waves of new information and technology were detected which influenced crop and animal husbandry. Both waves of innovations were traced to two bilateral aid projects, which had dominated agricultural innovation for years. While this finding was not new to the rural community, the lack of impact from other governmental services became evident and could be described visually.

Photo 1. History of innovation (Ethiopia)
Once the above stage is exhausted, the research team offers to provide feedback and confirm its understanding of the information by producing a linkage map. This offer tends to be welcome with curiosity. A linkage map is drawn step-by-step (see activity 5 in Box 1), describing and agreeing with the group on each linkage as it is drawn. Linkages within and among communities are first drawn; then come linkages with municipal “actors” described by the farmers: agricultural technicians, inputs salesmen, middlemen and tradesmen; finally come the linkages with provincial, regional and national actors (agencies of line Ministries, state colleges and universities, research stations and industry). As the map appeared on the paper, the farmer in the Philippines confirmed that indeed it described their views; as one of them put it, their “truths.”

Photo 2. Linkage map from Ethiopia

The power of farmer participation in diagnosis of agricultural and development problems became evident in the Philippines after the map was completed in a community. The map allowed the participants to verify whom they trusted and received support from, who they had failed to contact, and whose functions needed review. The discussion provided an understanding to both the farmer groups and outsiders on actors’ goals or mission statements. The map led to identification and analysis of major linkage mechanisms and communication channels.

Figure 1. Linkage map from the Philippines

Box 2. A joint analysis of options and opportunities.

We asked Filipino farmers to compare the services of the private farm contractor (who was introducing pineapple production by providing a package comprising credit, regular technical advice and an assured market) with that of the public sector agricultural technician (AT). They praised the latter’s commitment, but felt the impact was small. We commented that the contractors’
price for pineapple would already include a discount to cover the cost of that advice; in other words, they would be paying for the advice. This generated an excited discussion after which we asked whether one day they would be willing to subsidize the AT’s service.

The cautious answer: Yes! But conditional to the AT working for the barangays’ interests; and the payment calculated according to their real capacity to pay. In their words, the AT should become a problem solver to deal with their priorities and not a messenger from the researchers.

In the training exercise in Cajamarca, Peru, the linkage maps, which emerged showed how, the work of some NGOs promoting ecologically sound agriculture was working in isolation from the efforts by the national research stations, which were also searching for low-input options for farmers.

**Photo 4. Linkage map from Peru**

In the Philippines case, the study team interviewed village organizations, municipal agricultural technicians and officers, input tradesmen, and middlemen, provincial agricultural officers, regional representatives of government departments, and a select number of national-level officials. A meeting was held with the ATs who in turn drew their own linkage map. The team decided not to interview other agencies working in the area, which had not appeared on the linkage map. Interestingly, in the Cajamarca area, the mayor has convened a forum on a regular basis to coordinate action among local government, NGOs and other organizations. This *mesa de concertación* is a platform for joint planning, very much in line with the concept of platforms for agro ecological planning (Roling, 1994).

**Stage (ii): Analysis of linkage performance**
The linkage map says very little about the relative performance or importance of the linkages. A further stage is required in order to identify the key linkages and to understand why and how they perform. The major linkages identified were analyzed using the following six criteria:

- actors’ awareness of other actors’ functions in a linkage;
- relevance of other actors’ services;
- timeliness of other actors’ services;
- accessibility to other actors’ services;
- communication media through which link is mediated;
- control over the initiation and management of a linkage;

**Figure 2. Matrix for analyzing linkage performance**

In the case of the Mamala I case, the criteria served as a basis to recommend a revised role for the agricultural technicians. The criteria provided the framework to give meaning to the field-level findings, and on that basis, to articulate improved roles and linkages. Some further work also from the Philippines by Lawrence (1995) has shown the use of information indicators to describe change in the information systems used by different stakeholders. While there is no quantitative indicator of linkage performance, in essence an effective link contributes to both actors’ learning process while responding to the immediate needs of their job or economic activity.

It is worth mentioning that this part of exercise was only done after the fieldwork in the Philippines and it was not done in a participatory manner.

The above describes the rationale for **Stage (iii) Action plan to modify roles and improve linkages**. In future, this third stage needs to borrow more tools from the RAAKS where several steps are proposed for action planning (Engel & Salomon, op. cit.).

**5. Summary of findings**
Farmers are a major source of information

In all communities agriculture knowledge from the research system was found to be limited and, in most cases, inadequate. Farmers’ primary source of information like new seed varieties, were other farmers. The farmers’ needs were not met by ATs services, nor where the programmes handed down to the technicians for transfer to farmers adequate to their needs. In the Philippines, the technicians were profiled as trust-worthy in some communities. In one community farmers indicated that, while the function of the ATs was of limited practical use in term of technological input, their contribution to community organizing was important. One group of farmers recommended that ATs become trained in problem identification.

Need to transfer the role of extension worker

The role of private sector actors appeared to be complementary to that of public one, yet there is ample room for improving its linkage function between research and farmers. A glance at the linkage map reveals the fact that there are precious few horizontal linkages at the municipal level; and those at the regional level are more protocolary than functional. It is at this level that both public and private sector delivery systems tend to function, and, therefore, it is this level that there is room for improvement.

In Ethiopia, the exercise took place at the farm level with the presence of the Development Agents (extension workers). Their presence certainly influenced farmers’ statements on the role they had played. At the same time, the history of rural policies in Ethiopia in the recent decades have led to a very limited role for actors who are not part of the public sector.

Shared control is the key criteria for effective linkage
The six criteria utilized to assess linkage performance are also useful guidelines in the design of improved linkages. Of the six criteria, *linkage control* is certainly the most important; it raises issues of power relations among actors and institutions, which cannot be disregarded.

**Where the approach did not work**

The approach was most successful in those communities, which enjoy multiple linkages with actors at the local, municipal and regional levels of analysis. Not surprisingly, the opposite is also true: in marginal communities striving to subsist with little to buy and sell, the approach is of very limited use. This was our experience in the Philippines with a group of fisher folk who were about to be evicted and for whom our visit constituted a major linkage.

The approach was not successful at the district and regional level as the institutions were reluctant to describe the impact of their work.

**6. Applicability of the approach for different actors**

The three experiences described here contrasted in terms of the type of context in which they took place. The Philippines case was an inter-disciplinary action-research activity working directly in the field with no training component. The Ethiopia one included a training component and the approach was built into a broad rapid rural appraisal mission. The Peru experience was a hybrid combining training and action-research with a learning group.

**Farmers**

The approach is relevant as a visual tool to understand communication network and as a basis to improve information exchange. As such it should provide farmers with the following benefits.

(i) In the first instance the approach provides a common language that enables them to identify information demands and channels on an equal footing with outsiders.
(ii) This linkage analysis provides a general understanding of the pattern of change that have taken place over a certain period, a “history of innovation”.

(iii) While being able to identity the actors and their roles, the farmers can analyze the sources of intervention and information provided, and understand better the roles played by the different actors.

(iv) This approach provides an opportunity to identify potential improvements to the existing system.

Agriculture technicians & field staff

The technicians or field staffs are a potential link between the farmers and other more distant sources of information. However, at present their effectiveness is limited - and to a large extent absent - in the cases researched in the Philippines and Ethiopia. An interaction with the farmers using this tool can help the technicians in the following manner.

(i) It is a fact that along with the technicians a number of other individuals provide information and therefore play a role both at the community and municipal levels.

(ii) The recognition of farmers as decision-makers mainly in the production process becomes evident. The sources and type of information obtained by farmers become clear. These findings give the technicians renewed respect and confidence in the farmers they work with.

(iii) The technicians can appreciate the fact that farmers can be partners in their work, if the technician’s job description becomes more relevant to the farmer’s needs.

(iv) An important output of this approach is that the information obtained by the technicians can help them prioritize the needs within and among communities.
A systemic undertaking of this approach by the technicians can be of value to the identification of farmer demands and priorities. It can be the cornerstone for the development of a strong research and development base that will serve the immediate requirements of the farmers.

**Municipal Agricultural Officers (MAO)**

In the Philippines, the MAO will play the most critical role in agricultural programmes in a municipality. With the devolution of responsibilities granted to the mayors in matters pertaining to agriculture, the MAO will play a pivotal role in guiding agricultural development in their area. The mayors will likely need management tools that can be used to help recommend priorities and make decisions regarding definition and implementation of agricultural services. The approach developed through this study could be used to fill this need for the following reasons:

(i) One of the significant findings of the field visits was the identification of a large number of individuals and institutions serving the farmers. From a research point of view, all research centres and institutions have at some point of time passed on new technologies to the farmers. This is in addition to the private sector institutions, the media and NGOs that also help farmers.

(ii) As indicated by the ATs in their discussions with the teams, an important area for concentration is the training of ATs. However, it is up to the MAO to determine the areas and degree of training required in different aspects, taking into consideration the roles of other actors and avoiding duplicative training for tasks other actors are involved with. The information provided by the ATs can be the basis for training assessment for the technicians.

(iii) The information obtained from the ATs and their own analysis will assist the MAO in identity priorities and making choices for investment in the municipality.
(iv) As the municipalities will now have more financial authority, the MAO could play an important role in the research activities of the province and the central research institutions. This will be an interesting feature given the fact that most of the implementation of programmes under the PHILIPPINES 2000 will be top-down.

From the above discussion it is clear that the approach as presented can be effectively be used at the community and municipal levels to identify problems, actors who are playing a significant role in the interventions at the field levels, and the research area and development activities that can be bargained at the municipal level.

Researchers

Most researchers make a genuine effort to determine and understand the real life problems facing farmers in agriculture and animal husbandry. Their underlying purpose is to approach their activities in a problem-solving manner, and consequently generate adaptive research programmes to solve such problems. However, the techniques researchers rely on for identifying the problems in the field are few and not well used. An effective use of PRA techniques by the researchers in collaboration with the ATs and MAOs will provide a good basic framework to identify the problems.

(i) The adoption of the approach wed - either directly by them in the field, or from information obtained by the farmers, ATs or MAOs - will help researchers obtain information on field problems and networks. Understanding the networks of actors that serve the farmers will help the researcher obtain the cooperation of the different actors. For example, the private sector traders who provide seeds and agricultural chemicals could become involved in promoting adaptive trials along with local research station staff.

(ii) Most researchers are commodity oriented and their appreciation is mostly from a “cropping systems” perspective. Interaction with farmers provides them with the “holistic” environment into which the research activities must be integrated. As a result of this close collaboration
the research agenda of the regional research centres or any other organization may become more relevant to farmer demands.

**Policy Makers**

Policy makers stand to gain from this approach. They have many sources of information which if made available to Municipal Agriculture Officers (MAOs) and farmers etc. Farm programmes can be revitalized.

(i) The programmes could better reflect farmer demands and make implementation more meaningful.

(ii) An insight into the possible new roles for the extension workers will likely emerge.

(iii) The approach may enhance the quality of extension planning by providing a framework for consultation with different stakeholders.

It must, however, be acknowledgement that the approach has not yet been tested on a large scale.

**7. Conclusions and policy recommendations**

**Revealing function linkage and patterns of control**

Mapping linkages in a knowledge system uncovers the mechanisms, which are functional to the exchange of information, the demands and the supply. The matrix is the first step towards analysis of the linkages. The control of the linkage is vital for poverty alleviation.

**Rethinking the role of agricultural technician (field extension staff)**
This study shows the need for a new role for the municipal agricultural technicians (extension workers); where the major function is information brokering and not transfer of technology. In the Philippines, the field workers are committed and would be more effective as facilitators rather than as instructors.

A management tool the Local Governments Units

The approach provides a tool to assess farmers’ needs so that collaboration can be worked out. MAOs and the mayors are best equipped to negotiate when they are aware of the existing needs, resources and patterns of information.

Engage as many stakeholders as possible the start

The Peru experience showed the power of stakeholders. The Cajamarca experience with the *mesa de concertación* set an important precedent for these different actors to emerge as learning groups.

References


Versatile Weeding Machine

Padaru Ramakrishna Sastry

“PADARU” Weeding Machine

Areca nut is grown in 68,5000 hectares of Malnad region comprising Dakshina Kannada, Uttara Kannada, parts of Shimoga and Chikmagalur districts of Karnataka and Kasargod district of Kerala.

Weeds pose a problem due to heavy rainfall (3,000 to 39,000 mm per annum). Drip irrigation does not help much to suppress the weeds. Weeding has to be a time-bound operation to precede the first harvest in October-November.

The weeds, if not cleared, may conceal areca nuts that fall to the ground. The nuts rot. Even if each tree loses five nuts, the loss would be around Rs.3, 000 per hectare per harvest, totaling to a minimum of Rs.10,000 per hectare per annum. Each hectare has 1,300 trees yielding crops a year and each nut fetches 50 paise.

High Labour requirement

About 100 man-days are required to clear weeds in a hectare involving an expenditure of Rs.4, 000 to 6,000. As weeding operation clashes with the busy season, it is difficult to find sufficient hands.

Under sprinkler irrigation, weeding has to be done in September, November-December and in February-March. Under drip irrigation, it has to be done only in summer.

Research requirement
Mechanization of fungicide spray to prevent “Mahali” disease followed by the mechanization of harvest was the only solution to save the crop. Some farmers mechanized the process, as it is difficult to get labour in time.

Padaru Ramakrishna Sastry, a young farmer and an agricultural graduate has developed a simple weeding machine that can complete weeding in one hectare compared to 100 man days when done manually. The machine, (which can also be used as a pump set) is powered by 1.5 HP Greaves MK 12/2 HSPP Petrol/ Kerosene engine. The engine is mounted on 2 ft. X 1 ft. platform. A V-belt connects it to a gearbox. An 18 inch X 3 inch tempered steel blade is connected to the shaft of the gear box using a specially designed self-tightening bolt. The platform cart has two wheels to enable it to be easily pushed or pulled with the help of handlebars. The blade rotates in anti-clockwise direction at 1000 rpm. Weeds are cut slightly above the ground level into pieces of four or six inches. The cut weeds serve as good mulch to the garden. It may be manually collected to feed the livestock.

The machine weighs 38 kg and can be operated without difficulty. It takes 24 hours to weed out a hectare by an experienced operator. This saves 90 per cent of the labour cost.

**Salient Features**

- Cost Rs.: 14,000
- Trouble-free gearbox. Spare parts are easily available. The speed of the engine (3000 rpm) is reduced to 1000 rmp in the gearbox.
- The blade gets tightened as it rotates. It will not detach during operation.
- Lubricated wheels for free movement. For easy movement in orchards and gardens an extra rotary wheel is provided in the front. This wheel may be detached after the operator gains enough experience in handling the machine.
- Belt is adjustable
- Two rubber mats are provided. One at the back, another on the right-hand side of the cart to guard the operator from the weeds and soil particles that is shot back.
Caution

Nobody should stand in front and on the lateral side of the machine while it is in operation. A distance of 50 ft. in front and lateral sides would be sufficient and this should be maintained. The machine is suitable for highly uneven gardens.

Farmer Acceptance

Within four months of its designing, 20 machines have been made to order and are in use at present.

Address of some of the consumers are given

1. Harikrishna Bhat
   Deyyardka House
   Post Irde
   Puttur Taluk
   Karnataka

2. Mahabala Bhat
   Sullia
   Post Manchi-574 323
   D.K. Karnataka

3. B. Mahabala Bhatt
   Balekumeri House
   Post Kabaka
   Puttur Taluk
   Karnataka
4. C.B. Monnappa  
    Malnad Plantations  
    Kanoor Post  
    S. Kodagu-571 276  
    Karnataka

5. R.S. Patial  
    Behind Prasad Lodge “Shiva”  
    Gadag-582101,Karnataka
Name and address of the inventor

Padaru Ramakrishna Shastry
Post Kolnadu-574 323
Via Manchi
D.K. Karnataka
Phone 08255-53221

Name and address of the manufacturer

P. Annu S.
Ambika Engineering Works
Main Road, Bolwar
Puttur-574 201
D.K. Karnataka
Phone: 08251-2001
Role of Women in Sustainable Development

Anand Singh

Introduction

The post-World War II period saw the emergence of several independent countries. All this countries tried to give an economic content to their political freedom by going in for rapid industrialization. They mostly chose the Eurocentric model for the growth and soon realized that their was one hitch. In Europe, both the victors and the vanquished were only concerned with their quality of life and means of improving it.

People in the developing Third World countries in Asia, Africa, and Latin America on the other hand were merely concerned with their survival. In this clash of interests, ecology was the major casualty. The people who thrived on traditional crafts felt the pressure on land due to rising population. Some of the natural resources on which such crafts depended became near extinct due to overuse. Planners woke up to this danger and the term sustainable development was coined which strikes a balance between economic growth and conservation of natural resources while promoting that growth.

This paper deals with the experiences of KwaZulu-Natal province of South Africa. Here, mostly women for weaving hats, mats, bats, purses, etc use the leaves of a versatile palm, Hyphaene coricea, commonly called kala palm. The unopened leaves are used for making the items, the leaf shoots are eaten, and an alcoholic brew is fermented from the sugary sap. The palm is one of the several endangered plants. According to Steve McKean, a resource ecologist for the Natal Parks Board of South Africa which is engaged in the conservation of endangered plants, there are 1000 species which are used in traditional medicine and of these 30 are declining rapidly owing to over-exploitation. Many street traders and herbalists are actively involved in conservation of these plants.

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The Mpenjati nature reserve on the South Coast of Kwazulu-Natal is one of several reserves engaged in saving the Ilala palm. The reserve is only 66 hectares in size but boasts five ecosystems - marine, wetlands, coastal grassland, coastal dune forest and estuarine. Because of the small size, it was easy to keep track of the palm trees and map out a strategy for their conservation.

The story had its origin in 1950 when a list of grasses and grass-like plants used in handicrafts was prepared by school children. In 1980, when some of these plants were facing a threat, there was renewed interest. Only since the last five years an effort has been made to give a human face to development by making people central to economic growth. It was soon realized that indigenous people could teach a lot to the world than learn from it. With the involvement of UN and its agencies this idea got crystallized and it is generally accepted that sound development is possible only with the co-operation of the people.

There is a difference even here as is borne out by four World Bank papers, which dealt with the Quichua of Eastern Ecuador, the Maasai of Kenya, the Samburu of Kenya and tribal Filipinos. The Indians were eager to bring about development through natural resource management. They had sanctity attached to their land use practices and were willing to try out new methods provided there was no radical departure from old methods. The Maasai were ready to collaborate with the authorities provided they were allowed to harmonize their traditional knowledge with the new practices. In fairness it should be said that the current programmes try to take something from traditional lore so that the people may not feel ill at ease while implementing them. Most of the programmes deal with ecosystems and on how to preserve them. In the initial stages people’s wishes were not considered. But now it has changed. In the World Bank report cited above, the Deputy Director of the Environment Department of World Bank, Mr. Andrew Steer recognized that ‘indigenous people especially when they have not been displaced from their ancestral homelands, possess quite sophisticated environmental knowledge and are frequently excellent resource managers’.
“Our Common Future”, a UN report on sustainable development prepared by a commission headed by the then Norwegian Prime Minister Gro Harlem Brundtland, said in 1987 that ‘elimination of poverty is at the centre of sustainable development’. David Pearce (1990) and others wrote a book on the experiences of five Third World countries—Indonesia, Sudan, Botswana, Nepal and Amazonia. This was based on poverty eradication without causing undue harm to environment. The authors defined natural capital stock as the stock of all environmental and natural resource assets, from oil in the ground to the quality of soil and ground water, from the stock of fish in the oceans to the capacity of the globe to recycle carbon. This takes an all-embracing view of resources with which indigenous people have been dealing since ages and have been having a system of checks and balances to prevent overuse of those assets.

There was another report on ‘Indigenous Views of Land and the Environment’ with relevance to the World Bank and its borrower countries. It was recognized that the native populations could make a significant contribution to conservation projects.

Studies undertaken to eradicate poverty recognize the importance of women, as they not only manage the household but also natural resources. In a lucid analysis of the subject, Krishna Ahooja-Patel (1995) stated

"As women constitute an overwhelming majority of the world’s poor, their advance has to be regarded as the cornerstone of sustainable development. Indeed, enhance the status of women and we have already initiated the process of environmental improvement”

**South Africa: Growing awareness and debate on Sustainable Development**

The Mpenjati reserve provides an illustration of what purposeful action can achieve in sustaining scarce natural resource. In South Africa, this problem was aggravated by the former racist regime, which herded Africans into native settlements called ‘Bantustans’. The
natives were forced to eke out their livelihood from an overused land. In 1930, betterment schemes were introduced. But these did not improve matters as land, already over-exploited, and was scarce to meet the needs of growing numbers. The forcible relocation in reserves was meant to serve as cheap reservoirs of manpower for the ever-increasing mining, agricultural and industrial activities, which were controlled by the whites.

This dilemma of overuse of land and burgeoning population set people thinking about the future of South Africa once apartheid became history. A pioneering work ‘sustainable development for a democratic South Africa’, edited by Ken Cole, British Development Economist, was a result of this new line of thinking for the future of an independent South Africa, which has now become a reality. He arranged a conference in 1993, which attracted speakers from USA, South Africa, 13 British Universities, four non-governmental organizations and 120 participants. One of the participants, Robert Fine argued that sustainable development could work only if labour’s legitimacy is recognized. This is possible only when political democracy achieves social legitimacy.

It may be mentioned here that South Africa contains more biodiversity than all the countries, except Brazil and Indonesia. This has led to eco-tourism and in rural areas about six per cent of land is under conservation. No conservation programme will be incomplete if women are not given their due place. The regulated harvesting of ilala palm produce shows this.

**Saving South Africa's Natural Capital Stock**

African areas like Gamalaxhe, Ezingolweni, Thongai, and Nzimakwe surround the Mpenjati reserve. Women get the permission to harvest the palm by word of south. They pay one rand a day to harvest the leaves. A three-member panel made an assessment of harvestable palm in the reserve. It was found that there were 759 stems on the south bank of the reserve. Of these, only 472 stems had leaves of harvestable size. The tree produces only four leaves a year. Only one leaf may be harvested to enable the trees to regenerate themselves. The seeds stay on the
trees for two years and take another two years to germinate. This cycle shows how difficult it is to conserve the tree and prevent its over-exploitation.

I interviewed 50 women with the aid of four post-graduate students from my department who were fluent in Zulu over. Durban’s central train station and beachfront were the places where women making ilala palm products congregate. On any given day, there were 132 women working in 60 stalls on the palm products. The women set up stalls at station without permission and wore baskets, mats and hats while awaiting customers. The stalls also served as sleeping quarters for these women. The beachfront stalls were better organized under thatched roofs and were set up with the permission of Durban municipality. There was no manufacturing here and there was tourist traffic. Of the 50, only four commuted between their trading posts and residences. The rest stayed because their houses were far away. Some belonged to neighbouring countries like Mozambique, Malawi and Swaziland.

Harvesting the tree is no joke. Some of the women walked 50 km to get leaves. They sleep in bushes and walk back to a natural reserve. After getting the leaves, they bundle them to carry as head loads. Yet others hired a truck for 500 rand to carry the leaves. Some bought leaves from women wholesalers at the railway station. The leaves are first processed in their native villages. The women face problems in Durban, too. They do not have facilities for storing the leaves acquired after such exertions. If it rains the leaves get soggy. To prevent them from getting dried up in the sun the leaves have to be worked without such loss of time after harvesting. The women have to occupy the places at rail station for fear of poaching. They have devised a system when someone is constantly in attendance at work places when others go to their homes. There is a great deal of self-reliance and camaraderie among these handicraft women in the absence of security provided by state agencies to guard their work spots or their raw material. There is advanced planning to get palm leaves on a regular basis. Most of the women were not aware of a trade union. The group solidarity, which was an important aspect of work ethic, gave them more security than a trade union. They had to contend with thieves and pickpockets.
The women brought their unfinished work to railway station so that they could kill time while awaiting customers. The women work in groups, and one of them went off to sleep while talking to us as she felt tired. It takes four branches of one-metre length to make a medium-size basket, two for a broom, two for a sieve and one and half for a hat. The time taken to make the articles ranges from three hours to one hour working for four days to complete the articles. Foreign women from Swaziland have mastered the art of making grass curtains.

Pricing the products is a problem. The women solely rely on the deftness of their fingers to earn their bread. The nature resources of Natal Parks Board charges are one rand per harvest, irrespective of the number of leaves. An effort was made to substitute the palm leaves with grasses. As they are seasonal produce, the scope is limited. The grass curtains are sold for 20 rands in Durban. The grass costs 10 rands. In addition to basket weaving, some of the women sculpt wooden items. That is mostly done at home while others are engaged in weaving.

At the station, the customers are mostly Africans. The beachfront stalls attract tourists. The women earn 35 rands a day by selling five to six items. It works out at 500 rands or $125 a month. The women do brisk business in Indian-dominated areas.

The experience of South African women clearly shows that they have great skills not only in manufacturing handicrafts but commendable organizational capacity to gather the raw material, make them into attractive items and market them. This entrepreneurial odyssey should prove the doubting Thomases wrong that the indigenous population cannot prosper unless knowledgeable people lead them. A modern substitute to native wisdom has not yet been found. Sustainable development is possible only when traditional ways are married to modern methods. Women are the custodians of such traditional practices. In the case of the Mpenjati nature reserve, the women have not only subjected themselves to regulated harvesting methods devised by modern techniques but have sometimes adopted modern transportation methods by engaging a truck to bring the produce to their work spot.
Acknowledgments

I am indebted to four post-graduate students from my department without whose assistance I would not have covered so many interviews. They are David Bogopa, Nelisiwe Mlongo, Lunigisile Shangase and Bongiwe Sibsi. I am also grateful to the University of Durban-Westville for the grant that made this research possible.

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Why do farmers experiment with slow growing trees when they do not gain from it?

Flemming Nielsen

Introduction

The importance of indigenous knowledge in agricultural development is well documented and widely accepted, but its generation is still poorly understood. A better understanding of farmers’ knowledge generation is necessary to help resource-poor farmers.

It is generally assumed that a small group of farmers who consciously experiment are the main generators of new indigenous knowledge. This study focuses on knowledge generation, namely knowledge generation about agro forestry systems with slow growing trees. The growth is so slow that a sapling planted by a young farmer will still be growing when he/she dies. A farmer, who establishes an experiment will therefore, not be able to utilize the knowledge gained in a lifetime. As the time span from initial planting till the benefits occur from the second improved planting will be several decades, farmers do not benefit from experimentation. All the same, indigenous knowledge evolves quickly. This apparent contradiction led to the question, “Why do farmers experiment with slow growing trees when they don’t gain from them?” The present study revealed that knowledge was gained involuntarily and that there was no conscious attempt. The factors that were found to be the most important for knowledge in this study have been overlooked in some similar studies about fast growing crops.

Farmers’ experimentation

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Most studies are based on a division of farming communities into experimenting farmers and laggards. Conscious experimentation is seen as the main source of new knowledge. Biggs’ (1987) classical figure illustrates this view (see figure 1).

Figure 1: Biggs (1987) model of linkages illustrates a commonly held view of knowledge generation where farmers are divided in experimenters, adopters and laggards (form Chambers et al., 1989:168).

Rhoades et al. (1991: 251) identified three types of experiments that farmers do with potatoes: Curiosity experiments, problem-solving experiments and adaptation experiments. The last can be divided into two sub-types; one is when farmers test an unknown technology in a known environment, another is the testing of a known technology in an unknown environment.
Stolzenbach (1994) based his interpretation on Schon (1983) who also distinguishes three kinds of experimentation: Exploratory experiments which resemble Rhoades’ curiosity experiments; hypothesis-testing experiments which are similar to Rhoades’ problem-solving experiments and finally, move-testing experiments conducted for changing the environment itself.

Several studies have been able to identify experimenting farmers (e.g. Box 1989:64; Richards 1985; Sperling 94a) but others have failed (Okali et al. 1994: 87).

Biggs (1981) and Amanor et al. (1993) pointed out that natural selection is the missing element in analysis of agricultural innovation. A managed environment creates selective pressure that results in germ plasm being better adapted to the needs of man. Natural selection is thus an important non-conscious factor in agricultural development.

Some writers caution about interpreting every variation in the agricultural practice as a conscious experiment.

“The crop mix, the layout of different crops in the field is not a design but a result, a completed performance... Each mixture is an historical record of what happened to a specific farmer on a specific piece of land in a specific year, not an attempt to implement a general theory of inter-species ecological complementarity....

“Researchers are looking at the wrong problem. They are looking for the combinatorial logic in intercropping where what matters to the Hausa farmer is sequential adjustment to unpredictable conditions. It is important therefore not to confuse spatial with temporal logic - not to conflate plan and performance.” (Richards 1989:40).

Richards’ observation has important implications. As every farmer changes crop mix he/she can be said to be doing experiments from such crop mix. Experimentation can be confused
with agricultural practice. Stolzenberg in line with this logic, and with Schon (1983) as a point of reference writes.

The management of a farm can be seen as a conditioned series of experiments, by which, through the labour itself, the agricultural performance improves. It therefore becomes difficult to talk of an ‘experiment’ as a special action, separated from daily activities. Stolzenberg (1994:155).

Knowledge generation is a communal activity that is partially conscious. Both experiments and small changes affected by farmers might contribute to the knowledge base, their importance varying with time, space and technology.

It is important to understand how and who generates different types of knowledge. Okali et al. (1994:88) concluded that the lack of a generally accepted view of experimentation is the biggest obstacle to advances in participatory research.

**Background**

The International Centre for Research in Agroforestry (ICRAF) and Forestry Research Institute (FORI) has since 1987 collaborated on a research programme in Uganda Agroforestry Research Network for Eastern and Central Africa-Ugandan Programme (AFRENA-Uganda). One of the mandates is research in upper-storey trees in perennial crops, mostly a wide range of bababa varieties (*Musa* spp.) and robusta coffee (*Coffea canephora*). The trees are grown to maintain soil fertility and include numerous *Ficus* and *Albizia* species among others. Declining soil fertility is a problem faced by most farmers and it is a major issue being addressed by the AFRENA-Uganda programme.

The programme has so far used both rapid rural appraisal and participatory method for problem identification (Nielsen et al. 1995) followed by on-station research. Due to slow growth, this results in delay.
In Uganda, indigenous knowledge on agro forestry is constantly developing (Andersen 1994). So collaboration with experimenting farmers was seen as one way to speed up the research process. Bean variety trials in Rwanda (Sperling et. al. 94b) are an example of this approach.

**Little knowledge about farmers knowledge generation**

To understand the growth of indigenous knowledge about agro forestry, upper-storey trees were taken up in detail. Mukono district, a small area where farmers grew *Albizia chinensis* was chosen as the study area. Indians introduced the species in Uganda around 1920 as a shade tree in tea estates. A few in the study area got hold of seedlings around 1930 and since then knowledge about the species has become widespread.

Initially it was thought that only a few experimenting farmers had been the main generators of knowledge but exploratory surveys failed to sustain the hypothesis. It became clear that the *Albizia chinensis* trees were difficult to remove and they survived for decades before dying. In other words, a farmer can not set up an experiment, learn from it, and utilize the new knowledge when replanting trees at the same site.

Based on these initial findings and hypothesis one central question arose: Why do farmers experiment with slow growing trees when they don’t gain from it? At this stage, it was decided to trace the diffusion of *Albizia chinensis* from its introduction to the area, and to collect information about its diffusion and the evolution of indigenous knowledge.

**Study area**

Mukono district is a crescent of fertile land bordering Lake Victoria, stretching 75 km inland. The bimodal rainfall of 1,100 to 1,500 mm favours perennial crops like coffee and banana intercropped with cassava, beans and sweet potatoes. Cooking banana (plantain) is
the stable food and robusta coffee the major cash crop. Semi-subsistence farmers with an average of 1.9 ha dominate the area.

Farmers rely on fallow and agroforestry for maintaining soil fertility. Indigenous tree species like *Ficus natalensis* and *Albizia coriaria* are also grown in bananas (Nielsen, 1994; Odoul, 1990; Andersen, 1994). Trees are left to grow into big trees over several decades.

**Methodology**

Forty-eight farmers growing *Albizia chinensis* and a similar number of non-adopting neighbours were identified as the subjects. At a later stage more farmers were identified but could not be included due to time constraints. Guided interviews, questionnaire survey, farm walks and observations were carried out over three months. Some interviews were taped and transcribed.

The interviews focussed on reconstructing farmers’ biographies to get a better understanding of what led them to experiment. This resembles the method advocated by Box (1989).

**Findings**

The first farmers to plant *Albizia chinensis* in the 1930s did so out of curiosity as there was little land pressure and indigenous alternative species were easily available. Some farmers who had planted the species were concerned with declining soil fertility and problem solving was thus a motivating factor.

*Albizia chinensis* seeds are easily dispersed by wind and farmers find them growing in their fields naturally. They do not bother to remove the trees or because they have learnt from other farmers that the tree is good with crops. Sixty percent of the farmers having *Albizia*
Albizia chinensis had obtained wildlings from other farmers, whereas the remaining forty percent got the tree species through natural dispersal of seeds.

In the case of annual crops, a farmer can design an experiment with a new variety or type of management, establish an experiment where old and new varieties or management are compared, evaluate the experiment, and adopt or not adopt depending on the evaluation (e.g. Sperling et. al. 1994b). A farmer can repeat this research cycle many times in his or her lifetime but not so with slow growing trees.

In this case study, none of the farmers had gone through the complete research cycle. Even farmers who planted Albizia chinensis forty years ago still have the same trees growing in their fields. Not a single farmer based his/her decision about spacing on experience from own experiments.

Out of the forty eight farmers with Albizia chinensis only one had set up an experiment on his own farm that enabled him to compare the new tree species with indigenous species simultaneously and under similar circumstances.

**Discussion**

From the study reported in this article, it is evident that nature, in the form of natural diffusion of germplasm, plays an important role in the generation of knowledge.

The biological diffusion of the trees ensured that farmers who would otherwise not have experimented with them suddenly did so. The generation of knowledge is, therefore, interplay between farmers and natures diffusion and selection. Farmers diffuse germplasm, ideas and knowledge, and nature diffuse germplasm. Only one farm had established what could be termed an experiment that enabled easy comparison of performance between different species.
Most farmers who did not experiment consciously contributed to the generation of knowledge by setting up an agro forestry system different from other farmer’s systems, thus allowing the community to compare different treatments between farms.

Experimentation and normal farm management is one and the same thing for most farmers. This is why neither the community nor the researchers could identify experimenting farmers.

If experimentation is defined as gaining new knowledge by testing new options, then all the studied farmers are experimenting farmers. But they do not fit in most of the common classifications of experimentation since the classifications are based on the assumption that experimentation is always a conscious process. The majority of the studied farmers can be divided into two groups.

- Farmers who choose to plant *Albizia chinensis* but have no intention of experimenting. This group can be termed voluntary, non-conscious experimenters.

- A large group of farmers who just find *Albizia chinensis* growing naturally in their fields and leave it to grow because they do not bother to remove it. They are really involuntary non-conscious experimenters.

The study does not show which group contributed most to the generation of the knowledge.

When it comes to knowledge about planting niche and compatibility with crops, the involuntary, non-conscious experimenters are likely to contribute most to knowledge generation. Since they just leave the tree grow where they find it, they might end up testing tree-crop combinations or spacing that no voluntary experimenter would even consider.
The knowledge generation by involuntary, non-conscious experimenters is omitted in most classification of experimentation, since most classifications implicitly assume that all experimentation is conscious.

If, for instance, the classification by Rhoades et al. (1991) is used then a fourth category of involuntary experimenters needs to be added to account for the knowledge generation in the case study.

<table>
<thead>
<tr>
<th>Modified classification of farmers experiments based on Rhoades et. al. (1991)</th>
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<tbody>
<tr>
<td>1. curiosity experiments</td>
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<tr>
<td>2. problem-solving experiments</td>
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<tr>
<td>3. adaptation experiments</td>
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<td>4. involuntary experiments</td>
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Biggelaar (1994) studied Rwandan farmers’ indigenous knowledge about agroforestry. It was based on the hypothesis that farmers can be divided into experimenting and adopting farmers. Such a differentiation was not found in the Ugandan case study yet it led to knowledge generation.

The land pressure is higher in Rwanda than in Uganda, leaving less room for failures and thus for curiosity and involuntary experimentation. Problem solving experimentation might be dominating in severely constrained farming systems like in Rwanda and individuals with more insight, curiosity, room for failure etc. might do more experimentation than other farmers.

Another explanation might be that the Rwandan study did not document farmer experimentation directly but assumed that people who are knowledgeable about trees are experimenting farmers. The Ugandan study shows that such a correlation does not always exist. Some of the involuntary farmers with little interest in trees contribute important
information to the common knowledge base by leaving trees to grow in crop combinations and or spacing that conscious experimenters would reject beforehand.

**Conclusion**

The question posed in the title, “Why do farmers experiment with slow growing trees when they don’t gain from it?” can now be answered:

They experiment non-consciously. They have no intention of experimenting but through the small variations they introduce in their agroforestry system, they create new “treatments” that are available for comparison by the community.

Experimentation and the resulting knowledge generation thus becomes a community process that can not be isolated to a few farmers. We have to widen our field of observation from the farm to the community level to comprehend how knowledge is generated.

Seen from this perspective knowledge generation is not a mystery. Knowledge generation is unavoidable by any farmer who reflects on his or her observations.

Natural diffusion and selection as well as involuntary experimentation might play a role not only in agroforestry with slow growing trees, although they become more prominent with this particular system due to the natural dispersal of seeds and the slow growth that discouraged conscious experimentation.

The implications for farmer participatory research are important. If many farmers do curiosity experiments, it is easy to engage in farmer participatory research since such farmers are willing to try interesting things without having immediate need or use for it. If on the other hand, almost all farmer experiments are of the involuntary type, then the scope for farmer participatory research is limited, since farmers are basically not interested in experimenting.
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Exploring Local Knowledge Systems in Rootcrop Agriculture: A Step Towards User-sensitive Research and Development

by Dindo Campilan\textsuperscript{107} and Gordon Prain\textsuperscript{108}

Local knowledge in rootcrop agriculture

Rootcrops like potato and sweet potato are in great demand in the developing world. They rank fourth and seventh respectively in world food production. In economic value, they are among the top five food crops in developing countries (Woolfe, 1992). But not much money is spent in research on these crops. One reason is that they are hardy varieties and the second reason is that cereal claims the lion's share of R&D budget. Rootcrops thrive in less favourable farmlands.

Potato and sweet potato have been called secondary crops with primary functions (Castillo, 1992). This is because they contribute significantly to household economy in at lease four distinct ways. In terms of consumption, they are the main foodstuffs in several ethnic communities. They provide income to low-income households and female farmers. They confer some sort of power by way of knowledge and material resource on those who grow them and finally by playing a vital role in sustainable agricultural and resource management.

Users and Local Knowledge System

A knowledge system is an articulated network of actors expected to work synergically to support innovations in a given domain of human activity (Roling, 1994). Thus a local knowledge system can be viewed as comprising the following:

- **Actors** either as individuals, groups, communities or other relevant social aggregations.
- **Problem situation** which encompasses the actors' themes of concern with respect to the gap between an existing and a desired situation.
- **Innovation** as the process of change by which actors (re)construct knowledge and practices to improve a problem situation.
- **Knowledge** in both software (e.g., concepts, criteria) and hardware (e.g., tools, materials) forms.

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• Configuration of actors, their linkages and interfaces within a particular knowledge system.
• Boundaries, including the influence of other actors and factors in the knowledge system's environment.

Actors in local knowledge systems are appropriately considered users since they are the ones who ultimately and/or directly utilize technical and social knowledge for innovation, e.g. in agricultural production. Far from being passive receivers of finished products, they are dynamic individuals and groups who make creative use of knowledge in performing a wide range of activities along the food chain and demonstrating informed decision-making and rational action (Hardon-Baars, 1996).

While working towards successful innovation, users' perspectives are formed through knowledge processes involving other actors within and outside the local community (Figure 1). These perspectives represent local people's views and knowledge, their understanding of their social and biophysical world— including the meanings they attach to their experiences—on which their decisions and actions are anchored.

**Figure 1: Forming a user's perspective through access to different knowledge sources (Camplian, 1996)**

User Participation in Agricultural R&D
This knowledge is generally bottled up in those communities and it is the endeavour of UPWARD (the acronym stands for User’s Perspectives With Agricultural Research and Development, a network launched in 1989 under the sponsorship of International Potato Center). UPWARD uses the farmers both as participants and beneficiaries in the R&D network. This enables UPWARD to tap the vast amount of knowledge that lies outside the formal research sector. This is a comprehensive programme involving growers, consumers, processors, traders, etc. The important part of UPWARD’s strategy is to employ users as consultants so that they can help in problem solving as they are in the best position to identify the face on a day to day basis. This eliminates imposition of a solution from above, which mostly is resisted by people on the spot. This helps in R&D professionals and users to jointly generate knowledge. The users also act as R&D managers. Case studies are undertaken with this type of framework.

**Key elements of the user participatory approach**

- *Sensitivity to users’ perspectives*, those from different types and categories of users including not only farmers but also processors, traders, consumers and other relevant actors;

- *Focus on households*, taking the household as the basic unit for decision making and action, including the dynamics of its members and of supra-households;

- *Food systems framework*, locating technological change within the broader system of food production, processing marketing and consumption.

- *Integration of scientific and local knowledge*, drawing on both science-based and local knowledge as complementary resources to support innovation;

- *Interdisciplinary mode*, bringing together various biophysical and social disciplines whose collective inputs are critical to successful R & D.

- *Multi-agency teamwork*, facilitating relevant agencies and other entities representing various sectors and interests to form working partnerships supportive of the R & D process;

- *Problem-based agenda*, orienting R & D to address locally perceived constraints and opportunities in agriculture and food systems; and

- *Secondary crop orientation*, recognizing the functions of rootcrops and other secondary crops in order to better harness their agro-ecological and socio-economic contributions.

UPWARD views agricultural R & D as a process involving three main interlocking phases, namely:
• **Diagnostic phase**, which covers the early stages of documentation, situation analysis, needs assessment, problem identification and resource inventory. The outcomes provide the basis for determining the need for and focus of the action research phase.

• **Action research phase**, which covers the stages of planning, development and testing of feasible options in addressing identified problems and opportunities.

• **Local R & D management phase**, which covers the stages of scaling up, local-level long-term planning, sustained action, institutionalization, policy formulation and capacity building.

A major interest of UPWARD is in exploring how the formal R&D sector can work in partnership with users by strengthening their inherent capacity to devise solutions to perceived problems. Its field projects seek to demonstrate how users can become actively involved at different phases of agricultural R&D such as through the following roles:

• **Users as consultants**, whereby inter-disciplinary teams consult with users on perceptions of local systems and needs. Gaining users’ perspectives is particularly important in diagnostic, descriptive and assessment activities.

• **Users as research partners**, whereby R & D professionals and users jointly generate and validate knowledge to address specific gaps, identify and evaluate options for dealing with problems and constraints, and decide among feasible solutions for improving a problem situation.

• **Users as R & D managers**, whereby users assume leadership and take management responsibility for R & D professionals meanwhile support and facilitate local initiatives while continuing to offer options for consideration by users.

Using the above framework, UPWARD researchers have engaged in field projects with users to support local knowledge systems for innovation in rootcrop agriculture. These experiences-
from appraisal and documentation to action research and local R & D management are illustrated through case projects presented in the next section.

The methods employed by formal R&D sector to collect and document genetic plant material are well known. What is not generally known is the efforts of individual farmers who are an important source of such knowledge. This informal sector’s neglect will result in gradual erosion of a vital section, which, if tapped, could complement the R&D efforts undertaken on a systematic basis.

One such effort has been made in Irian Jaya, eastern Indonesia, which is an important source of sweet potato genetic diversity.

One way of collecting the data is to undertake germplasm-gathering trips. Such collections have, what is known as conventional passport, data like varietal name, location, and date but usually excludes a documentation of the relevant knowledge that farmers have about the genetic materials like local taxonomies, evaluation criteria, adaptations, practices, and other technologies. In the Indonesian experimentation this gap is filled. Earlier studies (Yen, 1974) have confirmed rich genetic diversity in the region. This resulted in concerted efforts under Cenderwasih University (Irian Jaya) and other R&D institutions to collect local landraces. This was supported by UPWARD and IPC (Sanor et. al, 1993; Schneiber et. al. 1993; Prain et. al, 1995 and Schneider and Yaku, 1996).

Informal, participatory methods were used by members of the households who acted as local consultants to gather data. Local knowledge covered four aspects - capacity to identify different varieties of sweet potato; the composition of mixtures; farming methods adapted to different environments and symbolical and mythological dimensions of such knowledge. The results showed the knowledge was rational and the farmers were able to manipulate many cultivars. The campaign has helped in strengthening local conservation and breeding work.
UPWARD adopted a more comprehensive documentation approach through memory banking in another project in Southern Philippines (Sawdoval, 1995a). This sought to systematize traditional cropping knowledge through a mix of formal and informal methods. It was found that this method was best suited to tap indigenous farmers’ knowledge for collection and preservation of herbarium specimens. This method complements germplasm collections and supplements cultural information lacking in standard documentation (Prain and Piniero, 1994). Next, in each region, a patch was set aside to preserve genetic diversity and to verify local names, etc. so that farmers may not have to tax their memory.

In Java, it was found that farmers were facing pest and disease problem in their sweet potato fields. It was naturally affecting production (Widodo, et. al. 1995). A core group of farmers was formed who devised their own strategy to tackle the problem.

Each farmer acted as field researcher in this integrated crop management (ICM) experiment. The farmers distributed elite sweet potato varieties and tested urea doses in one season and days progressed they improved their skills. The results were analyzed and agenda was set for the following season (Van De Fliert and Braun, 1996).

Table 1. Example of farmers’ research priorities for sweetpotato ICM in four villages (Van de Fliert et. al., 1996)

<table>
<thead>
<tr>
<th>Bendunganjati</th>
<th>Turi</th>
<th>Ngaroyoso</th>
<th>Kradenan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varietal performance</td>
<td>Sex pheromone</td>
<td>Varietal performance</td>
<td>Varietal performance</td>
</tr>
<tr>
<td>Weevil control</td>
<td>Time of fertilizer application</td>
<td>Sex pheromone</td>
<td>Sex pheromone</td>
</tr>
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<td>through irrigation</td>
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<td></td>
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</tr>
<tr>
<td>Sex pheromone</td>
<td>Use of lime for weevil control</td>
<td>Insecticide use</td>
<td>Planting system</td>
</tr>
<tr>
<td>Type of fertilizer</td>
<td>Varietal performance</td>
<td>Fertilization timing, dosage, type, no. of applications</td>
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</table>
The aim is to improve farmers’ skill in field monitoring and decision making.

The farmers of southern Luzon, Philippines faced the problem of declining soil fertility in the upland sweet potato fields. Through a series of community discussions, they identified technology options that they wanted to try out (Bagalnon and Sanjos, 1996). The options were

- Use of complete fertilizer (30-30-30) as per recommendation of the Agriculture Department.
- Current practice of using inorganic commercial fertilizer, ammonium sulphate (21-0-0).
- Use of bio-organic fertilizer recommended by a nearby farm research centre.
- A combination of farmer practice and bio-organic fertilizer use and
- No fertilizer application.

After trying out these options for eight cropping seasons, data was collected and it was found that a combination of farmer practice and bio-organic fertilizer use was the best method to get maximum output. Yield, uniformity, marketability, tuber size were taken into account while arriving at this decision. A simple cost-benefit analysis was shared with researchers (Bagalanon and Jabonete, 1996). Two results emerged from these trials. The Department of Agriculture recognized the efficacy of the farmers’ trials and incorporated in its technology recommendations and gave it wide publicity through print and broadcast media. Also a worker’s co-operative decided to market bio-organic fertilizer through its sales outlet.
The potato farmers of Nepal uplands faced bacterial wilt problem in their crop. This not only reduced the yield but also eroded seed supply to low land farmers. The only way to tackle the menace was to take community action by way of quarantine of the affected farm and prevent the spread to other areas and by ensuring supply of clean seeds (Pradhanang et al, 1995). The nature of the disease and its management requires full community participation, as well as the strengthening and empowerment of local institutions in order for the innovation to be successful. (Figure 2). Because of the cohesive nature of Nepali society, concerted action was possible. The only constraint was the country has no seed supply and certification network (Ghimere et al, 1996). The community approach appeared to be local till such time the formal R&D sector steps in with a strategy.

Figure 2: Schematic diagram of community approach to bacterial wilt management (Dhital et. al., 1996)

The Nepal experiment was tried in Bukidnon, central Philippines but faced several problems. First, the villages were not properly demarcated, the ownership was fluid and there was some
strong ethnic identity with the result community action on the lines of Nepal became difficult. The only option was to deal with interested individuals.

There has to be some local authority that can step in and involve the community. This was easier in the case of Nepal culture the system of village elders prevails. In the case of Philippines this was not possible for the simple reasons such as one village merging into the next and there being ethnic diversity.

The UPWARD experience clearly brings out the advantage of traditional lore in crop and soil management that can be a useful complement to the formal R&D methods. The system is all the more useful because of the participatory nature. It is a sort of a trial and error method as is borne out by the Filipino experience where farmers practice plus bio-organic fertilizer was used to increase soil fertility. They had to reject three options that they themselves suggested initially.

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Sustainable Development: Contribution of Indigenous Wisdom in Management of Biodiversity

Charu Sheela Naik

Biodiversity is the variety of living organisms. In the course of human evolution, a point has already been reached where along with air and water the availability of biodiversity has become a constraint to future growth.

Several questions may be raised. Can the current pattern of consumption be maintained in the long term? Are alternate consumption patterns available? Is the modern consumer paying all the costs? What are the ethical issues involved when one group of people derive benefit from natural resources based on knowledge developed by other groups of people?

While a universally satisfactory framework for sustainable development is not available at the moment, an understanding of why development becomes unsustainable could be useful. The most obvious factors responsible for resource depletion are economic growth and rising population. A further scrutiny suggests that lack of appropriate market and state polices are responsible for unsustainable development with increase in population and economic activity. Another argument suggests that the impacts of mega projects and monocultures lead to unsustainability in the long run. Yet another argument relates unsustainability to the breakdown of traditional life styles rather than simple growth of population.

In contemporary India there are some unique practices relating to choices individuals make regarding use of plants and animals in the course of their daily lives. What is the role of these traditional mechanisms in management of biodiversity? Do they have a place in future modern scientific management approaches? This study explores the role of some indigenous

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institutions in management of biodiversity. We first report a collection of practices of interest. Some interesting features are observed. Insights are generated to appreciate these practices in a modern perspective. A link between current issues in this area and these traditional methods is discussed. Issues in conservation of these practices are investigated.

1.1 Some examples of common Indian practices in contemporary India

1. Several days of the year are named after the food to be served on that day. On the fifth day of the tenth lunar month Khichdi is to be served and the day is known as 'Khichdi Pancham'.

2. In the ninth lunar month, unmarried girls in Gujarat observe a diet regime for five days. No salt is added in their food; only salty seaweed is included in the diet. Special ceremonies with songs, stories and religious services are undertaken. The entire exercise is supposed to ensure a good husband for the participants.

3. On the 11th day of the ninth month, the Bishnoi community in North India observe the ritual of Satgadda. Women go to the market and purchase all the variety of vegetables available on that day and cook them together according to a specific recipe.

4. The sixth and the seventh day of the 11th lunar month are jointly observed as 'Radhan Chhath' and 'Shitla Satam', which may be roughly translated as the 'Cookery Six' and the 'Cold Seven'. On the sixth day, elaborate cooking activity takes place and this food is served on the seventh day, when no cooking may be undertaken.

5. Anavils of South Gujarat follow a specific cooking rule on the 9th day of the ninth month wherein no kitchen instrument is used on that day. The meal consists of a dish of nine varieties of sprouted beans, hand-made bread and uncut chillies and cucumber.

6. Consumption of mangoes may begin after the 15th day of the fifth month when the first fruit is offered to the holy fire.
7. A variety of diet rules based on medical, religious and cultural principles are observed in different communities. Many of the rules combine two or more of these principles. On the 11th day of the month the diet of a Hindu requires consumption of food items such as wild rice, lotus seeds, water chestnuts, peanuts and some other wild grains. The ceremonial meal in the wedding ceremony calls for specific rich spices. Certain grains and vegetables are recommended/prohibited for specific groups of people. Certain ‘vrat’ call for avoidance of sour items; other practices call for eating of items made from specific vegetables.

8. Several social and seasonal customs requiring extraction of specific plants are found in different communities. When a sister visits the newborn of her brother she takes a gift of fresh neem leaves. On the first day of the spring, the gardener takes a bouquet of specific sprigs to the employer's residence. The blades of a grass coming up after the first showers is plucked and cooked in a ritual recipe.

9. When members of a community migrate, they carry with them plants from the homeland so as to maintain their daily routine in the new habitat. Also, they adapt some plants in the new land to suit their original habits. In the case of Anavils of South Gujarat migrating to Africa, specific varieties of sorghum, betal leaf and spices have been transported and now cultivated in their new homeland. Also certain varieties of mango and other fruits and vegetables have been adapted to suit their original cuisine.

10. The celebration of various festivals calls for the use of certain species in specific manners. On Dussehra, certain leaves are exchanged; on Holi colour extracted from certain flowers is sprayed on friends; on Sakranti, sweets made of sesame are offered to friends. There are festivals where cattle and other domestic animals are the focus of celebration.
11. A vast number of religious ceremonies for different days of the year and different deities during different seasons are performed by various groups of people, and these require elaborate ceremonial material comprising different plants.

12. Decoration for specific spaces, individuals and animals are to be made from specific flowers, leaves etc.

13. The grooming of a bride requires pastes, perfumes and flowers of a specific variety.

14. Different ceremonies for special occasions (e.g., house warming, naming, marriage, engagement, funeral) call for specific plant material.

15. Worship of specific deities requires offerings of specific plants.

16. Cremation procedures require specific amounts of different wood and plant material.

17. Rules to serve vegetables in different combinations, at different times, cooked in different manner have evolved to suit individual physical characteristics, seasonal requirements, other requirement such as travelling, preservation, sensitive digestion, quality nutrition and so on.

18. Different communities have evolved their own procedures for daily health care. These include oil massage, herbal cosmetics, weekly diet rules, daily menu etc.

19. Different regions have different popular home remedies for common ailments, infant routines, seasonal precautions and first-aid cases based on local species.

20. Different food preservation techniques are observed in different regions with different climatic conditions, religious customs, life styles, plant availability, etc. These include
sun drying, addition of other plants or salts, pickling procedures, storage space design etc.

21. Roti (Indian bread), rice and dal (lentil curry), the three staple foods, are served in innumerable different ways across regions, seasons, families, occasions and communities. Apart from cooking procedures and recipes these variations also call for different variety of wheat, rice or pulses.

22. The science of indigenous medicine is employed for human welfare by different experts with some variation in its implication for management of different species. Vaidyas, the indigenous doctors, prescribe medicines, which are to be procured by the patient from a local pharmacy. The pharmacy may extract the plants from forests or may cultivate them for its requirement. Some modern experts have specialised in a specific human disorder involving the use of specific plants. They grow these plants for their professional requirement. The Bhagats in tribal regions prescribe specific plants found in the local area for treatment purpose. There are other experts who are not traditional Vaidyas, tribal bhagats or modern experts. Their main income generating activity is not medical practice. Karimbhai in North Gujarat is a potter by family profession. He is well known in the district for his expertise in indigenous medicines. He has intimate knowledge of around 100 species growing in the mountainous region of Abu. When approached for relief from discomfort for his human or animal patients, he drops his work and takes off in the hills to procure the necessary plant. He provides the patient with instruction of application without charging any fee.

23. In its purest tradition, the indigenous medical science lays down the procedure for extracting plants for human treatment. The practitioner will go and invite the plants in a prescribed manner and only on the next day may he go and collect these.
24. The code of medical ethics prohibits unlimited extraction of plants for human consumption. The case of Mukundrai Vaidya is recorded. After successful treatment of a patient, he warned the patient to follow a disciplined lifestyle since the same treatment will not be available as it involves extraction of hundreds of plants. The patient did suffer an attack again and was refused treatment by the Vaidya.

25. Respect for specific beneficial species is expressed in various ceremonies to be performed on specific days of the year. There are days allocated to the snake, tulsi, banyan, peepal etc.

26. Procedures for milk preparations, milk handling and cattle rearing are also numerous. A respect for milk and cows, the source of nutrition, is expressed in a variety of rules. There are taboos on selling buttermilk (it must be given free), on removing milk after sunset, on deliberate curdling of milk, etc. Innumerable recipes of milk preparation are available. For infant welfare, regulating the fodder of the cattle in different seasons regulates the quality of milk. The respect for cow extends to the blue bull (neelgai) an antelope species whose meat is taboo simply because of its name.

27. Practitioners of indigenous medicine maintain plantations of medicinal herbs for their professional requirement.

28. Collection of rare, exotic or other plants for personal pleasure is observed in many traditional families.

29. Superstitions relating to disturbing beehives or nests, killing specific birds/animals and cutting specific trees prevail in different communities.

30. Individuals are linked with specific species through their horoscopes. Along with favourable colours, days, etc., favourable foods are also indicated in horoscopes.
31. Indigenous rules for survival in an emergency indicate the specific foods to be consumed during famine.

32. Sensitivity for different features of local species maybe noticed in several verbal forms. Idioms, proverbs and names highlighting a characteristic of a specific species are used in human speech.

33. Couplets/ riddles describing the favourable/unfavourable features of domestic animals are referred for selection of animals.

34. Songs and stories expressing concern for different species are popular in different communities.

35. Different common usage names indicating the technical properties of a recipe, procedure, or a plant have evolved in different regions. "Shiyalu pak" (Winter mix), "Thandai" (Cooler), "Gha-bajariya" (Wound millet) are examples in Gujarat.

36. In the mango growing region of South Gujarat, several local varieties of mangoes are named after the family, particular food preparation, flavour, time of ripening, colour and other such features. These are found only in certain homesteads and not in the market.

37. There is a hierarchical classification system for different life forms in the Jainism. Human beings should consume only those species from the lower order as necessary for life sustenance. Jains therefore are vegetarians. They further avoid the intake of roots and tubers as they may be harbouring other lifeforms of higher order. Some jains take this logic even further and limit their food intake to a selected variety of species. A mental declaration of this diet choice is believed to ease the tension on the other species surrounding the human being. Also, jains stop consumption of leafy
vegetables and mangoes during the monsoon. There are chances of insects residing inside vegetables/ fruits during the rainy season.

38. Some modern versions of traditional practices may be observed. Maintenance of memorial parks, planting of saplings on important occasions, interest in plant/animal collections, sponsoring of cattle in distress times, modern forest festivals (in which individuals are provided free saplings on a particular day), exchange of special heirloom species, sponsoring of community parks by corporations, public agencies and families, are emerging trends in modern life styles.

39. Garments, utensils, ethnic food and ceremonies are becoming fashionable along with ethnic interiors, in upper income groups and groups living abroad.

40. The practice of 'Bonsai' where the growth of plants is regulated to produce miniature trees growing in pots to be displayed in elegant homes is now popular in urban Indian households. But the traditionally sacred or shade giving trees are not included in the Bonsai garden of a Hindu family.

1.2 Scheme of Cultural Mechanisms in Traditional Lifestyle

A preliminary scrutiny of the above reported observations suggests the presence of an extensive scheme of cultural mechanisms linking various species with human life styles. Several features of the practices may be noticed and these help explain the design and influence of these mechanisms.

Form of the Practices

The observed form may be a specific behaviour pattern (ritual ceremony as in above no.14), a belief (superstition as in above no.29), or a verbal expression (songs as in no.34).
Type of Mechanisms

The mechanisms employed for guiding human life styles are in the form of social customs, taboos, superstitions, recipes, medical principles, professional ethics, religious doctrines, songs, and stories.

The Variety of Spaces in Life Styles

The incidence of the above mechanisms is aimed at various subtle, simple, common, unusual spaces in the life styles of the target community. At times, spaces are specifically created for a specific species. The occurrence of these spaces may be found in food habits, diets patterns, health regimes, medicinal procedures, ethical norms, entertainment activities, celebration of various incidents, and community / cultural/spiritual customs of a group. In the course of a routine daily life or special occasion activity an average Indian chooses a specific plant under the influence of these indigenous mechanisms.

Gender Bias

The presence of a gender bias in above scheme may be noticed in different forms. Women observe most of the cultural rituals. They follow innumerable diet principles for various days of the lunar calendar and for various occasions, and seasons. It may be seen as unfair bias, but it may also be the more effective design to suit women's life styles. Also the practice of these customs have channelized the knowledge of these customs, properties of various plants linked with these customs, and procedures for ensuring the availability of these plants towards the women of the society.

Domain of the Observed Practices
The observed practices are designed to cover a specific group of population on basis of gender, region, language, season, age, etc.

1.3 Implication for Biodiversity Management

Common feature of the above reported practices is the fact that these mechanisms guide human activities to link a specific species from nature to fulfil their social/ physical/ emotional/ religious/ cultural requirements. The nature of this link has different implications for biodiversity management. First, these links are associated with a variety of species, not all of which are meant for a direct physical consumption by an average individual. Some obscure plants are provided specific roles in special occasion ceremonies. This generates a sense of concern and protection for these plants in a community. Some uncultivated plants are given the status of special occasion foods. This generates a regulated demand and ensures availability of these wild varieties of crops. The seasonal and medical rules lead to extraction of subject species, but these rules are again combined with ethical codes as a precaution against over-exploitation. Direct taboos on exploitation of sacred species are designed to protect important plants.

Worship of specific domestic animals and common trees indicates a method of instilling respectful concern for useful or other species. The Ayurvedic pharmacopoeia is an encyclopaedia of medicinal herbs and plants. This treatise provides a knowledge base for utilization of thousands of species for medical purpose, and also for a scheme of technical classification of a variety of species. The Jain classification scheme for different animals and plants into a hierarchical order is another technical classification schemes. The dozens of different names for different varieties of mangoes are part of another technical assessment scheme. These names indicate knowledge of subtle varieties of the common fruit tree. Special recipes for specific occasions/ seasons call for a variety of vegetables, herbs and spices. These recipes are not merely for taste, convenience or nutrition requirements of individuals. They create a specific demand for otherwise unutilized species of plants. An acquired taste for these recipes ensures human concern for these marginal varieties.
In summary we observe that these mechanisms have a variety of functions for biodiversity management.

1.4 A Comparison with Modern Life Style Mechanisms for Biodiversity Management

For our purpose we consider the life style of an urban office-goer in a developed country. His daily food consumption pattern is not drastically different across the states of the country, the seasons of the year or across different population groups. The average food pattern includes much less variety of vegetables/ cereals in comparison with an average Indian diet pattern. The repertoire of common household remedies based on natural material is of a very limited range. The use of plants for other than food purpose is for indoor or outdoor gardens and gift of flowers. The range of plants is again very limited and these are procured from the market and not from the wild. The link to wild plantations is limited to holiday trips to natural parks in their own countries or other LDCs. The parks are guarded and protected by the state.

In the traditional life style, the indigenous mechanisms ensure continuous link with a wide variety of species, and an automatic nurturance of these species without the influence of the market or state mechanisms.

2.0 Some Current Issues in Biodiversity Management

2.1 Technical Assessment

A basic concern in biodiversity management is to identify and document the different species so as to be able to plan for conservation, utilization and valuation of this important natural resource. Wilson (1992) gives a classic account of how new species appear in bursts of
adaptive radiation and what cataclysmic events have disrupted evolution and diminished global biodiversity over the past 600 million years.

2.2 Ethical Issues in Utilization of Biodiversity

The utilization of biodiversity for human welfare is fraught with a variety of ethical issues. When an individual consumes a natural element for his own benefit, he may be depriving others. These others may be: individuals in future generations, individuals with more pressing current needs, people who have nurtured this natural element over the past several generations, or people who have less political or economic access to this resource.

The concern for compensation to others for utilization of biodiversity is of recent origin. Prior to the industrial revolution, with relatively abundant supply of natural resources, the issue of compensation did not arise. Also, as discussed earlier, the societies of today's developing countries had their own rules governing the consumption of biodiversity and other natural resources. In current literature, we observe a range of different positions regarding protection of the rights of groups with conflicting demands on natural biodiversity. Gadgil and Guha (1993) have undertaken a review of the ecological impacts during different rules in Indian history. They observe that till the time of the British Colonial rule the indigenous social and economic practices were undisturbed and the built-in mechanisms for environmental conservation were effective. The picture changed completely when India came in contact with Christian Europe. Various examples are analysed to conclude that in the wake of the Industrial Revolution there were drastic changes in state polices, local economic activities and traditional social norms which led to serve damage to the Indian ecosystem.

Today's complex international patent regimes may have implications for local biodiversity. Various perspectives in this area are available. Lesser (1991) has analysed the various issues connected with patent protection in modern international contexts. A detailed analysis of the benefits and costs (private, social, national, foreign) associated with plant breeder rights is undertaken. Supplementary legislative procedures for increased effectiveness towards
conservation of germplasm are suggested. Finally he concludes that more questions have been raised than answers found. The study reveals the complexity of conflicting issues involved in this area. In contrast to this multi-perspective study, other studies from a national or technical angle have taken very clear position against the GATT treaty. There have been striking achievements through sophisticated bio-technological techniques, but this process cannot lead to a perfect miraculous man-made germplasm collection. There is a need for improved diverse plant varieties, and conventional plant breeding based on material sharing, and unrestricted global cooperation must continue. The patenting of plant varieties serves only the interests of some companies. The case of Shaman Pharmaceuticals is now a well-known example of compensation to the local population by foreign drug companies in return for access to medicinal herbs. King (1992) gives the details of the procedures for compensation. This example now serves as a model for protection of the rights of indigenous people while the profit motive of a business organization and conservation of local biodiversity are also accounted for. In the context of state intervention for conservation of natural resources, McNeely (1993) surveys seven cases from diverse cultures of Nepal, Zambia, Brazil etc.. and identifies the strengths of common property resource management systems. It is argued that the traditional systems are more sensitive to conservation while central governments have higher priority on commercial exploitation. He suggests ways of adapting the traditional system to modern reality.

Outside of the patent regime, in the international trade arena, there is an area of conflict between the developed and developing countries. McNeely and Norgaard (1992) observed the need for internalizing the costs of environmental damage in export trade and suggest some mechanisms to this end. At the same time it is also pointed out that Third World countries are price takers rather than price setters. Compensation for degradation to biodiversity is difficult to collect from the developed world.

In the case of the reported Indian reality, the ethical issues are very different from those discussed in the above literature. There is little evidence of violation of individual rights by other individuals. The concern is to protect the rights of existence of other species in nature.
The taboos against disturbing the habitat of certain species, the norms observed by medical experts for extracting plants, the household rules for handling different species and natural material are all evidence of this concern.

2.3 Economic Analysis for Biodiversity Conservation

For efficiency of resource allocation, prices should correctly reflect resource scarcity. In the case of biodiversity loss, one obvious cause is the absence of the cost of natural resources in terms of market prices. In the national context, the difficulty may be located with the practical problems of estimating the true prices of natural resources. In the international context there is an additional difficulty of the inability of developing countries to correct these prices.

The difficulty of qualifying the benefits of biodiversity is addressed through different approaches. One approach to include environmental value is to estimate the price consumers are willing to pay for environmental benefits. The major methods are hedonic price analysis, travel cost method and contingent valuation. A review of these methods is available in the report of U.S. National Research Council (1992).

Young (1992) suggests alternate valuation schemes for protection of natural resources. The nature of the task of conservation of biodiversity does not easily lend itself to economic analysis. At the end of conventional and other economic approaches, again the matter comes back to modern ethics or indigenous practices.

The issue of economic valuation of different species is entirely absent in our reported reality.

2.4 Indigenous Methods for Conservation of Natural Resources

The current interest in indigenous methods of utilizing natural resources may be grouped into several broad categories. A simple, application oriented perspective is to collect and document effective traditional practices. These collections include use of local material for improved
agriculture (Bhemappa and Hosamani, 1996), religious practices involving nurturence of plants and other natural resources, traditional medical practices and accounts of social customs relating to natural resources (Jadhav, 1980). A deeper examination of such practices attempts to relate the observation of these practices to its influence on natural resources. Geeti Sen (1992) has examined indigenous life styles to attain an appreciation of the sensitivity to natural resource management in different cultures.

There are studies of effective incorporation of indigenous practices for common pool resource management into modern management. Successful experiences of using local traditional mechanisms in management of forest resources have been observed in Zambia and Kenya by McNeely (1993). In a different group may be placed the attempt to identify conceptual frameworks to explain the scheme of natural resource management embedded into the life styles, customs and practices of local groups of people. In this group we have studies by Vanucci (1994) and Gupta and Alcorn (1989). Vanucci has identified the scientific elements in Vedic practices. Dolmatoff (1976) has proposed a system model to explain customs of Amazon tribals. Alcorn (1976) has proposed a script model to represent the agricultural practices of Bora tribes. Arguments to strengthen indigenous practices for sustainable development have been made in several recent studies. In Nepal, Ostrom (1976) shows the effectiveness of local practices, Gadgil (1994) argues for incentives to strengthen original common pool resource management system. Shiva (1993) favours the traditional approach in comparison with the dominant modern approach for management of biodiversity and other natural resources.

The study by Alcorn (1989) is of particular interest here. She has conceptualized the agriculture procedures followed by Bora farmers as an indigenous script that guides the decisions of the farmers. A similar conceptualization may capture the daily behaviour of a traditional individual in our study.
3.1 A Link between Current Issues and Traditional Mechanisms for Biodiversity Management

Indigenous mechanisms can give valuable contribution to biodiversity management in current context. The modern technical classification of different species may be linked with the indigenous classification system so as to access their utility established in traditional cultures.

An understanding of the ethical codes developed by the traditional societies is useful to develop new codes appropriate for modern life styles. These may relate to individual and community behaviour or for international agreements.

A comparison of modern and traditional consumption pattern on basis of costs assigned to fulfilling similar human needs under different life styles may reveal interesting insights for valuation of biodiversity.

An examination of relevance of existing indigenous mechanisms in contemporary context would lead to some innovations appropriate for current reality. Some practices that are now counter-productive may be discouraged. The large amount of special variety of wood and herbs consumed for state funerals may be encouraging wasteful exploitation of natural resources for status value. On the other hand simple indigenous measures may be popularized by fashion models pop-stars etc.. to convey the importance of this resource. Desirable practices could be introduced into the leisure activities of a modern individual, e.g. travel and party games. The inner logic guiding the choice of species by a traditional individual may be seen as an indigenous script. A sensitive effort by the state, or other agencies to alter this script would have a significant impact on a society’s effort for management of its biodiversity resource.

3.2 Writing a Modern Script: The Role of "SRISTI"
The indigenous script embedded in different cultures is developed over generations to suit the specific context. Now it is obviously time to update this script to meet the requirements of current life situations. Individuals like Kaniyalal Munshi and Tilak introduced the now well established *van-mahotsav* and *ganesh-mahotsav* in the past.

Government could consider influencing human behaviour towards a desirable outcome through promotion of relevant new and old festivals, cuisine, daily habits and alternate health practices. A simple childhood habit could be significant in preserving a society's natural resource. Systematic inculcation of such habits should be seriously considered. The effort of organisation like SRISTI, Society for Research and Initiatives for Sustainable Technologies and Institutions, are examples of non-government efforts towards a similar goal. Such NGOs are devoted to research in indigenous practices for sustainable development. Their effectiveness could be enhanced by government support and positive interaction with other NGOs.

The dangers associated with a lack of strategic effort to transform this indigenous script along with efforts for economic growth through modernization are obvious. A population enjoying manufactured uniform diet in accompaniment of chemically engineered drugs for health care as well as media entertainment will have lost the capacity of enjoying their natural biodiversity resource, and the future of this resource in such a civilization does not appear to be healthy.

### 4.0 Conclusion

The traditional Indian individual has an inner sensitivity to the value of the natural resource of biodiversity. The task of management of this resource is incorporated into routine daily lifestyle through a variety of practices. This reality may be represented as an indigenous script directing human life activity in such a manner as to exploit the benefits of available biodiversity and simultaneously manage its occurrence at desirable levels. Some innovative
methods may be employed to maintain the relevance of indigenous traditions in today's context.

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Culture and Biodiversity in the Andes

by Grimaldo Rengifo Vasquez

Introduction

According to scientific definitions, biodiversity or biological diversity is the variety of life in all forms, levels and combinations. They include biodiversity of eco-system, of species and genetic biodiversity (IUCN, PNUMA, WWF, 1991) and refer to all existing species of plants, animals and micro-organisms interacting within a given ecosystem (Altieri 1995), i.e., all living beings.

According to Maturana and Varela (1995, p.73) living beings are self-sustainable and capable of reproduction:

‘if they are machines, living systems are self-sustainable machines in the sense that they are able to transform themselves so that their own product corresponds to their own organization. If we consider the opposite statement: a system, which is self-sustainable is therefore a living system. In other words, self-sustainability characterizes even the “organization” of living beings’.

Such a definition excludes stones and clouds. But now let us turn to an Andean vision of the world to see how it sees ‘biodiversity’.

In the Andean culture, diversity is holistic. Basically, it includes all living beings. *Runakuna in Quihua* (human beings) perceive *alpacas* or sweet corn as living beings. However, they also consider rivers, stones, stars, wind and all other elements incapable of reproduction, as forms of life. And in this, the notion of self-sustainability is totally meaningless.

The activities, which characterize any form of life, are not seen as the expression of individual acts. Rather, they are the sum of reciprocal and equitable participation of all regenerative activities. In Andean culture, there is no difference between what is ‘living’ and what is ‘lifeless’. For example, Andean people do not consider a new potato crop to be the result of hybridization of different living organisms in a given environment. Instead, they perceive it as a symbiotic process among all other existing things. In other words, the life of *papa* seeds does not only derive from the seeds themselves, it also involves, equally

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111 With ‘form of life’ we refer to the single expression that characterizes a living being and differentiates but does not oppose it to any form of life so that one can easily tell the difference between, say a *llama* and an *alpaca*, but this difference completes them. We are not referring here to external as opposing an internal figure. The expression ‘form of life’ implies/ includes internal and external elements.
importantly, the participation of earth, water, stars, apus and runas (people). In such a vision of life, everything is linked with everything else and they are all together engaged in the regeneration of the world.

Nowadays, this culture of biodiversity is threatened. Reports of extinction of species, varieties and cultures due to industrial pollution, unrestricted development, trade and modern agriculture are aplenty. Many programmes on biodiversity have been launched in response to this problem. Yet little is known about the nurturing of different ‘life forms’ within local communities. Even less understood is how these local communities regard the loss of seeds. Little is known about how seeds are grown by peasants and even less information is available about the so-called ‘seed culture’.

The Nurturing of Diversity

What really puzzles a peasant as far as the crop is concerned is not only the diversity of species, but also the great variety within the species themselves, be it papa (potato), firjol (bean) or quimma. The same is the case with animals such as alpacas, llamas, ocas (geese) and cuyes (sort of guinea pigs). Andean agriculture and livestock are extremely varied. The diversity in the species in the chacras (cultivated field) is accounted for by the interaction between ecological phenomena (such as climate variations, the tropical location of these areas, the historical geological changes and plentiful sun) and human interaction (horticulture and animal husbandry). As it was pointed out by Francois Greslou (1989), only a few studies acknowledge the Andean vision of the world as a driving force in the orientation of a nurturing culture in these tropical areas.

Following western explanations, interaction between humanity and nature is perceived as a conflicting relationship in that human survival is guaranteed only if humans are capable of imposing themselves on nature through technology intervention. A cultivated plant is deprived of its natural attributes so that its reproduction is only guaranteed through the process of horticulture. A cultivated plant is a subdued ‘form of life’ whose once complex relationship with the natural environment (transformed now to a ‘cultural landscape’) is simplified and even eliminated.

In such a process, the cultivated plant no longer belongs to the realm of nature (vegetable kingdom), but it belongs to the ‘realm of culture’. In this framework, culture and its related techniques are seen exclusively as a human attribute. Agriculture is, therefore, perceived as humanity’s triumph over nature. In the Andes, their cosmology leads to a completely different approach. From an Andean viewpoint, the nurturing of so many forms of life is considered to be a dialogue, or even a loving conversation. It is not a question of conflicting

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112 Robin Pellow, director of WWF-RV states that ‘A global assessment of diversity, coordinated by PNUMA and carried out by 1,500 scientists, found that biological elements of the Earth are in serious danger. The evolution of biodiversity - the multitude of genes, species and ecosystems that collectively form what we call nature - despite its 4,000 years of existence, is doomed to be destroyed, in the most part, within four generations…’ (Robin, 1996, p.36)
relationship between humans and nature, nurturing, agricultural centrality and life in an *ayllu* (community).

**A living world to be respected**

In Andean belief *runas* (humans) know that all things which exist are ‘forms of life’. Earth is a living being, it is our *Pachamama* (Mother Earth), mother of all, including *runas*. Andean people have conversation with her. The same can be said of water, seeds, stones, hailstones and springs.

In this sense, biodiversity of life forms is not just a privilege of ‘living organisms’. As don Calixto Huacca from the Community of Maka Qollo, Puno would put it:

‘Papa seed is like a living being. Sometime, it can even get tired after a certain time. For example, I grew *luki* for ten years, then it disappeared. This too depends on the degree of love one is able to give it. The more love you give, the more the *papa* produces. We say ‘conmigo so congenia y cuando no siempre se congenia, no congenia conmiga’ (papa is as vital for me as I am for him). That’s how we say it... ‘

(Chambi, 1996)

I would like to point out that when the Andean people refer to things as living things, it does not mean that they perceive a life-giving and transcendental spirit in stones, *papas* and rivers but a spirit which makes itself visible in a rite, as by magic, and changes its lifeless nature into a living substance.

If we assume that there exist living beings which are invisible to *runas’* eyes but become ‘visible’ in a rite (the way Christ is transformed into the host), it means that we are applying the Christian notion of ideal and matter, spirit and body, transcendence and immanence to the Andean world. Nor is this just a metaphorical way to refer to things. When a peasant says that *Pachamama* is her or his mother she or he is not making an analogy between the earth and her or his biological mother because for her or him the Earth has the attributes of her or his mother. In practice, he or she just means that *Pachamama* is also his or her
mother. The concept of identity does not make much sense to a *runa*, since it does not reflect an Andean point of view on how to understand forms of life.

To Andean people, the world is like a person characterized by interrelated forms of life which create a living texture whose ‘physiology’ depends directly on the conversation between its ‘forms of life’. Each part, like organs in one body, in fact, mutually interact, and converse, thus participating in the activities that contribute to the regeneration of the world. Everything that occurs inside this living animal, or *Pacha*, is immanent. That is, everything springs directly from its inner workings.

**Relationship between Humans and Nature**

When *runas* say, ‘*Pachamama* is my mother’, they mean that they put the earth and humans on the same level, in the same way. When they say, ‘I nurture *alpacas* just as they nurture me’, they show that, among all, an activity is not the exclusive privilege of one form of life but the result of relationships among all of them. This is a concept that is totally foreign to a western concept of hierarchy.

Hierarchy is based on the idea that all species evolve and develop from less complex into more complex forms, the former being inferior to the latter. Hierarchy also implies a specific unit of measure that is used to classify and organize.

This is the researcher’s assumption. For example, when he or she comes across a *papa* whose features are to a certain extent, considered better and superior (just because this *papa* is frost-resistant) to others. The new unit of measure based on its forms, resistance, will be used to classify *papas* closer to the frost-resistant prototype identified as the most promising, whereas the others are dropped from consideration. In an attempt to find the best variety, the scientist makes use of pre-existing genetic material (either cultivated or not) and from this, a new variety is created. In this process we fail to learn from the
peasant’s knowledge which has contributed to the creation of the genetic material. Rather, *papas* that do not possess these required attributes are redundant.

In this manner, scientists transform natural conditions with little consideration for nature’s own rhythms and conditions. Their only interest is to classify the *papas*. Once the new and stronger *papa* has been created, its task will be to substitute the other traditional and now obsolete varieties of *papas*. In many Andean areas, several *papa* varieties grown by *runas* have been labeled as obsolete. They only survive because the Andean peasants continue to grow them with love and care. We can only blame the scientists for their contradictory behaviour; they pretend to be puzzled by the decrease and extinction of numerous species and varieties, but it is the scientific approach that contributed to species extinction. It is also why the new ethic of biodiversity is not convincing.

The Andean way of life is in harmony with rhythms and cycles of nature and the activities carried out in the *chacra* (cultivated fields) by the *chacareros* (farmers). It does not violate nature. Regeneration of species and varieties is not seen as the search of miracle varieties. Regeneration follows the rhythm of the *chacra* and its inner system of life. Nor is it an isolated activity geared towards scientific discovery.

Peasant agriculture tends to reproduce certain species, creating at the same time crops with specific forms, with the potential to develop other species under certain circumstances. In the Andes, the creation of new crops and varieties, in contrast to modern science, does not involve the redundancy of the varieties already existing. They, in fact, contribute to the creation of new ones. Therefore, the new varieties are not seen as better or worse than the previous ones. Peasants take care of them as if they were new members of the family whose life comes from *Apus* or *Pachamama*.

The new crops are grouped together in families. Thus crops are made up of variegated groups so that the new species can easily harmonize with all the other members of the family. The new varieties coexist and do not substitute the others.
Nurturing

In the Andes it is common to hear breeders saying thus:

‘Just in the same way we nurture alpacas, they nurture us’. In ceremonies for celebrating the arrival of the first produce, which are displayed in the so called *Fiesta de la Mamacha Candelaria, aymarus* from Conima Puno, the wives of the local authorities receive the very first papa tubers out of the furrows and put them together with the *papas* of previous rites. The Andean ‘priest’, playing the role of the *papa* itself, then addresses the new *papas* with the following words: “In the same way we have nurtured these people, now it is your turn to nurture them.” (Chambiy Chambi, 1995, p.60).

In the report by Mauricio Alvarez from Paucartambo, Cusco, as it was told to Luis Perez Baca from Centro de Servicios Agropecuarios (CESA):

“Turnip is a mother which nurtures us during times of food shortage when harvests rot in the fields because of the *jatun poccy* (rainy season). Together with the *arac papas*, turnips are the only edible goods which human beings could feed themselves on. During the *Fiesta de la Virgen Purificacion*, the so-called *Mamacha Nabo*, a maiden with a yellow dress, or *yuyu*, dances and sings a sad song before the living community. In this song she tells the crops that their mission is accomplished, since they saved people from starvation. And now it is their turn to nurture the *Kcara huicsas* (turnips). That is why from this day onwards, the turnip loses its favour, because there is other produce humans will use to feed themselves on. With the new crop, we will have a new type of food. When we are nearing carnival everybody gathers new produce (*Chaccos*) of the *chacra*. We celebrate this by kissing these new fruits and by kindly thanking *Pachamama* for the *miccuna* (food) she supplies us with.’ (Perez Baca, 1994).
These are but a few examples that help further explain that Andes nurturing is not just a privileged activity of people but it is of every ‘form of life’. To further clarify what we mean when we refer to nurturing we will tackle the example of a ‘conversation among equal beings’. From a western point of view, language is peculiar to human beings and to some species of animals. But stones and stars do not have the ability to speak. If some one were to say ‘the river is talking to me’ or ‘the river is writing a poem’, most probably we would think that this person is speaking metaphorically. But, in the Andes this is not so.

From an Andean point of view, each form of life is provided with a voice of its own and expresses it itself through senas or lomasas (signs).

Given the diversity of human communities, of chacras and microlimas, no conversations are alike. Everything differs from everything else. The variety of plants grown by peasants is accounted for by their long and loving conversation with the plants.

To be able to understand the ‘sign’ of a plant means being able to have a conversation with it, to let oneself ‘be nurtured’ by the plant. In turn, being nurtured is being capable of ‘feeling’ the moment when any form of life is talking to you, namely letting the forms of life nurture you. Those who let themselves be nurtured are those who know that they are incomplete. If not, why would humanity impose itself on nature? This is what happens with scientific cultivation, horticulture and animal husbandry. People impose themselves on plants or animals to such an extent that animal and plants lose all their characteristics. In the West, humans have lost the ability of letting nature nurture them. They just impose themselves on nature without ever engaging her in conversation.

In the Andean conception of the world, the notion of ‘ancestry’ for plants and animals does not exist in the way agronomists understand it. Indian corn and papas have other mamas, mamatas or maman (mothers) which are another sort of corn with specific characteristics. For Andean people, the ‘mother’ of corn participated in corn reproduction, in the sense that
she lets this happen. To them, corn does not derive from any previous biological ‘species’, but from the corn *maman*. As long as *maman* exists there will always be corn. Therefore, Andean people are not only growing corn, but also ‘corn families’ and their mamas.

Aymaras breeders say, ‘The day when *alpacas* will no longer be there, the world will disappear’. *Alpacas* were given by *Apus - cerros tutelares* (guardian hills) - to *ayllus* (Indian communities) so that they may nurture them. If *aymaras* do not nurture them, *alpacas* go back to *puqyos* (the place where they come form), and the world comes to an end. Nurturing is at the core of biodiversity in *Pacha*.

**Centrality of Nature**

Farmers refer to *chacras* as the setting in which every form of life is nurtured. *Sallqa* (nature) which comprises meadows, mountains, birds, deer and stag, vicunas, wild *papas*, is not perceived by Andean people as something which is wild and untamed, but rather as a *chacra* nurtured by *Apus*. The word *Sallqua* in Peruvian may be translated into ‘wildlife’ in English, the contrary of what is tamed. Such a dichotomy, however, does not make sense when it is applied to the Andean world.

The human community held *Apus* high in nurturing ‘nature’ through the activities carried out in a *chacco*. The *chacco* is a sort of wild livestock roundup, including animals such as *vicunas*, partridges and foxes, which are together from where people can collect and hunt all the ‘produce’ nature provides. But for Andean people it represents also another form of ritual nurturing through which *sallqa*, after a formal request to the *Apus*, is ‘pruned’ to encourage each form of life to bloom again.

By convention, this type of activity is considered to precede any form of agriculture. But in the Andes, cultivation goes hand in hand with this hunting and gathering activity. *Chacra* and *Chacco* are two complimentary ways of nurturing different forms of life. In this sense, *chacra* is but another way of nurturing the varied forms of life in nature. It is not a human
invention, but goes with all that was and is done by the *Apus*; the nurturing of *sallqua* increases in certain areas and it involves all those elements which ‘demand’ a different treatment. The *chacra* can be either inside or outside *sallqua* and in specific areas, since not all plants and areas need a *chacra*. *Chacra* has its own area. Whereas in the *chacra* humans nurture *sallqua*. This is the privilege of the *Apus*.

Humans are nurtured both in the *chacra* and *chaco*. As biodiversity applied to all forms of life, people are also different from each other. Each ethnic group distinguishes itself from the others through their customs. Those from Quispillacta, Ayacucho, say that their customs ‘come from nature’. Humans are connected to their place of origin, which accounts for the difference between people.

When humans nurture a *chacra* they do the same way as the *Apus*. Agriculture is one of the forms of life. Foxes, which belong to nature, have their own *chacras* of geese and papas, which are called *atoq oca* and *atoq papa*, which science considers as wild forms of *papas* and geese. *Vicunas* like foxes are nurtured in the *Apus chacra*. In the human’s *chacra*, *runa* do not limit themselves to grow plants. Peasants use to say, ‘The llama is my *chacra*’. They talk about *chacra de oro, chacra de sal, chacra de sachas* and so forth. Therefore, *chacra* is not only the place in which agriculture is practiced, but it is any place of nurturing since different forms of life talk to one other to contribute to the *pacha* - as the *chacra* as such presupposes *runas’* engagement, it belongs to everything and is for everything.

**The Ayllu (Indian community)**

As the peasants would say, not all *papas* can take root in all fields, nor can every plant mix with all plants, nor a *runa* gets accustomed to all places. The *chacra* is the expression of empathy, of harmony among different forms of life which respect one another and give one another shelter. The community in which all forms of life live together in harmony among different forms of life, which respect one another and give one another shelter, with the sole aim to regenerate is called *ayllu*. 
The ayllu is not the community of blood-related human beings, Andean people refer to Apus as their grandparents and Pachamama as mother. Corn species are considered as their offspring, the water of certain springs in some rites is addressed as a son-in-law. In addition, any corn species has its own mother, the so-called Saramana, papas have their Papamama, rivers their own Yuacumama and their pacha. Peasants consider corn and beans as their brothers since they grow without ‘sticking together’. And in other case, they say ‘La papa y quinea son familias porque no les afecta las plagas’ (Papas and quineas are ‘families’ because they are not infested by blights).

Each form of life is limitless in an ayllu (be it a runa, waca or sallqu). Runas contain the waca and the sallqua forms of life within themselves. In each Apus dwell the forms of sallqua and runa. This explains why in certain rites runas dress up as corn or condors. To them, in that moment, those disguised are the corn itself or the condor itself. Performance differs from the West where nature is an observed object.

Runas are performed as if they were ‘animals themselves’. (Rengifo et.al., 1993, p.37). When the ceremony is over, the so-called form of a runa prevails again. The same happens when the alpacas marry. This does not mean that male and female alpacas marry following runa’s customs, nor does it mean that the runas are playing a part. It is a human performance, it does not mean they are humanising or embodying the alpacas. It just means that the alpacas, as any other form of life, marry when it is deemed to be right time in a livestock cycle. In the ayllu everybody has the same attributes; humans are not the measure of all things.

This explains how natural is to a runa to talk to a plant or to alpacas. Within the runas themselves there are other forms of life. That is why in the Andes the conception of runa cannot be absolutely compared to the same conception of human as is being done in western societies. The pre-condition on which a western society is based is that any sense of nature is expelled from the concept of ‘man’ as ‘rational animal’ represents a way to
distinguish and, to a certain extent, elevate humanity’s relationship to nature. Modern society was built on such a conception, humanity being created in order to dominate nature.

In the case of runas, the viewpoint is different. Mutual nurturing of plants, animals and wacas is one of the most natural things. Runas’ behaviour is not guided by the utilitarian conception of what is useful to the chacra.

Andean reciprocity is the ‘pleasure of giving and nurturing with love’. It is not an obligation within a given framework. Nurturing is not an action based on domination, give and take. In the ayllu everybody nurtures everybody.

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Ecology or Regeneration?

Frederique Apffel Marglin and late Eduardo Grillo Fernandez

Eduardo Grillo Fernandez was a member of the Andean grassroots NGO PRATEC till 1987. He died in April 1996. PRATEC aims at strengthening and preserving Andean peasant agriculture and culture by working with peasants throughout the Andes, particularly in Peru. It also instructs technicians of rural development on how to decolonize the mind of western knowledge. PRATEC has many publications in Spanish and Zed books will publish manuscripts of some of its essays in English. Eduardo Grillo was the main thinker in that group. I have been collaborating with PRATEC since 1994 and had begun to write this essay with Eduardo before his death.

Eduardo had convinced me of the dangers of using the term ecology when speaking of Andean cultures. The term refers not only to scientific ecology but also to the dissident traditions going back to the time of Thoreau and Goethe in the West. The grassroots ecological movements in the North are heirs to these earlier thinkers. Eduardo held the view that terms like ecology and environment are not needed in the Andes as they foster a continuation of the imperialist stance towards Andean peasants.

“It is said that the word ‘ecology’ appeared for the first time in the English language in 1837. It was born thus in a world in which humans had to dominate nature by divine mandate; a world in which the notion of nature as a machine was dominant; a world where the Baconian doctrine that knowledge is power reigned; a world where the doctrine of evolution was in full flowering. Without doubt this environment marked the notion of ecology profoundly. That is why the term does not refer to nature but to the ecosystem, which is an anthropocentric concept. The German ecologists succeeded in having political influence but they were unable to

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achieve a diminution in environmental pollution in their country. Rather, it continued its rhythm of growth. Similarly the ecological farms in Germany, the major impulser of these ideas, are only a very small percentage of the whole in spite of the fact that they have a series of incentives.

Nowadays the ecological movement reaches Peru impulsed by imperialism under the modality of ecological agriculture, presided by Altieri from the University of California, in order to foment here supposedly universal recipes. In contrast, the millenarian Andean-Amazonian culture, which is the culture of nurturance, harmonizes itself through the consensus achieved through conversations between the three communities of the huacas (deities) the communities of the sallqa (Nature) and the community of the runas (humans) for the nurturing of the charcra (cultivated field) in that agrocentric world.

It is not simply an issue of building according to the initiatives and plans of the human community. Here the pacha (landscape) is nurtured/raised through the consensus and accord between the three community forms that make up the Andean world...”

Eduardo saw science as functional to the industrial mode of production and to capital. “Science has been immediately put at the service of the construction of capitalist society and she is the faithful servant of the bourgeoisie. Science is an instrument of the development of capitalist production.”

These excerpts show Eduardo Grillo’s rejection of ecology in its application to the Andean landscape as the term is enmeshed in science and capitalist production.

He saw clearly that the Church and science were not rivals but two powerful intellectual forces that severed humans emotionally from the nature by uprooting what in the 19th century West was called “pagan animism” and then establishing rational objectivity that
distanced humans emotionally from it. In environmental historian Donald Worster’s words, reason was the weapon of conquest in Bacon’s imperialist cause, namely “the enlargement of the bounds of Human Empire, to effecting of all things possible” (Worster, 1977:51).

Eduardo stressed the fact that the kind of communion that Andean peasants hold with nature, their *huacas*, and other members of the human community to achieve harmony and regenerate their world, would at worst be erased or at best relegated to anthropological archives. There is no doubt that today we have what Wolfgang Sachs (in Global Ecology, 1993) has branded as an eco-cracy in global ecological issues like global warming, biodiversity, the ozone hole and so forth.

Focussing on biodiversity, the noted German biologist Christine von Weizsacker reveals the dynamics:

Due to the “infrastructure for the further loss of species”, biodiversity is getting scarcer and scarcer. Due to the speeding up of cultural and environmental changes there is a growing need for the adaptability provided by biodiversity. So, the North expresses a growing economic need. A new biodiversity expert elite is being created. The scientifically and economically most powerful Northern countries will supply just enough funds for training the necessary compliant and loyal Southern scientific servants. They will also use this to stake their claims for the “mining of biodiversity” (in Sachs, 1993:125)

Dams, highways, mines, the Green Revolution, and others, many of them financed by the World Bank cause biodiversity loss. The World Bank has created the Global Environmental Facility (GEF) and through it emerges as the defender of the biodiversity. (Shiva, in Sachs, 1993:152)

Science and global market have brought about the biodiversity crisis. To understand this crisis, it is necessary to take a good look at the roots of the Green Revolution. The
development of hybrid corn in the US in the first half of the 20th century illustrates the point. Kloppenburg minutely documented it in 1988; see also Marglin, 1996). It shows how science directed by private enterprise broke the biological barrier to the commodification of the seed. The biological barrier is the seed’s ability to regenerate itself. This prevented the seed from becoming a commodity as peasants generated and regenerated their own seed supplies. “Hybridization is thus a mechanism for circumventing the biological barrier that the seed had presented to the penetration of plant breeding and seed production by private enterprise” (Kloppenburg, 1988:92).

The hybrid corn was developed till 1940’s with massive research funds. Kloppenburg identifies the birth of the Big Science, not to the Manhattan project that developed the atom bomb, but to the development of the hybrid corn.

The “miracle” of hybrid corn is impressive but not miraculous. It was the product of political machination, a solid decade of intense research effort, and the application of human and financial resources that must have been enormous by any ordinary plant-breeding standards. It also entailed the abandonment of the potentially productive well-being of population improvement. Two decades before the Manhattan Project, the agricultural sector had already witnessed the birth of “Big Science” (Kloppenburg, 1988:104).

There was no research on seed improvement through open pollination, the usual practice by the farmers world wide. Such research would not benefit private enterprise and thus were not undertaken. The story of the hybrid corn and the later developments in biotechnology make it perfectly clear that the division between basic (or pure science) and applied science in an idealization that persists because of its ideological utility in focussing attention on the search for knowledge rather than on the search for the commodity (Ibid: 45).

The Green Revolution opened global markets for the hybrid seed. It also gave birth to agricultural research institutions like IRRI, ICRISAT, IPRI and others. They use local
geneplasm to develop new commodified seeds. The life span of a hybrid seed varies from three to nine years. New seeds need to be evolved which are pest-and-disease-resistant and suitable to environment. The North is totally dependent on the South for the provision of geneplasm. Germplasm banks and other biodiversity prospecting institutions became necessary with the spread of the Green Revolution. In the 1970s, AID prepared a Biological Diversity Action Plan designed to incorporate genetic resource issues into all its development programmes. The Green Revolution has been a major conduit of southern geneplasm to the North.

Geneplasm banks and biodiversity preserves are necessary to the western scientists. These solutions preserve the separation between knowledge & life and theory & practice institutionalized in the Kantian University, which has now migrated worldwide with capital, colonization and now the global market. Discussing E. O. Wilson’s book Biophilia, Shiv Visvanathan points out:

[For Wilson] the forest is not a “dwelling” in the Heideggerian or even tribal sense. Wilson inhabits the forest as a field biologist but does not dwell in it, nurturing it, preserving it, or merely watching it unfold. The forest as a whole does not exist. One senses that before he has even entered it, it has already been resolved into a cluster of research programmes. (1996:310)

In the 1990s, the erosion of biodiversity was identified as a global issue. With this biodiversity has migrated into the domain of northern or northern trained experts, and out to the peasants and tribal fields. The separation between living and knowing is strengthened and the mutual growth that peasants engage in is relegated to the background due to modernization. With the Biodiversity Convention produced at UNCED in 1992, we now have a situation in which the germplasm of the diversity-rich south is to be categorized as the common heritage of mankind freely available, whereas HYV are commodities to be bought on the market. Eduardo was justified in identifying ecological science with imperialism.
There is another barrier. The seed’s ability to interbreed with relatives, wild and domesticated, to produce new variants. This ability can be either thwarted or encouraged by the human community. Monoculture and the destruction weeds militate against new varieties in the field. Polyculture, exchanging seeds and bringing wild species near the house or field encourage diversity. In the last issue of Honey Bee the practice of peasants in Madhya Pradesh of taking a handful of each variety of seeds to the temple to be worshipped before planting is mentioned. The priest, thus spreading the variety throughout the community, then redistributes these seeds to other persons.

Regeneration is not only something that existed previously, but the generation of something new. To be a success, the engineered plant or seed must interact with the particular environment in which it is growing to produce a phenotype that may deviate from the prototype.

Regeneration is the process of divergence to get around the competitive struggle for limited resources. Darwin in both the ‘Origins of Species’ and in the ‘Descent of Man’, persistently ignored the implications of divergence because it contradicted his emphasis on competitive replacement. The commodity exists in a competitive field and the Northern nations are pushing forever more extensive and stringent patent laws to protect the competitive edge. So those processes that preserve and increase diversity on which the commodification of engineered animal and plant species depend are being gravely eroded by commodification itself and the science that it requires. In other words, the boundary between a purely biological regenerative process and a purely cultural one is very difficult to draw.

As Eduardo argued, and as Kloppenburg has documented in the case of the development of hybrid corn, the Green Revolution and biotechnology, this commodification goes hand in hand with a certain type of knowledge, namely Western science based on the separation between knower and known. As Kloppenburg puts it:
“Western science not only made the seed the catalyst for the dissolution and transformation of pre-capitalist agrarian social formations, it also staffed and institutional network that has served as a conduit for the extraction of plant germplasm from the Third-World.” (Ibid:15).

For the vast majority of farmers ‘the agricultural development process based on rapid widespread technological advance has been a nightmare.’ (Cochrane, 1979 in Kloppenburg, p.35). Dairy farmers and produce farmers in Wisconsin are returning to natural grazing and organic farming.

In the South, however, policies are heavily tilted towards modernizing peasant and tribal agriculture. This is a very shortsighted stance as the policy is based on the fact that the regenerativity of non-hybrid crops presents a substantial barrier to the development of Southern markets. Green Revolution cultivars displace and eradicate the land races that provide breeders with the genetic variability needed to engineer new hybrid seeds. As Wilkes notes, “The technological bind of improved varieties is that they eliminate the resource upon which they are based.” (in Kloppenburg 1988:162).

This has caused concern to northern countries about the erosion of biodiversity, giving rise to a new eco-cratic elite, which tells peasants how to conserve their biodiversity. Tribal agriculture is labelled “traditional” as opposed to “modern”. Organizations like PRATEC, which dedicate themselves to strengthening of peasant agriculture and culture, are called idealists. This is true regarding the spread of capital, commodification, and Western science along with seeds. The peasant’s social, political and cultural life regenerates himself or herself based on the assumption of plenty, abundance, sharing as well as self-reliance. These are all directly inimical to the penetration of commodification.

An Andean peasants’ practice is called ayni (reciprocity) in which seeds, labour, food, love, respect, songs are shared. The more one gives, the more one gets - the exact opposite of the market principle of scarcity and competition. The latter, as Lewis Mumford has argued,
requires a capitalist rationality that preceded the abstraction of modern science (1963:25). The former has given rise to one of the richest centres of biodiversity in the world comprising 3,500 varieties of potatoes, 1,600 varieties of maize, several hundred varieties of oca, olluco, mashua and other Andean tubercules, and many varieties of grains such as quinua and kaniwa.

As Eduardo Grillo has written:

“In the Central Andes, agriculture was born with the generation and nurturing of the chacra which is not merely to domesticate plants and animals. It is to nurture lovingly, respectfully and ritually the plants, animals and with them the waters, microclimates, the soils and the whole landscape which is called the pacha. The pacha is the house of the Ayllu and the Ayllu is all that lives in the pacha: the stars, the rocks, the plants, rivers, animals, human beings, dead and alive. The pachamama is also pacha but refers more specifically to the land that offers us its fruits, and is like a mother to be loved and respected. Before beginning any agricultural operation, permission is asked of pachamama through an offering. Andean peasants reciprocate through ritual offerings with the land, the waters, the sky, the constellation, the sun, the moon, the mountains, and many other beings of their pacha. As we are all children of the pachamama, we are all relatives. The chacra is not merely the place where the soil, the water, the microclimate, the plants are nurtured, but it is also the ritual space where one converses and reciprocates with the deities, the ancestors, the sun, the moon, the constellation, the plants, animals, the clouds, winds, rainbows, etc. Everything is alive and everything speaks. We are a world in which harmony is nurtured in each moment with communal participation of all the members of the living world.”

This shows that the regeneration of the seed is only a very small part of what happens in the Andean peasant world. Biology and culture are one continuous process. In modern Western epistemology and ontology, humans stand apart from and in front of nature; they make
representations in their minds of the world; these are conceptual and linguistic. Such representations enable a manipulative stance towards the world as to transform into what is useful and of benefit to humans. As Eduardo put it, “The world is decidedly confronted in order to transform it into “what must be”, that is, into what is convenient to power.”

Such a statement echoes the words of India’s philosopher saint Gopinath Kaviraj. Referring to the Cartesian attitude of doubt toward all that is captured in the famous “cogito ergo sum”, Kaviraj says:

“Such an attitude of doubt, however, which in the West was first clearly stated by Descartes, involves a breach of faith toward everything that is. This breach entails the hostility of all against all things. Nothing can be sure and immediately certain any more except one thing, the doubting ego.” (Quoted in Medard Boss, 1966:108).

Here there is no ontological separation between humans and the world, no breach of faith with all that is. People (runas) are not understood as “rational animals”, as they have been in the Western tradition ever since Aristotle. Representational thought is radically anthropocentric and entails a dualism between organism and environment. It is not conversation; it is not an act. The dualism between organism and environment is related to the mind/ body dualism since the stable centre, the ground is a ratio. Rationality is the stable center for which the body and the body of the world becomes an object, a part of what-is, to be known, defined, measured and manipulated for the benefit of humans. As Descartes had seen clearly, this new ratio gave one power and control over nature. Eduardo Grillo specifically links representational thought and modern notions of time and space with industrial capitalism:

As Heidegger put it, modern western culture, the culture of capital, is characterized by making an image of the world; the world is not as it is but rather as I represent it. But, of course, it is not any image, but an image functional to capital, which permits it to manipulate nature, to exploit it, to reduce it to productive resources. The image
of the world for modern westerners is constructed on the basis of the instruments of space and time. Descartes himself constructs analytical geometry in order to contribute to apprehend (to measure) nature. Leibnitz and Newton construct infinitesimal calculus, thus compelling the instruments to measure the res extensa. With infinitesimal calculus, the world becomes a continuous quantity, susceptible of being cut up as needed, susceptible to being measured. Paniker notes: “With the arrival of modernity and industrialization, emerged a purely commodified time, a time entailing the sale of the labor, a quantitative time, linear, abstract.” (Paniker, 1989: 47) (Grillo, 1993:38-39).

Here one could also cite the work of C. V. Seshadri about the ethnocentricity of modern notions of linear continuous time.

I hope that this quote and the foregoing, summary as it is, will suffice to sensitize people to the fact that the perception of Andean, or for that matter Indian peasant practices such as mutual nurturance and conversation with the arch, the mountains, the waters, the plants, the animals, the rocks, the stars, etc., through ritual and other kinds of acts are seen as “traditional expressive non-productive practices”; in other words, “backward” is only from a certain point of view. Such a perception emerges from the point of view of modern western scientific knowledge.

Andean and Indian peasant practices are inscribed in the regenerative processes of nature and differ according to cultural divergence. What they all have in common is the non-separation between humans and nature, the reciprocity principle, the perception of the world as being alive and probably many other things.

Mutual nurturance, therefore, brings regeneration that creates and preserves diversity. Rationality and commodification destroy diversity in forms of life and knowledge. The non-commodified peasants do not need ecological experts; they need only to conserve their regenerative practices. We, in turn, need to converse with such collectivities and learn with
and from them. What we need is a model, not of learning about but, of learning with others and learning with the world.

References


Ancient Terrace Cultivation Revived

Miguel Vasquez

For over six years, the Hopi Cultural Preservation Office (HCPO), Bacavi residents, and my students and I from Northern Arizona University (NAU) in Flagstaff have been able to restore the 700-year-old terrace gardens at the village of third Mesa. The Hopi people used to coax the harsh desert soil of Arizona to yield corn through this method.

The sustainable food production method is invested with an aura of spirituality. The descendants of Hopi who resurrected it feel it is a part of their cultural legacy. They do not treat it as a commercial venture to supplement their food output. Nowadays they do not have the same compulsion to resort to these methods of cultivation. They are no doubt surrounded by the settlements of the new masters - the Americans of European descent. Yet they have food security in the form of grocery store and federal aid in times of scarcity.

These terraces were built below Hopi villages and monsoon water was used to irrigate the terrace gardens. Before we came on the scene, most of the water was allowed to run off. Only three families were still practicing the terrace cultivation. Most of the terraces have become disused and we had to revive them. It is the attitude of the Hopi to this revival programme that is remarkable. Dry farming and orchard cultivation still continue in some scattered spots as with the families mentioned above. It is not widespread because more and more families have turned to wage work and native crafts and given up cultivation. This has been the case since 1960s. Modern means of communication have ended the isolation of the Hopi and coal revenues led to an improvement in the economic well being of the arid region. These things have resulted in even less than a third of local households relying on farming on even a minimum scale (Talker, 1992).

It was a Herculean task restoring disused terrace walls, steps and pathways, planting of fruit trees and building of check-dams to prevent further erosion. In the second year, the project
gained acceptance. Members of two Kiva societies returned to the gardens and blessed the venture by planting *pahos* (prayer feathers). The same year also saw attempts made at compilation of useful data on agricultural practices of Hopi based on interviews with elders. The data covered a lot of, hitherto unrecorded, adaptations in plant propagation, pest control, soil and moisture conservation, the latter so useful in the arid region.

Of late, the project has become an educative one, involving children of the community. A mother remarked to the writer, “if they are going to learn (about) the traditional Hopi way, the children need to have the terrace gardens to work with”.

When the project began, only three families were cultivating as per Hopi tradition. Now there are thirty families who cultivate the Hopi way in Bacavi canyon and four other villages want technical assistance to restore terraces below the villages. The interest in old methods of cultivation is due to a desire for old varieties of food.

Mr. Leigh Jenkins, HCPO Director, and a resident of Bacavi, approached the university to have the terraces resorted. He reminisced about his childhood, when he used to work on the garden with family and friends. The Canyon was no longer green. Others too supported the project and wanted to bridge the generation gap. An old lady said of the project, “Miguel, this is not about growing veggies, it’s about growing kids”.

For centuries the Hopi had lived in harmony with nature without a murmur. They were working with nature and not against her. Elders considered the terrace garden to be an ideal classroom to impart Hopi values. They felt that youngsters were looking beyond Hopi culture to the dominant society and wanted to stem the root before it was too late. The Swiss Development Visionary, Theodor Abt, expressed the plight of people of the canyon in these words: “human beings can endure anything except a state of meaninglessness.” (Abt, 1983).

The indigenous people of America fought back white man’s economic imperialism on a moral plane. This moral principle says Varese (1996) “permeates the social life of Indians and
reinforce the struggle which take place in daily forms of opposition to external intervention. Deliberate native refusal to yield to the principles of capitalism is manifest in their indifference to accumulation, their commitment to reciprocity and ceremonial sharing.... This equalization process impoverishes economically while empowering politically”. Varese draws on Scott’s Moral Economy (1976) while formulating his ideas.

This is obvious from the fact that Indian elders, including Hopi, bemoan the 'loss of canons'. The terrace garden revival project is a step in this direction where the entire community irrespective of age and sex is enthusiastically involved. The community is finding its roots through this revivalist approach in which the University and National Park service play their part in restoring tribal culture and ruined sites respectively. This leads to a mutually beneficial relationship between nature and culture, as also Leopold maintains.

The following are the benefits flowing from the back-to-the-roots campaign:

1. Restoration of the terrace area at Bacavi is enhancing the local ecosystem.

2. There is genuine reciprocal exchange of goods and services between people and natural community. Villagers provide labour and get food, medicine and dyestuffs in return.

3. There is an integration of physical, intellectual, emotional and spiritual side of human personality to landscape. That is the essence of Hopi culture.

4. The terraces represent Hopi genius for survival in a harsh environment.

5. The experiment reactivates old practices not merely for record’s sake but for the rejuvenation of community. This back-to-nature experiment in the Arizona desert is unique in that there is perfect coordination between old and new.

Acknowledgments
The Hopi Cultural Preservation Office, Northern Arizona University, and the Bacavi Village Council have been particularly supportive of this work, in terms of both continued funding and strong moral and philosophical support. Grants or donations have also been received from the Arizona State Historical Preservation Office, Feed My People International Inc., Native Seed/SEARCH, and the International Alliance for Sustainable Agriculture.

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Documenting and Disseminating Innovations and Indigenous Knowledge in Tamil Nadu: How it contributed in Development Action

P. Vivekanandan

This paper narrates five years of my experience in documenting, systematizing, testing and disseminating innovations and indigenous knowledge in agricultural and veterinary practices in Tamil Nadu villages. I also tried to incorporate indigenous knowledge in the development work of SEVA, an NGO based at Madurai.

Biodiversity Contest - An Approach towards Documentation

During 1991-1993, I have organized biodiversity contests for school students, women and herbal collectors in 38 schools covering 40 villages. School students were asked to bring plant samples and identify them before a jury. The students had to explain the use of plant relating to health, agriculture, etc. Scores were given to them.

The contest was announced two weeks in advance so that the participants could be prepared. The jury selected the best three winners in each school and rewarded either prizes or arranged free tour to biodiversity-rich mountain areas. The jury consisted of a schoolteacher, a person conversant with locally available flora and fauna and a botanist/staff of SEVA or any other institution.

Documenting of indigenous knowledge, innovations of outstanding farmers were also arranged through discussions with village elders and parents of school children. This led to transformation of knowledge from elders to younger generation.

115 Sustainable-agriculture & Environmental Voluntary Action (SEVA), 43, T.P.M. Nagar, Viratipathu, Madurai- 625 010, India. Tel: 91-0452-604082
A student studying in the seventh standard identified 116 plants and a herbal gatherer identified a maximum of 224 plants. Such contests will be held for students of higher academic institutions also. A list of plant species becoming rare or vulnerable has also been prepared. We have also collected list of plant species becoming rare or vulnerable in their respective region.

**List of Plants/Plant Races, which are vulnerable or need to be conserved**

<table>
<thead>
<tr>
<th>Name of Plant</th>
<th>Place</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vandukolli maram</td>
<td>Sathuragiri Mahalinga hills, (Western ghat)</td>
<td>Used in treating skin lesions or insect/reptile bites</td>
</tr>
<tr>
<td>Vellaiporasa maram</td>
<td>Ayyalur Hills</td>
<td>Timber</td>
</tr>
<tr>
<td><em>(Mundulea sesicea)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thoratti <em>(Capparis zeylanica)</em></td>
<td>Thirumanickam</td>
<td>Used in respiratory troubles</td>
</tr>
<tr>
<td>Semunamaram</td>
<td>Ayyalur hills</td>
<td>Fruits can be eaten</td>
</tr>
<tr>
<td>Vishamaram</td>
<td>Ayyalur Hills</td>
<td>Timber</td>
</tr>
<tr>
<td>Sannamboo <em>(Cyces cercinalis)</em></td>
<td>Puliangudi</td>
<td>Pest repellant</td>
</tr>
<tr>
<td>Neerakadambu <em>(Mitragyna parvifolia)</em></td>
<td>Natrampalayam</td>
<td>Timber</td>
</tr>
<tr>
<td>Vilambalam <em>(Limonia acidissima)</em></td>
<td>Palamedu</td>
<td>Fruit Tree</td>
</tr>
<tr>
<td>Poovarasu <em>(Thespesia populnea)</em></td>
<td>Sedapatti</td>
<td>Timber, green manure</td>
</tr>
<tr>
<td>Iluppai <em>(Bassia longifolia)</em></td>
<td>Sedapatti</td>
<td>Timber and oil seed tree</td>
</tr>
<tr>
<td>Uthiyamaram <em>(Lannea coromandelica)</em></td>
<td>Narikudi</td>
<td>Green manure fodder</td>
</tr>
<tr>
<td>Siriyanangai</td>
<td>Mahalinga Hills</td>
<td>Medicinal plant</td>
</tr>
<tr>
<td>Erusingi &amp; Erangusingi</td>
<td>Velliangiri Hills (Coimbatore)</td>
<td>Medicinal plants</td>
</tr>
</tbody>
</table>
### Crop variety

<table>
<thead>
<tr>
<th>Name of the plant</th>
<th>Place</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brinjal variety (Valaiapatti Pudhur)</td>
<td>Kombaikadu, Palamedu</td>
<td>Dryland variety</td>
</tr>
<tr>
<td>Pumpkin (Valayapatti Pudhur)</td>
<td>Kombaikadu, Palamedu</td>
<td>Dryland variety</td>
</tr>
<tr>
<td>Paddy – Manakkathaib (Pichavari)</td>
<td>Chengalpattu</td>
<td>For veterinary medicine</td>
</tr>
<tr>
<td>- Kottainel</td>
<td>Anchetty</td>
<td>For children diarrhea</td>
</tr>
<tr>
<td>- Vadakkithikaru</td>
<td>Sivagangai</td>
<td>Low lying area direct sown</td>
</tr>
<tr>
<td>- Chandikaru</td>
<td>Sedapatti</td>
<td>Dryland</td>
</tr>
<tr>
<td>- Kattakaru</td>
<td>Perambalur</td>
<td>Big and bold grain</td>
</tr>
<tr>
<td>Ragi - Karunchuruttai/ Kettiragi</td>
<td>Anchetty</td>
<td>Fine variety Resistant to saline soil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Withstand rain during flowering</td>
</tr>
</tbody>
</table>

### Sacred Groves

Sacred groves exist near village temple sites in Tamil Nadu. The land varies from a few cents to many hectares. Most of the temples are of Dravidian origin where folk deity or villages gods are worshipped. The trees and shrubs are indigenous flora of the locality. The woodlots are preserved because of their tradition of conservation deep in their beliefs and social moorings. Nowadays these groves are not properly cared for.
The biodiversity contest has helped in restoring sacred groves and setting up community genetic gardens in 13 temples sites of Madurai and Kamarajar districts. Villagers and school children have been given 11,000 rare tree and herbal seedlings for sowing in the existing groves and school gardens for conservation. This programme has been assisted by WWF (India), New Delhi.

Network meeting for grass root innovators and indigenous leaders

A dialogue has been started among interested members for greater sharing and interaction. Four such meetings were held in a year. Readers of Num Vazhi Velanmai (Tamil version of Honey Bee), experts in herbal medicine, veterinary healers, farmers, women group leaders and scientists representing different places of Tamil Nadu participated in this programme.

The workshop led to innovations. We have made many literate farmers and officials of Agriculture Department of Tamil Nadu aware of the need for ecological farming based on innovations and indigenous practices.

Some veterinary healers expressed sorrow at the threat of extinction to some animals due to negative attitude of government doctors. At present the network has 920 members. (Annual Subscribers 730; life subscribers 190 for the Tamil version of Honey Bee).

Direct sowing of Neem seeds

The farmers of Siddirediaoatti village, Madurai district use 2 - 3 kilo of neem seeds for one acre while sowing millets and pulses in the dry lands during the monsoon season. The trees are pruned till they attain a height of 10-11 feet in the second year. The trees are cut for timber between 10th and 12th year. Neem fruits provide additional income annually. The seedlings are surrounded by thorny branches of Seemai karuvel (*Prosopis juliflora*) as a protection against animals. Cow dung slurry is also sprinkled as an additional protection. We have promoted this model in T. Ramanathapuram village after reviewing the traditional
watch and ward system. Nine women Sangams promoted by SEVA covering about 200 ha of neem-based agro-forestry do this work.

**Sprayer auction fund - the sustainability of farmers association**

In the initial stage, farmers participated enthusiastically in the Sangams. Then they lost interest. Systematic follow-up action is needed to sustain their interest. In Anaikaraipatti village, SEVA has donated one hand sprayer to a farmers’ group (28 members) with the condition that they should be used for spraying plant-based pesticides and not chemical-based. For three years, we have not visited the village but Sangam meetings are held every month. The sprayer is auctioned at monthly interval (at the meeting) and the successful bidder is the one who has offered the highest rent for the sprayer for one month. He, in turn, will use the sprayer in his own field or rent it to others. The common fund (including sprayer auction fund) has reached Rs.4,000/- now.

**Sprouted bengal gram + herbal deworming will induce oestrus**

It is the local practice in Madurai district to give feed animals with sprouted bengal gram to enable them come to oestrus or conceive. For the first three days animals is given leaf flesh extract of *Aloe vera* (with a single leaf each time). The animal is given about 200 gms of sprouted bengal gram daily in the following two weeks. This induces conception. SEVA has asked four farmers to field test this method with 10 problem animals (2 cows + buffaloes). Out of these 10 tested, nine have conceived. We are planning to try the method on 100 animals, which did not conceive in the normal course.

**Development of Jatropha oil stove for reducing kerosene consumption**

Sri. Thirumurugan, a peer group member of SEVA, has designed a stove that runs on a mixture of Jatropha oil plus kerosene. This increases the heating in a given time while reducing the consumption of kerosene. It has two tanks. One for kerosene and the other for
the mixture. For lighting the stove, the kerosene tank will be opened initially. As the temperature rises a few minutes later, the other tank will be operated. The nozzle in the burner has been little enlarged so as to allow the flow of Jatropha oil whose viscosity is much higher than the diesel/ kerosene. The viscosity of Jatropha oil is 0.435 while for diesel it is 0.255.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Time required for boiling 20 litres of water</th>
<th>Oil consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jatropha oil - 0% Kerosene - 100%</td>
<td>53 Minutes</td>
<td>635 ml</td>
</tr>
<tr>
<td>Jatropha oil - 50% Kerosene - 50%</td>
<td>70 Minutes</td>
<td>575 ml</td>
</tr>
<tr>
<td>Jatropha oil - 60% Kerosene - 40%</td>
<td>70 Minutes</td>
<td>484 ml</td>
</tr>
<tr>
<td>Jatropha oil - 75% Kerosene - 25%</td>
<td>43 Minutes</td>
<td>450 ml</td>
</tr>
</tbody>
</table>

*Indigenous pest control method and field testing*

In Tirunelveli district adjoining the Western Ghats region, male cones of Sannamboo plant (*Cycas cercinalis*) are tied to sticks and set up in paddy field to repel paddy earhead bugs. The farmers bury mud pots in the coconut garden containing fermented water of soaked ground castor kernel to attract adult Rhinoceros beetles which fall in the pots and get killed. The farmers sometimes use a whole plant of Kozhunji (*Tephrosia purpurea*) as repellent.

During 1994-1995, SEVA tested the efficacy of plant product formulations for controlling paddy pests. We told the farmer to initially try the method in 20 cents of field and then
compare with the other practices in the rest of the area. Predator birds were found to be more active in the fields having cones of *Cycas* due to migrant swarms of ear head bugs.

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
<th>Percent reduction of pests of paddy</th>
<th>Yield of Paddy kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Neem kernel 3% spray</td>
<td>42</td>
<td>2895</td>
</tr>
<tr>
<td>2.</td>
<td>Neem oil 1% spray</td>
<td>22</td>
<td>2882</td>
</tr>
<tr>
<td>3.</td>
<td>Seethapal seed powder + Ash (1:4 ratio) 20 kilo/ac</td>
<td>48</td>
<td>2790</td>
</tr>
<tr>
<td>4.</td>
<td>Turmeric Powder + Ash (1:4 ratio) 20 kilo/ac</td>
<td>50</td>
<td>2535</td>
</tr>
<tr>
<td>5.</td>
<td>Placing cones of <em>Cycas cercinalis</em></td>
<td>36</td>
<td>2684</td>
</tr>
<tr>
<td>6.</td>
<td>Control</td>
<td>25</td>
<td>2588</td>
</tr>
</tbody>
</table>

**Revitalising traditional tank management system**

Tanks have not been cared for many years. As a result, these reservoirs of rainwater got silted and are becoming less efficient in storage. This adversely affects irrigation. Government’s renovation work in selected tanks is unsatisfactory as huge funds are siphoned away by politician contractors.

We promoted a tank farmers association in four villages to remedy the situation. We convinced government to release funds under JRY directly to people’s association for tank renovation work. Farmers have been organized to contribute 25 per cent of total cost as free labour. Water sharing system based on indigenous knowledge has been revived.
However, in one village farmers were reluctant to contribute their share and expected 100 per cent grant from the outside agency. In this village, farmers have wells in addition to the monsoon.

Collaboration with SRISTI

Our collaboration with SRISTI has enabled us to document innovation from other states. SRISTI has also supported for printing ‘Num Vazhi Velanmai’ newsletter for the initial 2 years. This newsletter is a quarterly publication in Tamil. It has 920 subscribers.

In addition SRISTI’s fellowship has helped the author to undertake action research and tour of many villages and institutes for finding solutions through indigenous innovations. SEVA has specific strategies for protecting, systematizing and disseminating knowledge to benefit local people in Tamil Nadu.
Spiritual Approach to Sustainable Natural Resource Management - Lessons from the Philosophy of Bhagawan Sri Sathya Sai Baba

N. Sivakumar

Introduction

“The concerns of ecology, environment quality and human affairs continually intersect like the threads of a fabric. Some of these intersections are obvious, such as pollution and urban crowding; whereas others may be subtle such as unsuspected behavioural responses to various features of the environment” (Southwick, 1972). While the author could clearly identify the obvious and the non-obvious aspects of ecology and environment, another important aspect of sustainable development and resource management has become relevant in the current times. This is obvious because people the world over have come to realize the dangers of unsustainable development. It still remains in the non-obvious territory because development still goes on without regard for its impact on the future generations. These paradoxical actions lend urgency to the problem. Sustainability is no longer a luxury of a few but an imperative the world over.

The human philosophy towards nature is fundamental to the discussion on natural resources. If people understand nature, they will act in a manner that leads to sustainable development. This paper deals with this issue. It provides a spiritual basis for such resource management. This is substantiated from the philosophy of Bhagawan Sri Sathya Sai Baba, regarded by many as the Avatar (God incarnate) of this age.

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The paper will first review unsustainable actions regarding natural resource management. It will then give Sai Baba’s philosophy regarding sustainability and derive lessons for natural resource management from them.

**Unsustainable Natural Resource Management**

Most actions have no regard for sustainability. In India, a large majority of people depends on agriculture for their livelihood. While the population has increased yields and land availability have reduced over the years. One of the reasons for this is the unplanned industrial growth, which has taken large tracts of fertile land for industrial use. This has led to pressure on the available agricultural land. The indiscriminate use of this shrinking area has further led to large regions becoming unfit for cultivation. This has set in motion a cycle of problems.

This is not only about land use management, but also concerns other natural resource like water, minerals, air, forests and wildlife. We have perennial rivers and there are vast regions suffering from drought at the same time, as the available river waters are wasted. Forests are being destroyed daily to meet short-term needs. Air pollution in urban areas is increasing continuously. These things occur due to absence of sustainable thinking among people.

The major reasons for unsustainable decision making include:

- Lack of long-term orientation
- Greed and excessive desires
- Feeling of superiority leading to exploitation
- Lack of human values
- Lack of a holistic approach to sustainable management
The ecological movements here are imitations of what is happening in the west. In the West, ecology developed as a part of biological studies, which again was the outcome of their reductionist scientific approach. It regards nature as a machine that could be broken down into parts and to be assembled mechanically. Western approach looks upon everything in nature as a means to be exploited by human beings for their happiness, which is conceived in terms of material and physical needs and comforts (Parameswaran, 1988).

Spirituality, which is holistic and healthy, has long been ignored in Western thought and science. According to Tart (1975), “Orthodox, Western psychology has dealt very poorly with the spiritual side of man’s nature. Our culture and our psychology has ruled out man’s spiritual nature, but the cost of this attempted suppression is enormous”.

The next section will, therefore, provide a spiritual approach to sustainable thinking and decision-making using the philosophy of Bhagawan Sri Sathya Sai Baba.

Bhagawan Baba was born in 1926 at Puttaparthy in Anantapur district in Andhra Pradesh. In 1940, he proclaimed his avatarhood. Today, several millions throughout the world worship him. The philosophy of Bhagawan Baba provides a basis for defining human relationships with nature. It can be studied under the following heads:

a) The basis and reality of nature
b) Human relationship with nature
c) Solutions to sustainability

Each of these aspects are discussed in the following sections:

**The Basis and Reality of Nature**

According to Sai Baba, nature is essentially divine. This can be understood through the following aspects:

- Creating of nature
Western scientific thought subscribes to the ‘Big Bang’ theory. Bhagawan Baba says, “Creation is the projection of divine will. This creation is called nature.” 1. “God is the material cause of creation, of the cosmos, the universe. He is the substance, the basis.” 2. As divinity is the creator of nature, “In every object emanating from nature the divine principle exists and must exist.” 3.

- The real form of nature

Modern humans think that nature is to be exploited. According to Sai Baba, “Nature is a vast mirror. You regard as real the varied objects you see in nature. But they are all different forms of the divine.” 4. “This nature is not mere falsehood. It is the splendour of God, God’s reflection. It is God’s own substance, manifested as multiplicity, as latent energy.” 5. As the real form of nature is divine, “the cosmos demonstrates the unity of God and nature.” 6.

- The real purpose of nature

Nature has a great purpose and a very special role which, according to Sai Baba, is to help man, the crowning achievement of the evolutionary process, to realize the divinity immanent in creation.” 7.

**Human Relationships with Nature**

The divine creation of nature and its spiritual basis has tremendous implications for human relationships with nature. This can be studied as under:

- Exploitation of nature:
Sai Baba recognizes the wanton destruction caused today when he proclaims, “Man is misled into believing that nature is his rival that has to be defeated and conquered. He considers it heroic to undergo travail in what he calls conquest of nature.” 8. He also states that human beings have not properly used science and technology. Instead of using it for the welfare of the world, it has been used for its destruction. According to him, “the Divine operates in the manner to preserve the cosmic order. When this order is disturbed, the world is in peril.” 9.

- **The reasons for exploitation:**

The basic reason for the exploitation, according to Bhagawan Baba, is the lack of human values, like gratitude. “Man is deriving innumerable benefits from nature. But what is the gratitude he is showing to nature? This is the reason for his becoming a prey to various difficulties and calamities.” 10. The gratitude should be in the form of sustainable usage of nature.

Man’s selfishness is yet another reason for destruction of nature. “Whatever man seeks to achieve, he has to rely on nature. Nature is not anyone’s private property. It belongs to God.” 11.

Bhagawan Baba says, “Science is tending to get out of control. People are gloating over the phenomenal success of science and technology. But what should be recognized is that, in controlling the forces of nature, the balance should not be upset. In dealing with nature there are three requirements. The first is the knowledge of the laws of nature. The second is the skill to utilize the powers of nature for human needs. The third is to maintain the balance among natural forces. It is the disturbance in this balance that has led to such consequences as soil erosion, pollution of the atmosphere, etc.” 12. Thus, lack of human values is the basic reason for exploitation of nature.

- **The reason for the erosion of human values:**
Bhagawan Baba then goes on to explain why there has been this erosion. According to him, “Man has been engaged in exploring the infinite secrets of nature. Because of the vagaries of the mind, intellect and ego, he has failed to understand the true, eternal, spiritual basis underlying everything in the universe and has lost himself in the pursuit of the external phenomenal world.” 13.

As all creation is essentially divine, human beings, who are part of creation, are also divine. But, instead of recognizing their true nature, people are engaged only in exploring the external nature. According to Sai Baba, “everyone should seek to know the basis of their reality. Instead when one is engaged in exploring nature, one is pursuing only a chimera” 14. “The knowledge of the principles governing nature can at best provide man with food and clothing; it teaches man ways and means of gaining them; it leads to the exploitation of the weak by the strong” 15. Thus, Baba explains how the single-minded pursuit of only secular world, physical knowledge without any spiritual insight leads to the erosion of human values.

**Solutions to sustainability**

- **Learning Lessons from Nature**

The first and primary way to cultivate human values is to learn these lessons from nature itself. As Bhagawan Baba puts it, “Nature is the best teacher”. For example, the trees provide cool shade and sweet fruits equally to all people, whether they have fostered them or harmed them. They teach man the lesson of equal mindedness 16. Consider next the bird. The lesson it teaches is self-reliance. A bird perched on the leafy twig of a tree is not affected by the wild swaying of the twig or the storm, which might blow it off because it relies not on the twig or tree but on its own wings for its safety. It knows it can always fly and save itself 17. Thirdly, the earth does not profit by its rotations and revolutions around
the sun, but man exists and prospers on account of them. Mother Earth teaches her children the lesson of service and sacrifice 18. Thus, nature has lot of lessons to teach human beings, especially lessons in human values.

• **Observing the Right Laws of Living**

According to Baba, “All things in nature observe their laws with undeviating regularity. The sun, the moon, the seasons, observe their respective laws. Man alone violates the laws of his being. Man needs to be taught the rules of *Dharma* or right living. He has to cultivate morality and integrity. This can be attained through pursuing the spiritual path.” 19

• **Understanding Human Limitations**

It is essential to realize one’s own limitations before one takes decisions. As Sai Baba puts it, “The biggest fan made by man can provide breeze only for a small area. But the winds caused by nature can blow over the whole world. There are several lamps at our homes that can illuminate a small place. But the sun created by God illumines the whole world. We pump water with the help of pump sets. Can the water pumped by these sets equal even a fraction of the water got from a heavy downpour of rain?” 20. Thus, it is essential for people to realize their limitation before they take decisions.

• **The Correct Order of Attention**

According to Sai Baba, “It is a pity that, instead of paying attention to God, Nature and Man (in that order), men today are concerned most with themselves, next with nature and very much less with God. From birth to death, man pursues fleeting pleasures by exploitation, despoiling and desecration of nature, ignoring the truth that it is the property of God, the Creator, and any injury caused to it is a sacrilege that merits punishment.” 21
• **Visualizing Divinity in Nature**

The final and most important solution to sustainability is to visualize nature as divine. Baba explains this when he elucidates the true Bharatiya (Indian) way of viewing nature. “The Bharatiya knows that nature is God’s vesture. He does not talk of conquering nature, exploiting nature, or commanding the forces of nature. He moves from nature quickly and easily, to nature’s God. He realizes that he is but a short-term tenant on God’s estate. There is no justification for claiming ownership or mastery over the spoils of conquest. No exploitation but love, not mastery but reverential homage is the Bharatiya reaction to nature and her mysteries.”

Bhagawan Baba wants people to “look upon nature as the vestment of God; it is the manifestation of His glory; His power; His might; His majesty. See these in every blade of grass, in every floral petal, every slice of fruit. Through this worshipful attitude of man and beast, plant and stone, you must remove the veil of ignorance and achieve equanimity. Then you will become aware of your own self.”

Thus, Bhagawan Sri Sathya Sai Baba gives the most vital solutions for sustainable thinking, from which one can develop policies for sustainable use of nature and its resources.

**Lessons For Sustainable Natural Resources Management**

Some of the lessons that can be learnt for natural resources management are:

• Treat natural resources as divine. They have to be revered and not exploited.

• Nature and its resources are selfless. They always give and serve. Similarly, one should cultivate the attitude of giving rather than getting. In Baba’s words, “Love gives and
forgives, self gets and forgets”. Only this attitude can save human beings from wasting natural resources.

- Natural resources are God’s property and created for all. Thus, if people think only of the present and forget the future generations, they violate this basic dictum.

- Human beings have inherent limitations. They cannot exploit natural resources, as they do not have the ability to replenish them.

- Decisions regarding natural resources usage should never upset natural balance. God maintains the cosmic balance and working against it, is to work towards one’s peril.

- Be grateful to nature for its bounty. Natural resources form the basis of human living. To misuse it is to misuse one’s own foundation of a peaceful life.

- Science and technology growth is not the solution to sustainability. More important than science and technology are human values. When we cultivate basic human values, than we will acquire the capability to beneficially use science and technology.

- Nature teaches many valuable lessons. Use those lessons while taking decisions to use natural resources.

Dedication

The author humbly dedicates the paper to Bhagawan Sri Sathya Sai Baba, the Revered Chancellor of Sri Sathya Sai Institute of Higher Learning, and the inspiration behind the paper.

Notes
All references of Bhagawan of Sri Sathya Sai Baba have been taken from his writings and discourse published in *Sanathana Sarathi*, a monthly magazine of Sri Sathya Sai Publications Trust. The specific references (discourses/writings) quoted in the paper are as under.

3. See Note No.1
5. “Sparks from the Divine Anvil”, March 1986, p.81
6. “Bhagawan and Bhakti”, March 1986, pp.63-68
8. “Quotation”, March 1986, p.77
10. See Note No.7
15. “Bharatiya Paramartha Vahini”, January 1978, pp.241-244
17. See Note No.14
18. “Offer the Vessel Brought”, April 1982, pp.93-95
19. See Note No.16
20. See Note No.7
23. “See Note No.5
References


Man’s place in nature is under constant scrutiny due to the mindless exploitation of natural resources in the name of progress. The question of ethics and morality has also impinged on the issue.

Should nature be exploited to provide comforts to man? This has become a burning issue. Two theories hold the field nowadays. One is the ecocentric theory that encourages us to respect nature for its own sake rather than for human purposes. The anthropocentric theory places man at the centre of things where ecology is concerned. This paper deals with the moral question in the first part and then the question of national sovereignty and local communities in the latter part.

Ecocentric arguments derive sustenance from Utilitarian and Kantian ethics. In the contemporary discourse on the environment, they have affinity with deep ecology.

Hedonist utilitarian ethics makes *sentience* the criterion for identifying the defensible boundaries of concern for the interests of others. Jeremy Bentham used it in the 19th Century with respect to slavery in the British dominions. According to him, it was not whether they (slaves) could reason or talk, but whether they could suffer. A capacity for suffering—and for enjoyment gives a being a right to equal consideration. A stone cannot suffer, hence it does not have *interests*. There is no moral obligation on our part to concern us about its welfare. But there is no moral justification for not taking into consideration the interests of beings who do suffer. The principle of equality requires that its suffering be counted equally with the like suffering of any being (Singer, 1986). Of course, it is arguably

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not necessary to be a utilitarian in order to recognize the moral significance of pain (Johnson, 1993:50).

So, both humans and other animals are worthy of our consideration while tackling these questions. Plants cannot have wants and desires of their own, or the capacity to suffer and enjoy. In the writings of Aristotle and Thomas Aquinas, we encounter the metaphor of the tree as it grows and develops according to its own inter nature. Does the growth or languishing of plants suggest a good in itself?

Deep ecology, first enunciated in the Arne Naess wishes to preserve the integrity of the biosphere for its own sake, regardless of any benefits to human beings. The shallow ecology on the other hand concerns itself with the health and affluence of the people in the developed countries (Naess, 1991). Deep ecology poses an intrinsic relation between things, such that the relation is itself constitutive of the definition of the things in question. It also accords respect to ways and forms of life on the premises that the equal right to live and blossom is a value axiom. This is the basis of the principle of biospherical egalitarianism. This calls for diversity and richness of life forms and cuts at the very root of the survival of the fittest theory.

Deep ecologists value both human and non-human life on earth and believe that man has no right to diminish this richness and diversity except for the satisfaction of vital needs. One problem with this argument is how to assess the worth of the whole ecosystem. There is no way of determining the value of each individual plant.

All organisms may be part of an interrelated whole, but this is insufficient to establish that they are all of intrinsic worth, let alone of equal worth (Singer, 1986:282).

Ecocentric arguments address this gap. Kantian ethics asks us to treat others as ends in themselves. It has been argued that what is good for a person must be determined by that person’s own nature and self-identity. Not only rational beings, but others too should be the
objects of our moral concern. Like individuals, species also have an interest in surviving well, in fulfilling their nature in an appropriate environment. A species is a living system, an ongoing coherent organic whole, with properties that are not simply the aggregate of those of the individual species members. Similarly, the biosphere is not the sum of all living beings, nor yet is it a separate entity. The relationship between the natural world and human well-being is seen as profoundly similar to that between friendship and human flourishing in Aristotle.

The anthropocentric argument, in its best and broadest sense, makes possible the consideration of three issues that have political importance in recent debates on biodiversity and biotechnology. These are national sovereignty, local communities, and future generations.

Each of these issues is underwritten by essentially liberal principles of autonomy and agency, with the possible exception of the last that can logically contain only an implicit notion of potential agency. In the case of both the local communities and nation-state the question of rights and obligations crop up. The claim of autonomy for local communities leads to the idea of their rights - as collectivities - to the ecosystem which not only sustains them, but to the preservation and improvement of which they have historically contributed through creative practices now recognized as indigenous knowledge systems. Finally, the potential for agency and autonomy that is attributed to future generations (on the assumptions of their continuity with the present) calls for the recognition of their rights to a natural world that is not destroyed and eroded, either in the quantum of its resources or in their richness and diversity.

It is imperative also to recognize that each of these claims takes the particular form it does-viz., that of a claim - precisely because there are serious economic and political constraints on their fulfilment. It is not merely the awareness of depleting resources but the predatory conduct of the North and their multinationals that has focused attention on ecology.
National Sovereignty

Who should own and control natural resources? Who should determine how these resources might be used? Do these resources belong to humankind in general, to nation-states within whose territory they exist, or to the peoples who live in and by them? On the answer to this first question depends the answer to the further questions of both the limits of use as also of the infringement of national sovereignty. It is possible to argue that such resources belong to humankind in general, and that there is therefore nothing wrong in countries exploiting for commercial purpose strains that have originated in other countries. But its moral appeal is quickly undermined when these uses are sought to be patented in the form of intellectual property rights in the context of a trade regime that is patently unequal as between nations. The developed nations have the material and intellectual resources to experiment and devise adaptations in laboratory conditions. Do they have the moral right to all future use of those genetic resources, regardless of the country of their origin? This question is relevant because many countries of the South, including India, are rich in germplasm, while Northern countries despite their advances in genetics and genetic engineering, have little or no germplasm (Sahai, 1995: 2917).

The destruction of the tropical rain forests has led to a raging controversy with the result Northern NGOs like the WWF and the IUCN. In collaboration with the World Resources Institute, the World Bank, and the United Nations Environmental Programme drafted the original documents on biodiversity conservation. These drafts had traditional environmentalist approach. It was only in 1991 that the Group of 77 countries, at a Geneva meeting, asked for the issue of biotechnology to be included with that of biodiversity. A month before the UN Conference on Environment and Development (the Earth Summit) held at Rio de Janeiro in June 1992, a document was drawn up at Nairobi, which embodied substantial concessions for which the US had driven a hard bargain. But eventually it failed to sign the Biodiversity Convention at Rio. The Convention on Biological Diversity, in force since December 1993, has, however, been ratified by 127 countries.
The general declaration adopted at the Rio Summit reflects an anthropocentric approach towards sustainable development. It also gives to nation-states the sovereign right to exploit their natural resources, in accordance with their own policies on environment and development.

Many Southern countries assert national sovereignty and even environmental activists are frequently forced to resort to nationalist arguments in the face of threats from a predatory global political economy. Chatterjee and Finger have argued that the biodiversity convention exemplifies a perversion of the concern for the destruction of the World’s biodiversity into a preoccupation with new scientific and biotechnological developments for economic growth. There are, in their view, three key arguments that hold this perversion together:

First, the convention gives nation-states the sovereign right to exploit their own resources pursuant to their environmental policies, thus transforming biological diversity has into a natural resource to be exploited and manipulated. Then, the convention implicitly equates the diversity of life - animals and plants - to the diversity of genetic codes, for which read genetic resources which can be manipulated by science. Finally, the convention promotes biotechnology as being essential for the conservation and sustainable use of (Chatterjee and Finger, 1995:42).

Consequently, biotechnology is projected as something that is good for the conservation of biodiversity, as it is conducive to the maintenance of genetic diversity, as well as for improving production crops, livestock and aquaculture. Biotechnology secures not only material producers but also biodiversity conservation. Biotechnologists do not labour painstakingly for the common future of mankind but look to commercial interests- mostly in the pharmaceutical and biotechnology industries.
This becomes evident from the fact that biotechnology is stated to account for almost 60 to 70 per cent of the global economy for at least the next two to three decades. It will play a role in fields as diverse as mining, feedstock chemicals, energy, pharmaceuticals and, of course, food. This biotechnology sector will be almost entirely in the hands of the 10 to 12 largest multinationals of the world (Sahai, 1995: 2916).

By allowing sovereign governments (and, by implication, local industries) the right to use and manipulate their own natural resources, the communities who depend on biodiversity for their sustenance, their habitat, food, medicines and even culture are often overlooked.

**The question of Local Communities**

In technical terms, this question has two components. First, the argument that the local communities who live in and by these resources have a historically validated right to them. Secondly, these communities are living repositories of knowledge systems about these biological resources, on the basis of which they have creatively adapted and innovated in impressive ways that deserve recognition.

It is generally presumed that communities that live off forests and have great knowledge about them, have their rights. This includes indigenous peoples also. Some of them have been facing displacement due to river valley projects.

The admissibility of rights-claims collectively and individually amounts to recognizing that communities, no less than individuals, have a capacity for agency and autonomy. Classical liberal theory attributed this capacity exclusively to individuals the contemporary discourse on rights gives explicit recognition to such claims. What is the substance of such rights in relation to biodiversity? It is chiefly historical. Because of the customary lien such communities have enjoyed over resources like food, fodder, house construction materials, raw material for medicines, and so on. Another school of thought does not believe in the lien theory. It says that the material progress of the nation is hampered by such claims by or
on behalf of local communities. Another variation of this argument is to bring these communities within the mainstream. What is often ignored is the fact that forests have provided sustenance to the communities and the latter, in turn, provided knowledge of various species.

This is the basis for the further claim to recognition for the practices and creative innovations of these communities, as they have historically interacted with their natural environment. (for a variety of examples, cf. Warren et al., 1995). This gives the communities a sort of a copyright over innovations and implies collective intellectual property rights. Similar claims made by transnational corporations and sought to be enshrined in multilateral agreements between nations reflect self-interest, whether national or commercial. These have, on occasion, taken the form of the political mobilization of farmers to, for instance, protest against the Dunkel Draft, or the announcement that patenting neem is an act of intellectual piracy by companies who seek to use local knowledge and resources without permission.

Thus, while the sovereign rights of nation-states to biodiversity have received international recognition in the form of Biodiversity Convention, these rights need to be further translated into the prior rights of the communities who have maintained and preserved it. In the post-Rio era, the onus lies squarely on governments to ensure that the diversity of both species as well as of communities is protected. Vandana Shiva has argued persuasively that there are three imperative here:

(a) The ethical and ecological imperative of recognizing the intrinsic worth of all species.
(b) The imperative of giving equal recognition to creativity in diverse cultures, especially indigenous traditions of knowledge.
(c) The economic imperative to provide basic standards of health and nutrition to all citizens

(Shiva, 1996:1629-30)
The Question of Future Generations

Finally, there is the question of our duties towards future generations. According to modern philosophy those beings who have rights, should have interests. Plants can be said to be capable of having a good. Is not that good, however, distinct from having interests? Interests presuppose something like belief, or cognitive awareness (Feinberg, 1980:168). If the plants need for nutrition or cultivation, its flourishing or languishing, suggest that it has interests, the interests that thrive when plants flourish are not plant interests, but human interests. However, though neither plants nor whole species can be said to have rights in the strict sense of the term, we may assert duties to protect threatened and endangered species, not duties to the species themselves, but rather duties to future human beings, duties derived from our housekeeping role as temporary inhabitants of this planet (ibid:172).

It has been argued that in the course of the twenty-first century, the projected loss of species may be to the tune of 20 to 50 per cent of the world’s totals, which means a rate between 1000 and 10,000 times the historical rate of extinction. Further, it is argued, the rate of loss far exceeds the regenerative capacity of evolution to throw up or evolve new species. Thus, extinction outputs far exceed the speciation inputs (Pearce and Morgan, 1994)

The implication of species depletion for the integrity of many vital ecosystems are far from clear. The possible existence of depletion thresholds, associated system collapse, and huge discontinuities in related social cost functions, are potentially the worst outcome in any reasonable human time horizon.

At one level, it is possible to make the claim that biotechnology enhances the prospects of future generations because of advances in genetic engineering. At another, however, it is equally validly possible to argue the value of preserving the natural world from further depredations and degradation so that future generations may enjoy it. The first argument is
justified by reference to the Enlightenment view that science and material progress have the potential of solving most human problems and that this potential only increase as the frontiers of science expand. The second is justified by a view that is clearly ethico-philosophical as well as ecological.

Any claim for the conservation of biodiversity, which appeals to our concern for future generations is, of course, clearly located in an anthropocentric ethic.

So, the claims to rights of nation-states and local communities are based on the assumption of autonomy and agency, while the same are attributed to future generations who are expected to be not unlike us in this matter. Thus, we assert the sovereign right of the nation-state to the biodiversity resources found within its boundaries, and seek to formalize this ownership in instruments of international law. Developing countries have been partially successful in their efforts to this end. The rights of local communities to the biological resources by which they live, free from the depredations of both the state and transnational as well as indigenous corporate interests have not been recognized. India, does not have a too distinguished record of conservation or sustainable development. It has largely followed a developmental path that is imitative, and becomes increasingly so as the economic reforms process set in motion five years ago gathers momentum. If the overall economic and therefore developmental - strategy is so imitative, what price are the assurances of the Biodiversity Convention? Further, in the field of technology, India has largely relied so far on imported technology, and lacks the capability to develop high tech products based on indigenous genetic resources on our own (Gadgil, 1995:317).

This tension may also be seen in the positions taken by environmental NGOs. On the one hand, they must support national sovereignty and on the other hand they must also oppose the national government while safeguarding the interests of local communities.

Typically, claims to rights - whether of nation-states or of local communities-involve ideas of property and ownership, especially when physical resources are in question. The political
position that repeatedly emerges from environmental activism is that nation-states should have sovereign rights of ownership and control over their biological resources, that local communities should be recognized as the owners and creators of indigenous knowledge systems and indigenous technology, and that future generations are potential owners as the inheritors of this legacy.

All these claims strongly echo the imagery of property. The concept of property recalls not only the idea of commoditization, but also an attendant notion of inequity and lack of participation. This paper, therefore, questions the appropriateness of couching such claims in the vocabulary of property rights, and suggests a shift in the way in which rights are explicated in this area. Drawing upon the interpretation of rights as self-ownership (as evidenced in much liberal political theory, especially the influential work of Robert Nozick, 1974) versus rights as self-government (Ingram, 1994), this paper suggests that a shift away from the self-ownership view and towards the view of rights as self-government is appropriate. The self-ownership view, heavily imbricated as it is in the language of property, suggests control and command through ownership and is, eventually, the language of power and domination. Interpreting rights in terms of self-government, on the contrary, yields a more egalitarian, participatory and democratic perspective, one which is infinitely more suitable for an ecologically sensitive approach. The inequities and domination which are implicit in the interpretation of rights as self-ownership (and thereby linked inextricably to the phenomenon of property) are at least philosophically redressed, and a more radical ecological agenda rendered possible.

References


Religious traditions in ancient Indian culture: Their role in Conservation of Natural Resources and the Environment

by S. S. Pokhrana

Ancient Indians recognized the dangers to environment through human beings and evolved some code of conduct to control these activities. They had developed several traditions and customs to live in harmony with nature. The present paper analyzes these traditions and customs in the modern perspective. They can provide several new ideas and practical methods to preserve this planet from further degradation.

1. Ideas about Living with Nature in Indian Culture

Different schools of thought have dealt with man-environment interaction.

1.1 The Four Ashrams

The total life span of a person has been divided into four parts viz. Brahmacharya Ashram, Grahastha Ashram, Vanprastha Ashram and Sanyas Ashram. Taking an average life span to be one hundred years, the first two spans of fifty years have been set aside for learning and establishing a family, which involve taking resources from the environment. The other two parts of fifty years have to be passed in forest and in returning the resources like forests etc. back to the environment. In modern science, it implies some kind of equilibrium between man and the environment.

1.2 Brahmacharya: Action in Harmony with Nature

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Brahmacharya is not merely celibacy, but has a broader meaning. Brahma in the Indian culture implies nature (probably the whole biosphere). Brahamacharya means in tune with nature. Living with nature, which has become so popular after the Rio Summit, was already accepted by the Indian culture.

1.3 Yoga and Meditation for bringing Unity between Man and Nature

Yoga and meditation are emphasized in the Indian culture. Yoga is not a mere set of physical exercises. It is not only for developing coordination between mind and body. It has still deeper meaning, which is of great significance in the present context. The Indian culture divides the world into two parts, i.e., self (ego) and the rest of the universe. As per another nomenclature, there are *purasha* (symbol of action) and *prakriti* (nature). One should live in such a way that there is a harmony between these two. In *Patanjali yogasutra*, it is mentioned that the objective of performing yoga is to coordinate the *purasha* with *prakriti* and to ultimately merge one into the other. In Shankara’s philosophy, it is clearly stated that there is no difference between self and rest of the universe.

1.4 Holi Dip in Rivers: Symbolic Merging of Oneself with Nature

During *Kumbha Mela, Kartik Purnima or Makar Sankranti*, lakhs of people bathe in rivers. By so doing they develop an attachment and love with water and the rivers. It could be interpreted as symbolic merging of oneself with water and, hence, with nature.

1.5 Visiting Temples on Mountains for having actual experience of Beauty of Environment

Several temples have been built on mountains and many functions are regularly organized so that people visit these temples periodically. This religious duty makes one develop an attachment with one’s surroundings, besides providing fresh air.
1.6 \textit{Yagnas for maintaining Purity of Natural Resources}

A list of items required for \textit{yagnas} and other functions like marriages, etc. reveal the importance of environment and biodiversity. In a recently held Jain festival of \textit{Mahamastakabhisheka} of the thousand-year old statue of Lord Bahubali at Shravanbelgola in Karnataka, several types of plant species were brought from different parts of the country to proclaim the biodiversity.

1.7 \textbf{Worshipping of Natural Resources}

Worshipping of the Sun, land (soil), water, plants and air are very common in many religious and non-religious functions in our country. In the worship of Lakshmi on Diwali or Durga in Dusshera or Lord Ganesha during Ganesh Chaturthi, plants, water, and soil are involved in one form or other. In Indian traditions, air is called \textit{pran vayu}, being so essential to life. \textit{Bhoomi pujan} is commonly performed when a person buys a new piece of land.

1.8 \textbf{Ayurvedic Medicines and Biodiversity}

Ayurvedic medicines come from plants. Many plants might have become extinct as ayurveda is not very popular. Ayurveda is closest to nature hence this does not produce any direct pollution in the biosphere due to chemicals used in other systems.

2. \textbf{Ideas regarding Conservation of Nature in Jainism}

In Jainism these issues are discussed in greater detail. Thus there are five basic principles of Jainism. They are (1) \textit{Ahimsa} (non-violence), (2) \textit{Aparigraha} (non-possession), (3)
Bramhacharya (action in tune with brahma, i.e., nature) (4) Astey (non-stealing) and (5) Satya (truth speaking)

2.1 Ahimsa and Biological Equilibrium in Nature

Ahimsa implies one should not only kill other members of the biological kingdom. But should not even hurt them. One’s actions and thoughts should be such that they must not even hurt the feelings or emotions of other fellow beings and other biological species. Ahimsa is specially preached for less developed species. Because of this belief in our country we offer wheat or maize to birds in the morning, sugar to ants and chapatti to dogs or cows, etc., in the evening. Jains have special fund for jiva daya (pity to animals). This is specially used for feeding animals.

It is because of this belief that Jain monks and many Jains eat only vegetarian food. The monks do not take green vegetables for fear of killing small insects. The monks do not travel from one place to other in the rainy season and prefer to stay in one village or city only for a period of four months known as chaturmas. It is too well known that the growth of biological species in the rainy season is highest and the movement of the monks could hurt and even kill the small insects. Also many monks carry a broomstick made of very soft threads to clean the floor which walking so that small insects are not trampled under their feet. Many monks cover their mouths with a piece of cloth so that the hot air and carbon dioxide coming from their mouths and noses do not disturb the microorganisms present in the air. This should be contrasted with the gases that are being released into the atmosphere by our automobiles and industries. The Jain monks are practically implementing these principles from last hundreds of years. Environmentalists must admire the precision, depth and level to which Jains have developed these ideas.

2.2 Economic Activities, Environment and Aparigraha
Aparigraha implies reduction in number of items that one should possess. In modern terminology it means reducing all economic activities. This is so because if one starts possessing less and less number of items then demand for the items will decrease. As most of the modern environmental problems are a result of undue emphasis on this concept of economic development, the ideas of aparigraha are relevant here.

2.3 Equity through Non-stealing and Truth Speaking

The principles of non-stealing and truth speaking have indirect implication in the present context. Non-stealing means not steal to directly or indirectly the property of others. The emphasis is not so much on direct stealing as on indirect stealing. Whatever natural justice provides to other species should not be stolen. This is the principle of equity. Many landless labourers mercilessly cut the forests because they do not have means of livelihood. It could be that their small jobs or means of livelihood have been taken away by automation or opening sophisticated fully automated/computerized industries. This is therefore a case of indirect stealing. Because this trend people do not care for natural laws. Thus if a powerful or a rich person does not do justice to a weak or a poor person then the later fellow will also not do justice to animals, trees or small insects and ultimately the environment. The monopolistic trends in economy and a hunger or power to grab the property/belongings of others is becoming very common these days.

2.4 Minimizing the Consumption of Resources: Jain Monks are Ideal examples

Their principle of aparigraha means voluntarily reducing consumption of various resources. It is because of this that Jains monks do not have any permanent house or any property except for few clothes, utensils (made of wood) for carrying alms and some books, etc. They wear only white clothes if a person starts putting on coloured clothes then there is no limit to the number of clothes. As all colours are related with chemicals, the Jain monks do not contribute to pollution due to chemicals used in textiles.
3. **The Principle of Evolution of “Survival of the Fittest versus the Indian Principle of “Live and let Live” for Conserving the Environment**

The concept of “Live and let live” is strong in Indian tradition. This is in contrast to Darwin’s principle of “survival of the fittest”. It may be mentioned here that the famous British environmentalist Prof. Goldsmith believes that too much emphasis on teaching of the Darwin’s principle of evolution is the main cause of all environmental problems. Indian philosophy and culture emphasize on recognizing the underlying identity among all biological species whereas in the principle of evolution, the emphasis is more on the physical differences.


Various customs and conventions developed by ancient Indians have been given religious cover so that ordinary people just follow them in real life. These are just like control parameters in this huge biosphere which have to be followed for stability of the biosphere in the long run and are hence very critical for continuation of life process on this planet. They also reflect the interdependence of various activities of human beings on the biosphere. Hence the concept of one world so popular in the Indian philosophy should be understood in this perspective.

5. **Sustainable development. Sarvodaya, Bhoodan and Aparigraha.**

Coming to the practical problems it may be mentioned that nowadays environmentalists are talking of a new concept of development which is called sustainable development and it has become very popular after the Rio conference. In the Indian conditions, this will work in
real life only if our large population is taken into account in developing any model for resource production, consumption and conservation. Here it may not be out of place to mention that our leaders have already evolved a concept of Sarvodaya (development of all). This should be therefore the guiding principle for sustainable development. Thus we have to not only increase production of food, fodder and fuel in the long run in a sustainable way i.e. without further degrading the soil, water and environment etc. but we must also plan for a policy which emphasizes on proper distribution of the resources so as to generate employment opportunities. Again in this context one should recognize the concept of equal distribution of resources, hence the Bhoodan movement (donate the land) must be a part of sustainable development because this will be very crucial for landless labourers. Also one must talk of reducing consumption of resources, so again the concept of aparigraha is very significant. It appears that the idea of sustainable development can be described by four characteristics viz. resource development, equal distribution, reduced consumption and spiritual development.
How did American Indians “Get the Incentives Right”?  
Ronald L. Trosper

American Indians stressed on the rights of the community (clans, bands, villages) while awarding use rights to individuals. It was required that wealthy people and political leaders should be generous with their wealth. Particularly important were the sacred sanctions that forced chiefs of the tribes of the Northwest Coast of North America to distribute the communal wealth among all those who shared the same fisheries. With a focus on a recently published book by Terry Anderson, this essay reviews the arguments put forward by the property rights school and finds them incorrect. This school holds that the American Indians relied on market incentives to get land rights.

Terry Anderson’s recent book, Sovereign Nations or Reservations: An Economic History of American Indians, is the latest by members of the “property rights” school of political economy in the United States. Anderson seeks to refute the idea that values are the reason for the American Indians to act as stewards of their living space. If they were “Environmentalists,” it was because they adopted private property rights and acted as homo economicus. The dust jacket contains endorsement from two authors of important works on Indian economic development, Robert Nelson and Joseph Kalt, and from a prominent property-rights economist, Gary Libecap. The book and the earlier article by Baden, Stroup and Thomas (1981) need critical study. American Indians enforced their environmental values through institutions that were not those of private property rights.

I agree with Anderson and his colleagues only on two major points: institutions and incentives matter and American Indian Institutions are worthy of study (Trosper 1995). I find little evidence for the private property rights theory in the sense used by the property rights school. Other systems of property rights provided the incentives that encouraged environmental stewardship. Anderson is right that mere environmental ethics are not

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enough. At the same time accepting an analysis that depends heavily upon “the egocentric individual who maximizes wealth or well-being subject to constraints imposed by the physical and institutional environment” will be wrong (p.4).

Anderson recommends that Indians need to “get the incentives right” for growth of their reservations. He says property rights institutions were private property rights. He does not favour imposition of private property rights systems by outside authority. He criticizes the allotment policy both for being imposed upon Indians and for not being a private property right system.

An alternative is that Indians adopt modern ways to get the incentives right. After getting the incentives right, American Indians can continue to be good ecosystem managers.

First, I wish to state briefly my understanding of the approach that motivates Anderson’s work. Secondly, I will state at somewhat greater length by approach. Thirdly, I will evaluate the five lessons, which Anderson has found from his study. After considering each of his lessons, I will offer an alternative lesson for the reader’s consideration. Fourthly, and by way of summary, I summarize the argument regarding the incentives systems that Indians use to support their environmental values and review the key facts about Indians that the property rights school has not recognized as significant.

**The Property Rights Paradigm**

The first chapter, “Culture, Property Rights and Paradigms,” provides an overview of the analytical assumptions of the book. These can be summarized in five categories: individual motivation, production possibilities, ownership rules, political systems and important questions.

*Individual Motivation*: Individuals maximise wealth according to their values whose scope is limited to personal concerns. They can be more than just an interest in material goods.
and services (pp. 7-9, 19). Human behaviour consists in identifying the relative costs and benefits individual faces, which are in part determined by property rights institutions (p.4.).

*Production Possibility*: Because economies have few externalities (other than pure public goods), a private property rights system aligned with individual ownership will ensure that costs and benefits of economic decisions are fully internalized, resulting in overall economic optimality (pp.8, 21).

*Ownership Rules*: Property rights systems should be judged by how far they are “effective in organizing output” (p.9). Much of the property rights are individual rather than collective. Ownership rules exist on a continuum from private property to communal property. Ownership is a bundle of rights, and as the bundle decreases in size, one moves away from full private property and away from desirable economic outcomes (p.8). An owner has dominion over his or her property. In communal ownership, the problem of free riding is serious (pp.2, 19-20, 29). Anderson departs in portions of the book from a strict emphasis on private property rights; for instance, “the experience of tribes on reservations prior to allotment attests to the fact that institutions other than private ownership may be effective in organizing output as long as there is a reward and penalty system...” (p.9).

*Political Systems*: Government’s role is to protect individual rights and provide public goods. Government officials often use the powers they have for personal gain owing to the coercion needed to provide goods. Personal gain takes the form of rent seeking to redistribute wealth, which always reduces the total amount of wealth in a society (pp. 8-10).

*Important Question*: How can governing institutions be arranged to promote economic growth? Since the above assumptions suggests that a private property rights-based market economy can promote environmentalism (Anderson and Lel, 1991), and American Indians were environmentalists, then if we examine American Indian history, will we find evidence of private property rights institutions? (p.7). Why are American Indians poor “in the midst of the richest societies in the world?” (P.6) “The fundamental problem... becomes how to
create collective units that have the necessary power to protect individual rights and to produce public goods without that power being used to transfer wealth to those who control the political power” (p.10).

**My Assumptions and Approach**

This section parallels the summary of the property rights paradigm given above.

*Individual Motivation:* There are four guidelines for organizing exchange relationships. Alan Fiske has defined them as follows.

a) In Communal Sharing, all members of a collective can draw upon a defined set of resources without comparing how much each individual gets.

b) In Authority Ranking, use of a set of resources is based upon rank; higher the rank greater the share.

c) In Equality Matching, each member of a collective receives an equal share of the resources.

d) In Market Pricing, each member of the collective receives resources in proportion to some other characteristic of the person, such as initial wealth or work effort.

Fiske justifies these four forms with evidence drawn from literature in many social sciences. Many of these elementary forms make sense from the viewpoint of evolutionary psychology, and the book edited by Barkow, Cosmides and Tooby (1992) show that humans apply logical reasoning better in contexts that involve one or more of these elementary forms.

Utility functions are defined only when the fourth template applies, with its use of relative values in allocation. A social system should be examined to see which resources individuals who compare relative prices and that the duties defined by the other three systems are not relevant govern. Sometimes one or more of the other three forms may constrain or direct
the market pricing system. One consequence of this is that per capita income yardstick is called into question in societies where communal sharing, or ranking are important ways of making judgements.

*Production*: Any society that depends on ecosystem for its energy needs should be able to handle energy resources when the ecosystem is disrupted. A key issue is whether or not energy imports are available.

But even when energy imports are available, externalities are important as they reveal themselves over long time scales and large landscapes (Holling and Sanderson, 1996). These are less important in the short run. Any comparison of production systems has to identify the use of energy and energy products as inputs on each side (Costanza and Folke 1996, p.23).

*Ownership*: Ownership is a complicated social process and a great variety of structures can occur. Classification of the different structures is aided by careful attention to four categories: the nature of the things owned, the characteristics of the owners, the modalities of use and benefit allowed owners, and the characteristics of persons who are excluded by a particular ownership rule (Christman 1994, 23-27).

Things owned can be land, personal property, titles, songs, etc. A particular ownership structure cannot be applied uniformly. Owners can be individuals, families, clans, bands, tribes, corporations, nation-states, etc.

An individual may be able to use an item, such a fishing site, but may have to compensate a community for that use. An individual may be able to use a parcel of agricultural land, but may not be able to give or sell it to anyone else without community approval.

An Iroquois village had jurisdiction over land cleared by the men of the village, against members of other villages. After clearing, clan mothers assigned garden plots to the female
members of her clan, who then organized the production of corn on “their” land. If they do not raise corn, the individual woman lost control rights. The men had rights to hunt for deer on other lands, some of which were the abandoned cornfields of previous village locations (Starna 1988).

This classification is more complicated than a continuum between “in common” and “private property.” An increase in the clarity of property rules is not necessarily a move toward individual ownership; such clarity could create some other type. The Iroquois and other horticultural tribes exclude others from the use of their land, passed from generation to generation. Within the village, the land use would look like sharecropping leases between the ultimate owners, the village, and individual women governed by clan obligations. When confronted by the possibility of vesting fee simple private property rights in land among their members, the Iroquois resisted (Noon 1949, p.104).

*The intersection of ecosystems and ownership rules:* The Iroquois land tenure system resembled shifting cultivation of the forest, and was adjusted to the pattern of succession in their forests. The Kwakiutl ownerships rules applied to a fishery, and adjusted incentives to the requirements of a fishery. Both were clear and provided the right incentives; neither was a system of liberal private ownership.

*Political Systems:* The modern state is not the only choice available to a community. I agree with the Anderson that the state is a major problem today; but I do not identify tribal government as necessarily identical to the state. Aboriginal political systems had principles that limited the power of their leaders, such as a requirement to be generous, separation of powers among many chiefs, impeachment and bicameral legislatures. Often, an entire community had to agree to a decision through a process of consensus, which meant that a mere majority was not enough to control governing power. Requiring unanimity can limit rent seeking.
To study Indian history, the list of political alternatives has to be longer than that of Anderson: family 4, self-help and religious authority (pp.9, 11, 28). Aboriginal Americans had clans, villages, bands, confederacies of villages and cities. Notably absent was the concept of a sovereign monarch. With the arrival of Europeans, the systems of monarchy and colonial bureaucratic administration need to be added to the list of alternatives. As a result of interaction with the democratic confederacies of the Americas, Europeans also developed constitutional republic (Grinde 1992).

*Important Questions:* How did Indian societies set up incentive systems to manage ecosystems before Europeans came on the scene? How have some aboriginal communities ever survived in the United States?

*A Critique of Five Lessons*

Anderson disassociates himself from attempts to impose private property systems on Indians. To express his position, he refers to the argument of Jennifer Roback (1992):

I share Roback’s pessimism about prescribing rights solution and her enthusiasm about what scholars can learn from studying Indian institutions and institutional change (p.161).

On the next page, however, he asserts that private property institutions were consistent with Indian traditions:

This only shows that current incentive structures are not consistent with Indian traditions and are not promoting productivity on reservations. Decision makers-private or political- must be held accountable for their actions (p.162).

What is the meaning of this? To be consistent with Indian traditions, then, is to adopt private property rights systems that Indians used to have, since within his political economy
approach there are no others to recommend. If there are others, then this observation needs to be accompanied by a description of institutions other than private property rights, which provide the right incentive structures and accountability. Read very broadly, this quotation could be an endorsement of the arguments of this paper.

One reason Anderson avoids the explicit recommendation of private property institutions may be the common judgement of the allotment policy as a failure. As a result, we see in this school, many articles about Indians a number of papers that offer rebuttals to the example of the allotment policy as a test of the application of a private property system. The rebuttals are:

1. The allotment system was not a private property system because of the trust restrictions placed on the allotments (McChesney 1992, Carlson 1991)

2. The top-down imposition of a particular private property system was the problem (Anderson, P. 108).

3. The BIA used the administration of the allotment process for its own purposes, to increase the size of its budget (McChesney 1992).

4. Within the federal system, a top-down policy will be plagued by rent-seeking diversions of the fundamental policy goal (Alston and Spiller 1992).

On p. 108, Anderson recognizes but does not stress the following rebuttal, which is probably the main reason that the allotment policy impoverished Indians:

5. The problem was the declaration of so much surplus land (for homesteads) and the transfer of so much wealth to non-Indians through biased market processes and state sales of land for taxes.

Thus, the pro-private property rights agenda is revealed by the attention given to nothing the ways in which the allotment policy was not a good example of a private property rights system. From consideration of these ways the policy was not correctly carried out, one
might be able to glean a number of recommendations about how to correctly carry out such a policy.

After his opening statement that he does not want to recommend private property institutions of the manner that have been previously enforced, he moves to the five lessons that he derives from studying the economic history of American Indians.

“Lesson 1. The fittest institutions survive.”

This lesson as stated appears to invoke an evolutionary explanation for the existence of private property institutions. Nowhere in the book does Anderson provide a discussion of the application of evolutionary theory to institutions. Evolutionary theory in all its forms analyzes the survival of traits through the replication processes of individual entities. In biology, the entities are organisms or genes (Dawkins 1982). When applied to humans, the entities are individuals (Boyd and Richerson 1985). In evolutionary economics, the entities are firms (Nelson and Winter 1982; Winter 1989; Mailith 1992). Nelson and Winter assume an institutional framework--private property rights--and investigate the evolution of productive knowledge.

Since social institutions are neither traits nor individual entities, how can evolutionary theory apply to them? Although he uses evolutionary language, Anderson provides no proof of the lesson as stated. What, then, did he mean to say with this lesson? The title sentence to the third paragraph is a better statement:

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Evolutionary models such as those provided by Boyd and Richarson (1985) may be able to provide explanations for the persistence of particular ownership institutions. Recent work such as that of Sothi and Somanathan (1996) presents the type of model Anderson would need to provide to substantiate his first lesson as stated. Sothi and Somanathan conclude that either selfish or cooperative strategies could survive in their evolutionary model. Although they identify cooperative strategies with common property institutions and selfish strategies with open access or private property institutions, this connection is not well laid out--perhaps private property could be seen as a type of cooperative institution.
When these rules got the incentives right, Indian tribes did well; when they did not, both resources and prosperity suffered.” (163)

Thus, the real claim of this lesson is that the Indian tribes that did well are the ones that “got the incentives right.” He concludes the third paragraph by stating, “Homo economicus as alive and well in the pre-European Indian culture.” (164).

This lesson, therefore, brings us to the main proposition: Indians had private property rights systems. I will consider each of the examples he presents to see if any of the ownership systems were private property rights systems. I organize the examples as he does, into land and other property. For land, there are three cases: (1) agriculture, (2) hunting and gathering, and (3) fishing. For other property, his main example is the horse among Plains Indians.

In terms of Fiske’s four elementary forms, usufruct tenure combines equality matching and market pricing. All members of a community can obtain land, a principle of equality matching. The amount of land controlled is proportional to effort, a principle of market pricing.

In many of the societies Anderson claims had private property rights, the usufruct owner did not have full rights to the product of the land. Among eastern tribes such as the Creeks, either a portion of the harvest had to go the village chief, or the landowner had to work on the chief’s land as well as his own (Driver 1969, p.279). The Iroquois required that a portion of the harvest go to the village (Starna, 1988).

*Hunting and Gathering.* Agricultural tribes typically use neither usufruct tenure, which is neither tenancy in common nor fee simple ownership. Indians living by hunting and gathering also had property systems, which were not private liberal ownership. Driver (1969, chapter 16) provides an overview of the systems across the continent. Anderson cites many of the examples of hunters and gatherers who recognized “hunting territories” that
belonged to a social group. The social group could be a family, a clan, or a village as common examples.

Both Anderson and Baden et al. (1981) cite the hunting territories of northeastern Canada, among the Algonquians, as an excellent example of individual ownership of territories. Indeed, when Tanner lived with the Mistassini Cree in 1971, he observed a system of hunting territories in which individual men had the right to organize the hunting efforts. This system was relatively unchanged from the time that Speck had studied hunting territories. To deny the claim that the Cree had private property would seem to be a challenge.

The Cree themselves denied that their system was private property in the European sense, because the individual who had rights to hunt could not sell the land. He owned the right to hunt, not the land in its entirety (Tanner 1979,). Tanner provides the following summary:

> Mistassini Cree ideology (as well as their practical concerns) places emphasis on animals rather than on land, and thus suppresses the question of the clear definition of boundaries....In practical terms, the definition of a territory boundary is not as often used in keeping outsiders off one’s land, as it is in making sure, in advance, that the hunting and trapping activities of one group do not overlap with those of another. A hunting territory is a unit of management...

To summarize the Mistassini ideology as it relates to hunting territories, the ideal of fixed tracts of land and father-to-son inheritance, which Speck emphasized, are today explicitly held. But so are other ideological principles which emphasize the management and inheritance of rights to animals and power over animals (rather than rights to land) by persons, of whatever kinship status, who have, by long-term residence and hunting success, established membership in the hunting group led by the territory owner (Tanner 1988, p. 70-71).
Thus, the territories do serve to give individuals claim to a steady harvest of animals in a particular area. Although it may seem to be a small distinction, the ownership rights apply to animals, not to land.

A similar system of hunting territories exists amongst the Wasnaniipi Cree:

Wasnaniipi harvesting is organized around the system of hunting territories. Each territory is under the stewardship of a hunter, usually an active elder. The territory system has been recognized by governments in recent decades for purposes of organizing beaver trapping, but the system predates official recognition, and it serves the Wasnaniipi for a much wider range of harvesting activities than just trapping fur-bearers. There are approximately 225 adult Wasnaniipi men, of whom approximately 50 are stewards. Stewards generally have the right and obligation, socially and spiritually sanctioned, to decide whether a hunting territory should be harvested for big game and fur-bearers during any season, and they allocate long-term rights and seasonal privileges to use the territories to hunters who do not have their own. They can direct where, when, and how game should be taken although this direction is normally kept to a minimum, and it takes the discreet form of suggestions and providing information, thus observing the relative autonomy of each hunter. Their supervision is widely respected. The decisions, therefore, are made by socially located individuals bound in a complex system of rights and responsibilities (Feit 1988, p.85).

For both these contemporary Cree communities, the “owner” of a hunting territory is obligated to allocate rights within the territory to other individuals. Feit describes the person responsible for a territory as its “steward;” other use “boss.” Tanner lables the person as a “leader” of the group, with father-to-son inheritance. As the Mistassini Cree emphasize, the man with the right to hunt in a territory cannot sell the land for other
purposes. His rights to exclude other band members are limited, since those members have right to hunt, although under the leader’s direction. Amongst the Chisasibi Cree, failure to harvest beaver in a sustainable manner caused a beaver “boss” to lose his position (Berkes 1987, p.87).

In all of the cases of hunting territories, Anderson argues that control of access to territory by a band or other small unit is equivalent to a private property system. The ability to exclude outsiders is a necessary but not sufficient condition for a group of resource users to implement a system of management of commonly held resources (Schlagger and Ostrom 1992). Such a power allows the group of resource users to implement management and assignment rules among themselves. Individual members have an ownership right; but they do not have liberal private ownership simply because the group can exclude others. The steward of a territory cannot use the territory exclusively, either; he must recognize the rights of community members to hunt, and they must hunt under his direction. It is his responsibility to prevent excessive harvest, and he can enforce his regulation because if a hunter does not follow instructions, he may receive less favourable instructions the next year.

The Cree hunting territory system provides stewardship incentives through definite rights, but it does not assign liberal private ownership, fee simple title, or individual property rights in land, because the hunting stewards cannot sell their right and must provide access to their territories to other individuals.

Fishing. Anderson notes that specific persons often owned specific fishing sites in the salmon-harvesting peoples of the Northwest Coast. The right to use specific sites was well defined and clear. Typically, such rights belonged to chiefs or heads of lineages, which controlled access to fishing at the site. Did these chiefs own the sites as personal, private property? They did not, because they were required to share the harvest of the site with other members of the community. As a chief of the Kwagu’t band of the Kwakiutl told Franz Boas in 1886:
We were told a man-of-war would come if we should continue to do as our grandfathers and great-grandfathers have done. My father owned the land and was a mighty chief; now it is mine... We will dance when our laws command us to dance, and we will feast when our hearts desire to feast. Do we ask the white men, “Do as the Indian does?” It is a strict law that bids us distributes our property among our friends and neighbors. It is a good law (Shandel 1975).

The chief is describing his desire to retain ownership of “his” land as well as to continue the potlatch, a well-known institution with a considerable scholarly literature. Anderson and Baden et al. both follow Boas (1966) in his mistaken interpretation of the potlatch, which it was a voluntary activity which persons undertook to acquire status. Drucker and Heizer (1967) and Walens (1981) show clearly that Kwakiutl belief and practice required chiefs to give away their wealth; it was not a voluntary or discretionary activity.

Among the Kwakiutl, ownership of land and fishing sites rested with clan-like social entities, the numaym, and were managed under the direction of the chiefs of the numaym. Since individuals held positions, and positions owned property, the system was not exactly individual-focused. In addition, each chief was obligated to give substantial portions of his numaym’s wealth to the chiefs of other allied numaym on an annual basis. Drucker and Heizer (1967 pp.39-40) noted the division of Kwakiutl into festival groups that shared inlets. Although ownership in the sense of control was clear, the rules for rights to income were not those of private property.

A requirement to share net returns among entities sharing common stocks of andranamous fish removes the prisoner’s dilemma for such a fishery. I show in another paper (Trosper, 1996) that the incentives created by the potlatch are correct for a fishing community. Neighboring Kwakiutl sharing an inlet would face a common pool problem. The game of prisoner’s dilemma is often presented to illustrate the fundamental puzzle that faces any
two or more persons that are harvesting from a common pool resource (Binmore 1994; Ostrom, Gardner, and Walker 1994). The dilemma occurs because if some fishermen restrain their harvest, other fishermen are free to expand their harvest, thus receiving a larger share. If all fishermen would use restraint, the total net returns would be maximized. With open access, no sensible fisherman will use restraint, total effort will be too large, and the fishery will be stressed.

But if the fishermen who aggressively harvest fish must give a share of their harvest to the other fishermen, then a sensible fisherman can restrain his effort, knowing he will receive a share of his rivals’ catches. The requirement to share—as among Kwakiutl festival groups—resolves the dilemma (Trosper, 1996). If this answer is so simple, why have so many commentators not stressed it? Most assume that an agreement to share the outcomes of a game such as the prisoner’s dilemma is not enforceable (Binmore 1994, Sugden 1984). In a society such as one that requires give-aways, however, the enforcement mechanism is credible. Given its ability to solve the common pool prisoner’s dilemma, the Kwakiutl were right to believe that the winter ceremonials, with their potlatches, were responsible for “a plentiful supply of food” in the coming years.

In the terms of this paper, the potlatch institution in the presence of clear title to fishing sites is still not evidence of liberal private ownership because the owner of the fishing sites does not have the right to retain all of the return from the fishing site. Private property ownership requires full right to income from a thing as well as control of it. In a society such as that of the United States, the right to income is limited by a need to pay taxes. The potlatch institution, however, requires the sharing of income with one’s neighbors, not with a central government.

Anderson’s first lesson derives from the information provided in Chapters 2 and 3. Nowhere in those chapters does he recognize the ubiquity of gift-giving among American Indians. Earlier, he summarizes the case in favour of private property rights as follows:
“With private decisions, costs and benefits devolve to the individual and thus provide appropriate incentives. Moving the decision-making locus from the individual to the collective, in the absence of unanimity, increases the likelihood that the decision-making body can pass along benefits to members of the collective who do not bear the costs.” (p.10)

This quotation assumes that all of the costs of private decisions occur to the private decision-maker. In the case of fishermen utilizing a common run of salmon, the costs of harvest are shared. The potlatch causes the benefits of harvest to be shared, as well, which lines up the incentives with the costs in a way that solves the common-pool dilemma of a fishery.

*Personal Property.* If we turn to a consideration of personal property--horse, tepees, farming implements--Anderson is on much stronger ground in his assertion that a great many Indian tribes recognized individual ownership. Such items were usually manufactured or created through personal effort, and the usual argument in favor of private rights creating the right incentives do seem to apply to such items.

One problem remains, however, in the presence of the common ethic of sharing: to what extent were individuals able to maintain ownership of all of their personal property, in societies, which gave high value to the practice of give-away? Anderson uses the Blackfeet as his main example for horse ownership. As Ewers reports, stinginess was a detested trait among the Blackfeet, and bandleaders were expected to feed the poor (Ewers 1985, p.163). Among the Crow, one first-hand report in 1923 described the following events during a visit between bands:

> These Indians gave away practically all of their horses. This is, of course, one of the old Indian customs... It seems to have an intoxicating effect on them when they begin to give things away and they do not know when to stop” (Hoxie 1995, p.212).
Because social obligation among the Crow required such generosity, of course they were pleased to give away their wealth (Hoxie 1995, p.218). Llewellyn and Hoebel (1941), in their consideration of Cheyenne property law, conclude that “the gift-exchange machinery” worked “as a practical limitation on the other party’s property right” (Llewellyn and Hoebel, 1941, p.236).

The brief reference to horses could extend to a full discussion of the requirement of the wealthy to be generous in many Indian societies. For the purposes of dealing with environmental management, I wish to emphasize land in my treatment. With regard to land, I propose to restate the first lesson as follows:

**Alternative Lesson 1:**

Because American Indians did not recognize absolute individual property rights in land, communities were able to compel their members to comply with community goals while using jointly held land. In addition, the incentives of the potlatch and similar institutions encouraged individuals to seek cooperative solutions to common pool management problems, a strategy which the settlers who removed Indians from their land did not easily accept.

**“Lesson 2. Effective Institutions Evolve from the Bottom Up”**

As with the first lesson, the second makes an evolutionary claim, which is not supported by any arguments based upon evolutionary models. Anderson gives examples of the failure of institutions imposed from above; the failure of such efforts does not prove that bottom up institutional change would succeed.\(^{121}\)

\(^{121}\) In the absence of proof regarding bottom-up institutions, he could have studied the history of self-government among the Five Civilized Tribes. These tribes did build governing institutions from the bottom up; and in order to carry out the allotment policy, the Curtis Act of 1898 abolished the governments which the tribes of Indian Territory had developed during the ninetenth century (Debo 1970, 127-149, 308).
As a colonizing government, the United States imposed institutions that were designed to achieve particular colonial goals. Anderson shows some awareness of the colonial goals, such as his discussion of the motivation of the distribution of surplus lands under the allotment policy in chapter 5. He examines colonial motivations within a political model that portrays the federal government acting in response to interest groups among the settlers and budget maximizing bureaucrats in the capitol.

He consistently downplays the land-grabbing and resource-obtaining theme in American Indian economic history. Indian land was taken when gold or other minerals were discovered. Under the allotment policy, agricultural land was taken first in areas with highest rainfall (Carlson, 1981). For Anderson, the problem with colonialism is that the governed do not consent to the institutions imposed: who could disagree with that? The transfer of wealth that was involved is ignored, in spite of his concern in other contexts with limiting the power of the sovereign to undertake such wealth transfers! The conclusion to chapter 5 (p. 108), rejects the taking of land as a prima facie piece of evidence regarding the cause of poverty. He is wrong to assert that we do not know the price of land taken relative to the value of the land: read the record of the Indian Claims Commission (Rosenthal 1985). Examine the failure of the United States Government to pay interest on compensation for lands taken without adequate payment, once awarded (Carlson, 1985). Examine the history of specific tribes and bands (Meyer 1994, McClurken 1996, Carrico and Shipek 1996). Geisler (1995) shows the importance of loss land ownership for the poverty of many minorities, including Indians.

In addition to abolishing tribal governments and undermining tribal leadership, the United States also attacked religion and family structure. Government supported missionaries

122 The tendency of Anderson and some other members of this school to ignore the direct effects of uncompensated appropriation of Indian-held resources on Indian income levels, when the school generally holds that wealth redistribution is bad puzzle me. His rejection of this hypothesis is the tough standard (not applied to evidence in favor of his theories) that “there is no systematic evidence to test this proposition” (emphasis added). Without citing the available evidence on the point, he does state, “If land was taken without compensation, there is no doubt Indians were disadvantaged”. (p.108)
condemned traditional ceremonies, which agents prohibited as best they could, and children were removed to boarding schools. As an alternative lesson, I would characterize colonial policy as follows:

**Alternative Lesson 2:** In the exercise of its power, a colonizing nation replaces indigenous governing institutions with ones that suit its purposes; such governing institutions have little legitimacy among the dominated peoples. Poverty among dominated peoples is caused by a combination of the uncompensated transfer of valuable assets, by interference with the leadership and governing structures of those peoples, and by concerted attacks on other means of organization such as religion and kinship.

“Lesson 3. Trusteeship Promotes Bureaucracy Not Self-Determination”

Tribes negotiated treaties to have barriers erected that would allow them to have internal self-determination. Indian leadership sought a way for Indian institutions—such as usufruct land tenure and potlatching—to be different from those of the surrounding society. Yet in providing these protections, the federal government obtained great discretionary power over Indian affairs. Anderson’s summary of this dilemma is as follows:

> Of course, evidence of lower productivity under trusteeship immediately raises the question of whether the restrictions are worth it. These restrictions may protect Indians against ruthless negotiators who would end up with the long end of the stick and prevent the further diminution of the acres in the Indian estate...If Indians choose to retain trusteeship over their natural resource assets, they must accept the position of the weaker party dominated by the stronger guardian. (p.168)\(^{123}\)

\(^{123}\) In discussion of this lesson, Anderson misses another point, that non-Indians receive access to Indian resources through federal trusteeship. He cites a study that shows that the BIA provided lower sales prices for timber than do Indians when they take over management of their forests. To whom did the benefit go from the low sales prices of Indian timber? When sold by the BIA, the wood was not less valuable, it simply occurred that a greater share of the value accrued to the non-Indian purchaser.
Anderson presents a dual choice: either have the domination of the Bureau of Indian Affairs as representative of the federal government, or be open to “ruthless negotiators”. This short list omits the self-determination alternative. Anderson presents no non-trusteeship concept of the relationship between tribes and the federal government.\(^{124}\)

Why is self-determination omitted as an alternative? Anderson and others of the property-rights school appear suspicious of current tribal government. Note, for instance, the opening paragraph of Benson’s treatment of Indian private property rights, an article Anderson draws upon heavily: “The centralized legal systems of modern Indian reservations, however, contrast sharply with Indian legal systems that prevailed before the arrival of Europeans in North America” (Benson 1992, p.27). Since that is the case, then the current claims of Indian leaders is rebutted: “...many tribal councils cite a commitment to preserving Indian culture as a primary justification for not releasing control over tribal resources to individual Indians and for not decentralizing reservation institutions” (Ibid). What exactly does “releasing control over tribal resources” mean? Does it mean instituting a system of “liberal private ownership,” or does it mean instituting a system of usufruct tenure and required generosity? If an Indian tribe wishes to implement incentive systems consistent with their aboriginal systems, these alternatives have to be allowed.

Because Anderson fails correctly to analyze American Indian property institutions and because he did not examine the governing institutions developed on Indian reservations and in Indian territory before the imposition of the allotment policy and the formal dissolution of those governing institutions, he provides the reader no guidance in considering alternatives to the two choices that he urges Indians accept in dealing with federal trusteeship. Current federal law only weakly, if at all, allows other alternatives. I would propose the following alternative lesson:

\(^{124}\) In private correspondence based upon an earlier version of this paper, Anderson indicates that he is willing to consider and in fact advocates relationships to the federal government that promote self-determination.
Alternative Lesson 3:
When trying to survive within a capitalist economy, indigenous peoples need to have the power to limit the penetration of capitalistic institutions. In particular, they need to have the power to create internal property systems that are neither communal nor private property. This power is part of a general ability to pursue self-determination.

“Lesson 4. Sovereignty Begins with the Individual”

This lesson continues the implicit criticism of tribal government that began with the third lesson. Anderson begins his discussion of this lesson by summarizing the debate in Indian law over the degree of sovereignty that tribes should have or do have within the US constitutional system. With the following statement, he quickly moves away from the issue of tribal sovereignty in relation to states and the federal government:

With the debate entering on which governments are sovereign, almost no attention has been given to the derivation of tribal authority and the basis of its sovereignty vis-a-vis individual trial members (p.169).

This statement is wrong as a matter of Indian law, since the Indian Civil Rights Act of 1968 (25 USCA §1301 et. seq.) explicitly addresses just this issue. There has been considerable attention to the rights of individual Indians in tribal law (Getches et al., pp. 499-514).

The statement serves as a transition into a discussion of the issues of governmental legitimacy that derives from the Hobbesian tradition. He cites evidence of the individualism of many Plains tribes as a way to show the relevance of these concerns in the Indian context. He states the following recommendation in several different ways: “To develop collective sovereignty, Indians will have to return to the basics of individual sovereignty and build from the grown up” (p.170). Admirably, this quotation acknowledges that the basics of individual autonomy existed among Indians, a position that is consistent with the argument of scholars emphasizing the native roots of American democracy.
(Grinde, 1992). By using the term “individual sovereignty” rather than a term such as “individual autonomy” (Christman, 1994), Anderson emphasizes the rights of dominion over land that are involved in liberal private property. “Autonomy” can occur without a full set of private property rights. The Cree hunt stewards, for instance, were careful to recognize individual autonomy in telling people where to hunt. The plains tribes were individualistic in this sense.

Discussion of individual autonomy or individual rights to self-expression would bring up the topic of the distribution of income within a society. Perhaps because he opposes governmental redistribution of wealth, Anderson avoids discussing issues related to the distribution of income or wealth within Indian society. Yet the limits on individual sovereignty in land ownership may well have existed in order to provide a high degree of equality and individual autonomy.

Given the ubiquity of give-aways, clearly traditional Indian values supported relative income equality. In political systems, both men and women selected leaders. In public debate, all were able to speak. This respect for individual autonomy and self-expression caused Rousseau to imagine “The Noble Savage” (Weatherford 1988, p.124). There is no doubt that Indians respected the individual. Systems of usufruct ownership were consistent with this respect. Because a system of liberal ownership has nothing to prevent the concentration of wealth, it is not consistent with individual autonomy; eventually a landless class will develop. Thus my fourth lesson is as follows:

**Alternative Lesson 4:**

After their traditional governing and productive institutions have been dismantled, indigenous peoples have a major problem in reconstructing them. In particular, concern for equality among the members of a tribe is hampered when only private property rights systems are encouraged.

"**Lesson 5. Binding the Sovereign is the Ultimate Problem**"
Anderson’s fifth lesson is a presupposition of the work. I have quoted above the statement that this *the issue* of political economy (referring to p.10). The prominent concern about the sovereign abusing his power is a European problem. European sovereigns did not exist in America.

Anderson acknowledges only two legitimate roles for government: protection of individual rights and production of public goods. “Sovereign governments have both a protective and productive role to play in any society, but this role requires coercive authority on the part of the government, making the ultimate problem one of limiting the use of that authority.” Was this ever dilemma among American Indians? Anderson fails to show anywhere in his book that this was an aboriginal problem. It is definitely a problem with governments set up by the colonial authorities, and is a problem today when the majority selects a government.

As a description of the modern nation-state, Anderson has a point. Central authority has grown strong, and abuse of that authority has occurred. Many examples of “iron triangles” have been documented in the United States, in which a coalition of politicians, bureaucrats, and private interests have captured part of the public domain for their own use (McCool, 1994).

Anderson emphasizes a particularly narrow issue in development of this fifth lesson: he is very concerned that Indian governments are able to modify explicit contracts (which he assumes were entered into by voluntary choice on both sides) by imposing taxes or by protecting themselves from suit with sovereign immunity. Treating the imposition of taxes as an example of contract modification is odd: governments typically have the power to change their tax systems unexpectedly.

Because tribes have acquired the European concept “sovereign immunity,” they can face a capital market barrier: the invocation of sovereign immunity can be used to void a contract. Consequently, those with capital would be reluctant to lend money without a waiver of
immunity. Thus, to borrow money a tribe must be able to bind itself. Of course, with the legal system of the United States available, this is actually an easy problem to solve. Federal and State courts are more than willing to enforce contracts for the utilization of Indian property, if those contracts are correctly executed.

Ironically, Anderson praises the U.S. Government as a responsible sovereign (relative to other governments), when the plenary power of Congress (which states that the Supreme court defers to Congressional Indian policy) removes Indian property from protection by the Court (Getches, et al. 1993). In a real sense, Indians know better than any other group the results of sovereigns that are not able to be held to their word. Yet Anderson objects to tribal exercise of taxation powers (and tribal sovereign immunity) rather than to the federal immunity and the federal plenary power. Consider the following astounding sentences:

Comparing the United States with emerging eastern European countries, for example, it is likely that potential investors would find an agreement with the U.S. government more appealing. Not only is there a reputation for justice in the United States but also there is a sense of longevity that increases the probability of collecting a return on investments (p.173).

He proceeds to treat Indian tribal governments as comparable to the emerging governments in Eastern Europe, in that they have a reputation of not living up to their agreements, ignoring the history of broken treaties in the United States. The Five Civilized Tribes had title to their land in fee simple, having experienced removal once, and even that was not protection against the allotment policy. As Roback (1992) points out, enforcement of agreements for Indian tribes has been difficult. His final summary of the chapter does recognize that “The Indian Wars and reservation policies of the late nineteenth century epitomize the exercise of federal dominion over Indians, a dominion that continues today.”

Anderson totally disregards the historical record of the duties of Indian leadership to distribute or redistribute wealth to the public, leaving themselves poor! A leader’s
legitimacy and ability to retain public office was traditionally dependent upon such public generosity (Fowler 1982). In that a way, Indian societies addressed Anderson’s “fundamental problem.” Their leaders had to be generous and could not profit from their positions.

Anderson may have ignored the secular duty of Indian leaders to be generous because he assumes that traditional Indian leadership was religious in character:

“In modern democracies, voting and politics provides the accepted way of aggregating values, but in primitive societies, aggregation often was accomplished through mechanisms such as religious leaders and spiritual visions” (p.9).

Or, in another part of the first chapter:

“Traditions, rituals, and taboos may constrain the power of charismatic, theocratic leaders” (p.11).

In searching for leaders analogous to European sovereigns, Anderson postulates that such leaders had religious legitimacy. This ignores totally the democratic basis of Indian governing systems.

Officers of the British monarch found negotiation with the Iroquois a confusing process. The European official had specific authorities, which derived from the power of the sovereign. Iroquois negotiators had authorities, which derived from the decisions of their communities, which sent multiple representatives to treaty gatherings, expecting each to speak (Fenton 1985; Druke 1985, p.93). The Iroquois, as was typical of most tribes in America, had strict limits on the powers of their leaders. If an Iroquois chief did not carry out his duties, the women of the clan he represented could remove him from office; this is the historical origin of the concept of “impeachment” (Weatherford 1988, p.138).
Turning to the question of alternatives available today, one has to accept the fact that the use of stored energy on the earth has supported the development of strong hierarchical institutions: the nation-state and the transnational corporation. Alternative governing systems for communities such as tribes need to be developed within the constraints of the dominant political structures. I am attracted to the idea that community-level governance can best be achieved by implementation of what John Dryzek describes as “discursive designs”. My attraction to this alternative is probably based on its resemblance to some aboriginal American systems, such as that of the League of the Iroquois (Fenton 1985). Dryzek describes a discursive design as follows:

A discursive design is a social institution around which the expectations of a number of actors converge. It therefore has a place in their conscious awareness as a site for recurrent communicative interaction among them. Individuals should participate as citizens, not as representatives of the state or any other corporate and hierarchical body. Not concerned individuals should be excluded, and if necessary, some educative mechanism should promote the competent participation of persons with a material interest in the issues at hand who might otherwise be left out. The focus of deliberations should include, but not be limited to, the individual or collective needs and interests of the individuals involved. Thus the institution is oriented to the generation and coordination of actions situated within a particular problem context. But complicity in state administration should be avoided. As long as a state is present, discursive designs should be located in, and help constitute, a public space within which citizens associate and confront the state. Within the discursive design, there should be no hierarchy or formal rules, thus debate may be governed by informal canons of free discourse. A decision rule of consensus should obtain. Finally, all the features I have enumerated should be redeemable within the discursive design itself. Participants should be free to reflectively and discursively override any or all of them (Dryzek 1990, 43).

Clearly, a discursive design contains some of the characteristics Anderson appears to advocate regarding local government. It clearly suggests suspicion of entities such as tribal
governments, which have been set up under rules specified by the federal government. But a tribal government, even if sanctioned by the state, may meet the other conditions and hence approximate a discursive design. Anderson ignores this possibility, which I express as follows:

**Alternative Lesson 5:**

True self-determination requires political institutions that allow full public discussion of major policy choices, followed by implementation that has broad (nearly unanimous) public support.

**Summary: How American Indian Institutions served their Environmental Ethics**

Two of the tribes that used usufruct land tenure, the Hopi and the Iroquois, are well-known for their modern advocacy of respect for the environment. The Cree with their hunting territories have used the animal resources sustainably into the present time, even given the many market opportunities now offered to them. The Indians of the Northwest Coast had not reduced salmon populations to unsustainable levels before they lost control of their fisheries. In each of these cases, property institutions that were not liberal private ownership supported sustainable land use.

The argument that native institutions supported their reputation as environmentalists is further bolstered by examination of their political institutions. Leaders gained legitimacy by generosity; if they were able to produce surpluses for the community, either through personal productivity or good resource management, they would gain followers. If a leader was not productive, people would go to bands or *numaym* lead by another chief (Weinstein 1994). Councils of leaders made major decisions. Women were important political actors because they were property owners, particularly in agricultural tribes.

Anderson and other members of the property rights school error *first* in their limited view of the political institutions among American Indians: the problem of restraining sovereign...
power had been handled. Tribes supported public discussion and consensus decision-making. As a result, publicly held environmental values could be articulated through the political systems. Rent seeking was prevented by a requirement that leaders give their wealth away.

The second error is misinterpretation of usufruct tenure rules for the ownership of land as examples of individual private property ownership. In usufruct systems, the community retains ultimate ownership of land, and is able as a result both to prevent concentration of ownership among a small class of landowners and to enforce community values regarding sustainable use. Even in the case of hunting territories among the Cree, what initially appears to be a system of individual ownership upon examination shows strong community ownership elements.

The third error is to ignore the incentive implications of give-aways. What on initial examination would appear to discourage hard work, the need to share output with one’s community and kin, in fact is a subtle and effective method of providing the right incentives in the presence of common-pool resources. The potlatch among the peoples of the Northwest Coast is the best example of this use of systems of required generosity. Chiefs, through a system of assignment of ownership that appears to be a private property system, have control over harvest decisions. But they must share the return of the fishery with other chiefs who own sites with access to the common salmon runs. As a result, the solution of the prisoner’s dilemma explains the great wealth of the Northwest Coast tribes.

References


Property Rights and Biodiversity Conservation towards the Recognition of the Rights of Local Communities

Annie Patricia Kameri-Mbote and Philippe Cullet

New forms of wealth have brought enormous pressure on the existing forms of property rights. Some of these have not fitted into the dominant property rights’ regimes. Problems have kept arising due to the appropriateness of those property notions in such cases, i.e., the case where environmental resources are both common and global goods. Ideally, conservation should be addressed at global level. Domestic laws also have an important role to play in implementing international conservation objectives.

Economic inequalities force the division of the world into developed and developing countries, with two-thirds of the world’s biodiversity situated in the latter. The developed countries have the technology for unlocking the value of that diversity. The property rights issue has become a political and economic one that divides the world into two uncompromising blocs.

Extracted natural commodities have since time immemorial been treated as commodities, plant gremplasm is treated as common heritage of mankind. This is a consequence of historical developments in plant breeding where gremplasm was freely exchanged among all users in developing and developed countries. It was thus viewed as a common good for which no payment was necessary.

The difference between conservation and extraction of biological resources should be noted. In recent years, questions have arisen as to whether countries should preserve resources that is the common concern of humankind. Linked to this is the issue of obligations of the international community to support conservation efforts by the host countries. Extraction of biodiversity for biotechnology applications leads to the issue of

125 Standford Law School, California, USA
benefit sharing from local communities and host countries to transnational corporations and developed countries. Conservation and extraction raise different property rights. While the former relates closely to permanent sovereignty over natural resources, the latter hinges more specifically on property rights of individuals, communities and corporations. Different users compete for limited supply of resources leading to property rights.

**Real and Intellectual Property Rights**

Two kinds of property rights, real and intellectual, are most relevant in biodiversity conservation. Real property comprises tangible commodities capable of exclusive possession and clear delineation. Land rights that flow with it, exemplify this kind of property. Ownership of land has historically constituted one of the main categories of property rights, conveying an array of rights upon the owner. Land is important in biodiversity conservation because it hosts diverse species and also encompasses a variety of ecosystems. In this regard land tenure arrangements are crucial to the interaction between biodiversity conservation and property rights holding.

Intellectual property on the other hand deals with informational services “which are intangible and amorphous... not readily susceptible to either possession or delineation.” While real property is relatively scarce and therefore expensive to protect and capture, the value of intellectual property is associated with creation of shortage of information by limiting the capacity of non-owners to capture it.

Allocating intellectual property rights to the creator of a work balances the private interests of the creator. The role of IPRs is to ensure that information providers do not lose rights to the information by disclosing it, since such information can be used by an infinite number of persons simultaneously. The fear of losing exclusive rights to the information once shared is real because another person can use the same idea without having recourse to the originator of the idea.
Relevant IPRs in the filed of biodiversity conservation are patents and plant breeder rights (PBRs). Traditionally, plants and animals were excluded from patent ability and were governed by PBRs. The gradual move towards patenting of life forms in the United States first affected plants and has recently been extended to animals.

Ascribing Value

Biodiversity is both public good, from which it is difficult to exclude others, and a private good whose consumption is subtractable. In the majority of cases, the ecosystem services that biodiversity provides are consumed directly and never get to the market place. This results in the under valuation of these services (which are in the public domain) and overstatement of private rights that are transacted in the market place.

Raw materials only acquire significance when they reach the market place and can be assigned a monetary value. Thus, the value of forest resources is broadly limited to the value of the timber that can be harvested and all other products whose market value is not known are disregarded.

With regard to raw germplasm, despite the recognized potential utility, assignment of value presents insurmountable difficulties because of the very low probability of any given sample yielding commercial returns. It is also argued that the taking of germplasm is different from extraction of timber because only a small part of the whole is taken while the rest is left on the ground.

Existing property rights regimes make it easier to ascribe value to germplasm that has been transformed through biotechnology. This is not the case with land races. While the latter are designated as primitive cultivars, the former is characterized as elite varieties.

The value of local biodiversity resources is also lowered by the standardization of systems of production, knowledge and institutions across the world. While such standardization has
its benefits, it tends to disregard the need to preserve diversity and take into account the contribution of local knowledge and institutions. The value of biodiversity must also be seen within the context of changes in habitat, which alter the value of the raw material.

**Recognized Property Rights Systems**

The way in which persons vested with property rights deal with those rights determines to a significant extent the efficacy of those rights in promoting environmental objectives generally and biodiversity conservation in particular. Since property rights provide an incentive to conserve and use resources carefully, it is important to assign the rights to the persons interacting closely with the resources. Open access situations are obtained where there are no property rights and the resources are accessed on a first-come, first-served basis. There has been a tendency, to our minds, to view common poverty regimes as synonymous with open access regimes.

The major property rights regimes relevant in the realm of biodiversity conservation are individual/private property, communal property and government control. For our purposes we will divide the property rights systems broadly into two, namely common and individual property rights.

**Common Property**

Common property resources are not controlled by a single entity and the access is available to a community which has set rules on the way those resources are to be managed. No one has the right to abuse or dispose of the property. Those dealing with the property have to respect the entitlement of others. Users of common property share rights to the resource and are subject to rules and restriction, embedded in cultural or religious customs, governing the use of those resources. Common property resources provide a basis for non-monetary and non-market economic relations. People enjoying these rights are merely in possession of their habitat and not the owners. In the words of Sigh, “forest dwellers have
traditionally not cognized their habitat as their property, common or private, since such a legal title did not exist in their world view.”

Bromely and Cernea posit that common property is akin to private property and only differs therefrom because of the number of persons who own and can exclude outsiders. They also argue that common property is like corporate property, the members of the group having a relationship different from that of corporate property holders.

The concept of common heritage of mankind was first discussed within the purview of the Law of the Sea Convention. A common heritage regime was developed in the context of deep seabed resources that do not fall under the jurisdiction of any state. Common heritage resources belong to all but can only be exploited in a way that benefits all.

A central regulatory and administrative agency has been put in place to supervise the exploitation of these resources and collect and redistribute the fee that users must pay to be entitled to access the Area. The Authority must establish an economic assistance fund to compensate developing countries that suffer adversely from a price reduction of the minerals exploited in the area. These new provisions of the 1994 Agreement on the implementation of Part XI of the Law of the Sea Convention are far from the original goals of the common heritage of mankind that seeks redistribution of proceeds to all but reflects the compromises that were necessary to enlist the support of all states.

**State Ownership**

State ownership constitutes another major form of property holding. This refers to situations where the state has ownership and control over a resource. The state may directly control and utilize the resource through one of its administrative arms or it could grant user rights to communities and individuals. At the international level, a distinction exists between areas subject to *ab initio* appropriation on a first-come, first-served basis and common areas whose access is regulated and restricted by international law.
States today still represent the most important property rights holders. In post-colonial societies, for instance, the destabilization occasioned by colonial rule contributed to the breakdown of social, political and economic communal structures. States moved in to replace the centres of power in all areas, including property holding. In this process, they took over most of the properties previously held by communities. States thus have come to monopolies common property resources.

**Private Property**

Private property rights denote “a bundle of entitlement defining the owner’s rights, privileges and limitations for use of a resource.” The recognition and enforcement of these rights depend on the machinery put in place by the State. The holders of these rights are either corporations or individuals who can exclude others from the benefits of their property and regulate its use.

Current trends in property rights are generally towards individualization and away from communal property rights. The role of corporations is significant and Transnational Corporation (TNCs) originating mainly in developed countries has made its mark in property ownership especially in the area of intellectual property. This trend has been facilitated by the globalization of international trade. The biotechnology industry seeks to make seeds merely a raw material by replacing their regenerative biological processes. Thus, the freedom of farmers to reproduce seeds is being circumscribed through biotechnology IPRs.

**Commons vs. Enclosure**

When property rights are not assigned in situations of open access, there is an incentive to over-exploit renewable resources. The other side of this argument is that when property rights are assigned in these situations, the market will act properly to balance competing
uses and force the participants to use such property in the most efficient way. Guided by the erroneous notion that common property is synonymous with property held in open access, the theory of the Tragedy of the Commons has been used to justify the grant of private property rights to resource held in common.

Over-exploitation can also occur when common property resources are privatized. This is the so-called “tragedy of the enclosure”. The transfer of authority over common resources from the realm of communal rules to the individual created conditions for over exploitation due to the sweeping aside of traditional structures that regulate use.

Environmental Protection

The Biodiversity Convention is the first binding international environmental instrument dealing with IPRs. The concerns expressed in the convention pertain to the threat to IPRs by the transfer of technology provisions contained in the Convention and the need to ensure equitable allocation of ownership rights. The provisions of the Convention emphasize the need to have the IPRs enhance its objectives but do not provide which ones prevail in the event of a conflict. Article 22 of the Convention intimates the possibility of property rights being overridden where they threaten serious damage to the environment.

IPRs in the area of biodiversity become relevant when ideas have been used to transform biodiversity as happens through biotechnology and plant breeding. The need then arises to protect that idea from wanton copying by third parties without permission or compensation to the originator of the idea.

International Framework

The international legal framework alternates between two extreme positions; common heritage is broadly defined and private rights are narrowly defined. Those agreements that emphasize common heritage principles, such as the 1983 FAO International Undertaking
on Plant Genetic Resources have tended to be non-binding instruments of United Nations organs where developing countries dominate. The others, such as the International Union for the Protection of New Varieties of Plants (UPOV), and the Agreement on the Trade Related aspects of Intellectual Property Rights (TRIPS), that reflect more closely the position of northern states, have taken a more obligatory stance. In between these two groups, the Convention on Biological Diversity has attempted a compromise.

**Common Heritage**

The free exchange of information and materials among breeders culminated in the adoption of the FAO Undertaking which embodies the concept of common heritage that had been developed in the previous fifteen years through negotiations leading to the adoption of the regime for the exploitation of deep seabed mineral resources. Whereas resources found in the area do not fall under the jurisdiction of any State, the affected biological resources are all situated within the territory of states and are therefore subject to sovereign appropriation. There is therefore a conflict between the principle of common heritage as applied to biodiversity resources and the principle of permanent sovereignty over natural resources. It is noteworthy that common heritage in this context covers both the flow of raw materials from host countries and elite varieties improved through biotechnology.

A salient example is the FAO Undertaking emphasis on national ownership of biological resources. It distinguishes between source and recipient countries but does not go beyond the veil of state sovereignty. These problems stand out more clearly for a number of developing countries where the communities interact directly with the resources but whose rights are less clearly identifiable than those of corporations.

The 1983 instrument was unacceptable to a number of developed countries that had significant interests in biotechnology industries. This eventually led to an interpretation of the instrument agreeable to all countries that stringently limits the applicability of the
principle of common heritage by recognizing both the rights of plant breeders and those of farmers.

**Private Rights**

Private rights unlike common property rights are much more vigorously protected under international instruments. Thus reflecting the trend towards individualization and the clout of transnational corporations. There are a number of instruments protecting IPRs internationally but only a handful specifically deals with environmental issue. The most significant ones are the UPOV Convention and the TRIPS Agreement.

The UPOV Convention projects new varieties of plants, both in the interest of agricultural development and of plant breeders. The rights granted to each Member State are effective only within that territory, and not internationally. The 1978 and 1991 revisions set out minimum scope of protection that states must grant. The 1978 revision expanded the number of criteria that a plant variety must meet in order to qualify for PBRs. There include an element of distinctness, homogeneity, stability, commercial novelty and the submission of an acceptable denomination.

The 1991 revision provides that parties are free to protect plant varieties by PBRs or other types of IPRs such as patents. States may also grant simultaneous protection to the same plant variety by more than one type of IPRs. Further, it extends breeders’ rights to all production and reproduction of their varieties, species, and general and specific plant varieties. The remaining exceptions to commodification include acts done privately and for non-commercial purposes, experiments, and breeding and exploitation of other varieties.

It is important to note that the latest revisions emphasize the increasing importance of patents in a world that sees PBRs as unnecessarily restrictive even after redefining the concepts of farmers’ rights and breeders’ rights.
Trade-Related Aspects

Other developments occurred in the context of the latest round of negotiations in the General Agreement on Tariffs and Trade (GATT). The new World Trade Organization established by the GATT 1994 agreement, now appears to be the chief multilateral institution addressing global uniformity of intellectual property standards and seems to be taking over part of the role played by the World Intellectual Property Organization whose mandate is to harmonies international IPR standards.

The TRIPS Agreement was the result of an initiative by developed countries to introduce more stringent IPR rules in trade because of complaints about counterfeiting and piracy. It only takes into account environmental issues in so far as they relate to patents. Patents are dealt with in Section 5 of the Agreement, Article 27 of which addresses the question of patentable subject matter. The latter article allows Member States to exclude from patentability plants, animals, medical processes for the treatment of humans or animals.

Article 27 reflects a wider debate on patentable subject matter that has been going on for several decades. The United States has been in the forefront of development in this area and was the first country to allow the patenting of life forms. American biotechnology companies have been arguing for the international recognition of such patents, a move that has been opposed by most developing countries. European Union Member States have been more hesitant to accept the patentability of life forms. However, despite the wording of the Convention on the Grant of European Patents that prohibits the grant of patents in respect of plant or animal varieties, the Examining Division of the European Patents Office accepted the patentability of a genetically made-up mouse that had been granted a patent in the United States.

Biodiversity Convention
The Convention on Biological Diversity represents the middle ground in the debate on property rights and biodiversity conservation. It tries to accommodate the differences between the two sides. It introduces the notion of common concern as opposed to common heritage. Common concern implies recognition of the global importance of biological diversity but does not diminish the ambit of the principle of permanent sovereignty over natural resources. It seeks to facilitate global cooperation for the conservation of biodiversity without forcing any state to participate in this process. The central idea is that the benefits of access to the resource must be shared equitably.

The Convention recognizes different potentially conflicting rights. The biodiversity convention qualifies the principle of permanent sovereignty and makes the conservation of biodiversity resources a common concern of mankind. This implies a duty to cooperate in solving this global problem. Natural resources are considered as a common good of humankind. States thus become guardians of the resources on behalf of humanity. However, the concerns of communities are not addressed directly in the agreements in force. All forms of compensation and all entitlement are channeled through states as guardians of the public interest.

**The Way Ahead**

Two approaches can be adopted if new management schemes devised to both foster a more sustainable use of resources and take into account the needs and priorities of local communities. And secondly, in situations where private rights are already institutionalized and where it is not practical to devise new schemes, ways should be sought to minimize the barriers that those rights create. Common property resource management systems can also create barriers to conservation in which case private property rights may be a viable alternative.

Legal systems should recognize and harness the role of diverse actors. All types of systems, knowledge and institutions should be respected. Private rights should not be allowed to
hinder environmental protection if common property would be more appropriate. For instance, the failure to acknowledge traditional bicultural knowledge restricts the flow of important information that is crucial to environmental management.

Too much emphasis has been put on private property rights, particularly IPRs. Common property regimes are also worthy of consideration. The current literature treats these two forms of property as diametrically opposed. One of the reasons for this is the confusion between open access and common property. Another is the confusion between common property regimes and common pool resources, the latter being open to all for use. The former, on the other hand, represents a group of owners with individual rights to a resource. Group members share a common functional link and have developed rules that determine the extent and condition of use.

Biodiversity was seen for a long time as part of the common heritage of mankind but only among states. Even if the emphasis put on states is misplaced, the concept itself can be usefully applied if redirected to communities.

Common property regimes have a lot to offer in the management and sustainable use of biological resources. Their advantages include their enlisting a multiplicity of factors and actors. This reduces the costs of administering the regime. It has been argued that unlike private property, common property regimes facilitate limited harvesting of scarce resources preempting overexploitation.

The importance of local and common management thus recognized, direct ownership by communities should be acknowledged and protected. In most cases, this would have to take place within existing nation states. Community ownership would draw on the communities’ mechanisms for self-regulation and dispense with state intervention, which in some cases have been inimical to conservation and developmental imperatives.
Biodiversity resources cannot be sold like ordinary commodities because in most cases, only a fraction of the whole is removed and the commercial value is often indeterminate.

The fairness of such agreements must also be viewed from the perspective of global importance of biodiversity resources. Since areas rich in genetic resources are also fertile and capable of sustaining human habitation, their communities are better endowed with natural resources necessary to fulfil their basic needs. This is not the case with regard to communities living in areas that are poor and have few genetic resources. Ways should therefore be devised to ensure that these latter areas also benefit from these resources and commercial products derived through biotechnology.

The common heritage of humankind doctrine as applied to biodiversity resources should be revised so as to take into account the interests of communities that are both gene and technology poor. This should flow from the acceptance that the environment is a common and global good. In practice, there is therefore no reason why a community that happens to be in a gene-rich area such as a rainforest should be able to reap all the profits from resources lying around whereas communities in desert areas, which have no resources to sell, get nothing from the exploitation of resources that are beneficial to the whole of humanity.

A similar argument was developed in international law with regard to landlocked countries. Their special and disadvantaged position has been recognized not only in the context of the Law of the Sea treaties but also more generally in trade agreements because of the importance of sea transportation in international trade. The Law of the Sea Convention is particularly relevant here because of the enclosure of a significant part of the high seas in the period prior to the adoption of the 1982 Convention. The “creation” of exclusive economic zones containing most of the oceans’ renewable resources where coastal states are granted sovereign rights for the purpose of exploitation led to the diminution of the rights of non-coastal states, including landlocked states.
Limits of Property Rights

Property rights can be beneficial in a number of ways. These include environmental conservation and preservations, enhancement of living conditions for local inhabitants and benefits for humankind at large that may be brought about either by technological improvements through biotechnology or compensation to communities not holding either technology or genetic resources.

Financial Mechanisms

Transfers of funds represent one way to give both incentives to host communities to preserve biological diversity and foster international equity. The framework for such transfers can be taken from the approach adopted in the World Heritage Convention. Member States to this convention can seek to have nationally important cultural, historical or natural sites recognized and listed as internationally important. Once the sites are added on the World Heritage List they qualify for support from the international fund set up under the convention to facilitate preservation. It is noteworthy that state sovereignty is not infringed upon at all because the procedure, though internationally devised, is voluntary.

The importance of biodiversity conservation on a global level has now been firmly accepted in international law. Since the problem extends beyond national boundaries and most areas in which conservation measures are vital lack the necessary resources to do so. Global cooperation is required if improvements are to be achieved. The magnitude of the problem is such that no single nation has either the financial capacity or the political will to undertake the necessary measures.

A global biodiversity fund to finance such measures represents one way to ensure that the necessary activities are carried out. Funding should be based on the relative commercial benefits received by each user. The principle of common heritage may find practical
application in this way. Biotechnology companies, as major commercial beneficiaries, should be required to contribute to the fund in proportion to the commercial returns received from any product derived from germplasm at any point in time.

Technology transfer in its usual dimension of a North-South transfer of resources is only another way to reward communities for the services they provide to humankind by hosting biodiversity resources. In this sense, it constitutes another form of payment.

**Partnership Issue**

In the field of biodiversity conservation, there are moves towards the establishment of partnerships between nations or between domains intent on preserving certain resources. These have taken the form of International Cooperative Biodiversity Groups (ICBDs) to fund research partnerships between private and public institutions in various countries and pharmaceutical companies.

Despite the movement towards IPRs, there are definite advantages to be gained from recognizing other forms of property rights regimes. The recognition of biodiversity resources as global goods and the necessity to enlist the support of all parties calls for new cooperative schemes including all concerned actors.

The international legal framework, particularly the Convention on Biodiversity, provides a god starting point to sustainable manage those resources globally. States also have a crucial role to play in mobilizing their citizens to foster the implementation of internationally agreed upon measures. However, since measures must usually be implemented at the grass roots level, the role of individuals and communities should be promoted since they are in much closer contact with their environment. In this regard, the role of communities in biodiversity conservation and management needs to be emphasized at both the domestic and international law levels.
The Product Space of Plant Varieties: Explaining the Global Tension between Plant Breeders’ Right and Farmers’ Rights

Dwijen Rangnekar

Introduction

The paper is an attempt to reanalyze the tension between plant breeders’ rights (PBRs) and farmers’ rights (FRs) from the perspective of the degree of control offered to plant breeders. The analysis is based on the notion of the product space of plant varieties as defined by legislation.

The paper begins by critically evaluating the underpinnings of intellectual property rights (IPRs) and proposing the notion that science/knowledge are quasi-public goods. This conclusion is based on a number of novel characterizations of the process of innovation and the possibilities of appropriation. It is argued that technological paradigms substantially determine the direction of innovation as well as present the limits and opportunities for appropriation. Strategic negotiations are also relevant in erecting barriers to competing appropriation or simultaneously in establishing knowledge as a public good.

The dominant characterization prevails and IPRs have been erected on this basis. Further these rights have been periodically upgraded on the rhetoric of ensuring the inventor learns a reasonable remuneration. The paper presents the notion of the product space as a conceptual tool to capture the widening degree of control the breeder gets through PBRs legislation. The notion is developed in the paper by identifying the crucial elements in the legislation which contribute to this degree of control. These elements are invariably left out of most discussions on PBRs. Utilizing this notion, the paper indicates the presence of rival groups contesting the claims and controls of the breeder over plant varieties such as competing breeders, seed merchants and farmers.

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Three issues that lead to a conflict of interest between farmers and breeders are analyzed in this paper in terms of the notion of product space. The first is the widely debated and discussed practice of seed saving leading the farmer to be a competitive supplier of seeds. This is related to current legislative changes at international Union for the Protection of New Varieties of Plants (UPOV) and in select northern countries. The economic implications of this practice are discussed. The second issue is that of reward and recognition for farmers’ varieties and landrace. The final issue is a conceptual resistance on the part of some commentators to define FRs in terms of existing notions of IPRs. This again is representative of an academic opposition to developing wider notions of property rights such as traditional resource rights.

The last section of the paper discusses the issue of germ plasm in international trade in the early eighties. This notion, enshrined in the FAO International Undertaking, has faced numerous hurdles in progressing toward implementation. Some of these are presented and briefly discussed in this paper. It is argued that these problems are symptomatic of deeper problems that are identified in terms of the tension between PBRs and elements defining FRs.

The conclusion is a brief comment on the existing political and economic space for developing a *sui generis* right for farmers. Given the inherent tension between these two attempts to control plant genetic resources (PGRs), it is felt that these rights will necessarily have to be developed as distinct and separate legal instruments. The necessity for a legal precedent is emphasized as solution for placing pressure on the FAO process of renegotiating the International Undertaking.

**Science/Knowledge; A Public Good Or Private Property?**
The Neoclassical Underpinnings for Intellectual Property Rights

The case for providing IPRs to inventors/innovators singularly depends on the characterization of knowledge/information as a pure public good (Dasgupta, 1988; Merges & Nelson, 1990; Dasgupta & David, 1994). This owes a great debt to K J Arrow’s work on the economics of knowledge production, which established three principles that have remained sacrosanct in neoclassical treatment of IPRs:

a) Substantial uncertainties govern the dynamics of investment in R&D,
b) Any economic pay off related to the use and exploitation of the results of R&D crucially hinge on the possibilities of establishing (and enforcing) property rights and
c) Absence of property rights results in market failures manifested in specially sub optimal investment in science of the difference between private and social rates of return, which spring from a characterization of knowledge as a public good.

Incomplete appropriability and imperfect exclusion mean that the private returns to investment in intellectual property are below social return. It is for this reason that it is argued that it is necessary to protect such rights and maintain incentives to innovation (Beath, 1990).

For some time it has been expressed that a competitive market left to itself would under-invest in knowledge production (Nelson, 1959). The dire consequence of this inability to appropriate the returns has been attenuated in recent decades by dramatic changes in the factors defining national productivity and growth, which is manifested in a new technological paradigm of production characterized by its crucial dependence on science:

(a) There has been a significant increase in the use of knowledge in the production process, i.e., knowledge is an input in production, and
(b) There has been a significant increase in the science-intensity of this knowledge (Kaplinsky, 1989; de Almedia, 1990; Bifani, 1990).
Both of these factors are further attenuated by the increasing proximity of knowledge/science with the finished product that emerges in the market, e.g., computer products and biological products. Bearing in mind the ‘reproducibility’ of knowledge and its public good characteristics (noted above), such a situation would pose insurmountable hurdles for the ‘efficient’ functioning of a private enterprise economy in high-tech and science-intensive industries.

Solutions to these problems have taken a variety of forms: (a) government production of knowledge, (b) public subsidies to private good. Little appreciated in such analysis is the multiple role of states in actually producing knowledge in a variety of forms, and additionally directly subsidizing private enterprises:

[...] First, the typical large multinational firm is no longer overwhelmed by the constraints of its home base’s resources or by the invisible hand of the market place. And second, governments are not always inept interveners, unable to turn the tide of a million corporate decisions. One of the paradoxes of modern global competition is that some firms have built the capacity to transcend the limitations of their home nation-state, while selected governments have learned to tip the terms of that competition in favour of domestically headquartered firms (Yoffie, 1993).

The paradox exists to the extent theoretical formulations of modern capitalism remains restricted to historical and non-institutional parodies of reality.

**Knowledge as a Quasi-Public Good**

Once discovered, the laws of the deviation of the magnetic needle in the field of an electric current, or the law of the magnetization of iron, around which an electric current circulates, costs never a penny. But the exploitation of these laws
for the purpose of telegraphy, & c., necessitates a costly and extensive apparatus (Marx, 1954: 386).

This forms the basis of a superior characterization of the process of knowledge production and utilization, which fundamentally dismisses the public good characterization. The proposal made here is to combine two groups of contributions that have developed conterminously: (a) sociological studies of science, and (b) technological paradigm approach to appropriation. The relevant central premises of these approaches are indicated below:

- **Tacit and codified dimensions to knowledge**: This reflects the operational and organizational dimension of creating and using knowledge. Various routines evolve in a localized manner that makes the effective transferability of knowledge costly. Additionally, the utilization of genetic knowledge may, in situations, require access to the tacit elements of knowledge that are retained by the innovator, i.e., diffusion of knowledge is hindered and circumscribed (Dosi, 1988a, b; Cohedet, Heraud & Zuscovitch, 1993; Callon, 1994).

- **Adoption costs are (and variable)**: Indicative of Marx’s point above, modern theoreticians have appreciated the fact that R&D involves two analytically separable moments: research and development, where the D of R&D is a costly process translating scientific results into tangible products for consumption (Rosenberg, 1994) [see chapter 1]. Apart from these uncertain implementing costs, competing firms have to incur additional costs in appropriating science. Imitating firms must necessarily maintain standing investments so as to be able to ‘pirate’ even the fragments of generic knowledge, a reality that poses as an effective barriers-to-entry in the relevant market (Levin et al., 1989).

- **Localized public goods**: Even in situations where knowledge acquisition involves marginal costs, it is possible to contest its nonrival status by introducing the concept of
local public goods (Callon, 1994). In Callon’s use, this signifies the strategic configurations of relevant actors in gaining ‘free’ access to select knowledge by becoming (investing) members of select groups: “...the boundary between a science that divulges its results and one that assures its confidentiality is a result of strategic decisions that may lead to its transformation into a local public good, which... [is] one possible mode of privatization (Callon, 1994).”

• **Technological paradigms:** In a variety of expositions, Dosi has introduced the notion of technological paradigms, which encompass the ‘set of heuristics’, the ‘exemplar’, and the rules, which reflect the principles of the relevant natural science (Dosi, 1988a, b). This notion emphasizes structural determination of the innovation process by the economy and the relevant technologies in a co-evolutionary sense: “sectoral patterns of innovative activities are determined to a substantial extent by the very nature of the relevant technology itself (Orsenigo, 1993).” This critiques the presumed characterization of knowledge as a public good while emphasizing the need for a sectoral analysis to identify contingent factors and institutions that enhance the proprietary and non-transferability of knowledge.

• **Spillovers, networks and controlled diffusion:** Crucial for the public good characterization of knowledge is the reality of a divergence between the social rate of return and the private rate of return. Recent studies on industrial organization demonstrate the development of networks designed to control the diffusion of knowledge so as to diminish the spillover effects, as well as to profit from exploiting a favourable division of labour and expertise (Rosenberg, 1982; Silverberg Dosi & Orsenigo, 1988; Cohendet, Heraud & Zuscovitch, 1993). This is widely recognized in the case of biotechnology where university-industry links have been prominent along

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127 This important notion of local public goods as a consequence of the strategic negotiations of relevant actors is applicable to the nature of the research exemption clause in PBRs legislation, as well as to the notion of ‘free access’ defined in the FAO International Undertaking which permit such access to ‘bona fide’ users only. This characterization is suggested in my Ph.D.
side the development of small start up Biotech research firms (Kenney, 1986; Orsenigo, 1989). An additional manifestation this attempt of controlled diffusion is the development science parks, where the presence of scientific institutions enables the firm to gain (free) access to basic and genetic knowledge (Etzkowitz & Webster, 1995).

The significance of this critical characterization of knowledge must be appreciated in a cumulative manner, i.e., all these points taken holistically. It is only in this manner that the critique’s full import can be accepted. Before closing this critique, it is only fair to state that some of these characterizations emerge from empirical studies in the neoclassical mould. For example, Levin et. al. (1989) conclude that there are intersectoral variations in the patterns of innovation. Their survey of 130 different business lines demonstrated that patents are considered as imperfect instruments of enabling appropriation, and more often alternative means and methods are preferred, such as lead time to the market, secrecy, learning curve advantages and sometimes also sales or service efforts. The essence of the point being that, though patents are designed to solve the problem of incomplete appropriability, there are alternative methods, which are preferred.

**The Role of Intellectual Property Rights**

Erected on these shaky assumptions are instruments of IPRs, which are surrogate private property rights in inventions designed to give the inventor monopoly power for a specified duration of time. The simple objective is to enable the patentee to appropriate some of the

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128 For example, in regards to the phenomenon of science parks noted by Etzkowitz and Webster (1995), this takes on an additional dimension when we incorporate the notion of local public goods introduced by Callon (1994). Thus, the firms participating in science parks by investing in this network gain access to basic knowledge that is only locally public. The strategic dimension of such negotiations between the state, the university and the monopoly firms is not difficult to see.

129 In a similar sense of fairness, I acknowledge that Dasgupta (1988) accepts he ‘economics of scientific and technological change perforce is concerned with oligopolist industrial structures’. However, this intuitive thought does not permeate the characterization of knowledge that underpins his work here and elsewhere. Thus, he reasserts a realm of science where knowledge is intrinsically a public good (Dasgupta & David 1994).
surplus value created by the invention (Scherer & Ross, 1990) [chapter 17]. The solution is a tradeoff between 'unhindered' competitive imitation and a socially sub-optimal result of artificial monopoly power. Efforts at balancing these tensions manifest in the political tinkering of the patent system by varying the period of protection, or stipulations on compulsory licensing, or the scope of protection etc. (Merges & Nelson, 1990).

Given the (assumed) intangibility of the subject matter of protection (an invention), these rights are inscribed in term of acts and activities related to the invention. Inherent in this system of rights is the need to hinge IPRs to some surrogate tangible object,

[...] The surrogate right regime sidesteps the problem of non-appropriability by substituting a surrogate monopoly right (in a dimension that is suitably appropriable) for the impracticable property right in information... it substitutes an appropriable flow for an inappropriable one in rewarding information-generating investments (Swanson, 1995a).

Defining the terms of protection, infringing acts, the scope of protection, which contribute to the product space of the invention, affects this result of channelling the benefits to the inventor. This notion of product space is the focus of my next section that develops this idea in terms of PBRs legislation.

PBRs and Product Space

Introduction

The reason for undertaking an overview of contrasting theories of patents and issues of appropriation is to familiarize oneself with the main theoretical concepts. Further, there is little novelty in mainstream thought when these issues are confronted in a different techno-economic and social setting. In the sense, revealing universalistic principles, these theories of patents are transported across and over the industrial barrier into agriculture without any
modification so as to tackle the problem of appropriation in plant breeding in a manner reminiscent of industrial patenting. The logic of granting protection, the method of solving the problem, as well as efforts in defining the scope of protection are all undertaken with the singular analogy of industrial patent protection. Thus, the Committee on Transaction in Seeds, the expert group that recommended the provision of PBRs in the UK in 1960, began its case for protecting breeders on the grounds that the basic quality of work was comparable to industrial activity:

As between invention and plant breeding, we do not find any basic difference in the broad quality of the work sufficient to justify the grant of rights in the one case while with holding it in the other... We take the view that the breeder produces or creates his variety in just as true a sense as the chemist is said to create his new product (Committee on Transaction in Seeds, 1960).

Further, in a similar surrogate sense, the demand was for rights were linked to a tangible object; the plant variety and certain specific acts related to the variety:

Only the production of stock seeds is reserved to the originator. And this exclusive right for seed production is necessary to maintain the type and quality of the creation (Schreiber, 1962).\textsuperscript{130}

The final element in this case was to provide an economic rationale in support of monopoly rights in plant varieties:

[...] By giving the plant breeder a form of ownership of the variety which he produces, the job of plant breeding will be made more rewarding then it is at

\textsuperscript{130} Schreiber was the President of the Seed-Flower section of ASSINSEL, an international organization of plant breeders, which was centrally instrumental in establishing PBRs in Europe in the sixties through its work in founding UPOV. By relating the breeders' rights to production of stock seeds these demands were supported by seed certification agencies concerned with varietal purity and the authenticity of seeds used in cultivation. This proved to be a useful rhetoric in the campaign to promote a consensus in support of granting PBRs. These issues are dealt with in detail in my Ph.D., which is currently being written.
present. [This follows the protection granted to breeders abroad] against the uncontrolled exploitation of his new variety... [By granting such rights], the [Plant Varieties & Seeds] Bill is an effective attempt to create conditions for the industry to do its best work (Lord St. Oswald, House of Lords; Westminster : 26 November 1963).

Lord Oswald made this statement in the UK Parliament while introducing the PVS Bill that eventually provided PBRs. The evocative impact of the phrase ‘uncontrolled exploitation’ is only diminished by subsequent mention of piracy.\textsuperscript{131} It is the inability of the breeder to control the use of his variety that hinders the accumulation of economic returns.

**The Social Construction of Plant Varieties through Legislation**

The preliminary point to note with respect to plant varieties, especially in light of the grant of protection, is that the inherent notion/concept of plant variety is abstract and socially constructed. The origins of the notion of plant variety is to be found in efforts to standardize and rationalize seed certificate regulations which were preoccupied with naming, distinguishing and classifying varieties (Weiss & Little, 1961; Fejer, 1966). These early efforts culminated in a definition by International Code of Nomenclature of Cultivated Plants in 1958, which focussed on the retention of distinguishing traits significant for agriculture over a series of reproductive cycles:

\begin{quote}
The concept of variety is, in a sense, abstract: a variety exists because certain characters are displayed by seeds or plants, but generally observation at any given points in not enough to confirm that the seeds or plants are in fact of the variety
\end{quote}

\textsuperscript{131} Such is the impact of this imagery that during the entire Parliamentary debate on PBRs, only minimal discussion focuses on the grant of these rights and the scope of protection. Instead, discussion gets diverted and centred on issues of varietal purity, cross-pollination and import of seeds. This overwhelming consensus in granting property rights in plant varieties is expressed by Lord Hackney of Amherst during the discussions: “...one feels the case is overwhelming that it is difficult to see why legislation on this subject was not brought in many years ago (House of Lords, Westminster : 26 November 1963).” This is indicative of the larger process of constructing consensus and public approval, which is discussed in detail in the Ph.D. with respect to developments in Europe.
they are said to be. Whenever a reproductive cycle is completed, it is necessary to grow another crop to be certain that the characters of the variety have been retained (Kelly, 1968).

These notions are incorporated as the primary conditions for a grant of PBRs, which are known as the distinctness, uniformity and stability (DUS) conditions. The motive force is to establish inter-varietal distinctness and intravarietal uniformity and stability so as enable the identification of a breeders’ personal invention. “When one wishes to enforce property rights in a cultivar, it must be recognizable from all cultivars from the same species, it must show distinctive traits which are typical and identifiable (Nijdam, 1967).” In this crucial sense the DUS conditions separate varieties from plant varieties. The claim of social construction through the means of legislation is further substantiated by two additional observations. Firstly, these criterions for of protection are the simple generalization of the method of breeding self-pollinated or inbred lines. In this manner legislation actually outlaws all other methods of breeding (Berlan & Lewontin, 1986), and effectively restricts plant varieties to this method of breeding.

Secondly, there is a legislative demand for fixity of distinct traits through out the period of protection (UPOV, 1961: art. 10(2); 1991: art. 22(1); also PVS Pt I S 6(4). These fixed plant varieties are the subject matter of protection under PBRs. This clause reinforces the primary conditions for grant of PBRs and the essential concept of a plant variety as existing with fixed identifiable characteristics. The necessity for identification is a contingent factor in enabling unambiguous rights being granted to a breeder. Hence, it would not be unfair to

132 This is significant point in my Ph.D. that is currently being developed. I am aware that the 1991 revision of UPOV clearly notes that a ‘variety’ does not have to fulfill the DUS conditions (art. 1 (vi); however, and this is the point, a plant variety necessarily is one that has satisfied the DUS criteria (and is commercially novel).

133 In addition, there is an exclusive demarcation of breeding material that can be submitted for protection that identifies only “clone, line hybrid or genetic variant [PVS S 38(1)].” No other category of genetic material will be considered as plant variety. Dworkin (1983) draws attention to the 1983 amendment where efforts were made to initially delete any such definition from legislation but ended with a non-exclusionary definition. The US legislation of PVPA 1970 does not include hybrids with its ambit, thus denying it the status of being a plant variety.
characterize the notion of plant variety implicit in this legislation as a snapshot, fixed throughout the period of protection.\footnote{It may be contended that this is necessitated by ensuring the smooth functioning of agriculture such that authentic seeds and truth labelling protect the farmer fraudulent seed merchants. Thus, a protected variety must necessarily remain true to its initial description throughout the period of protection so those farmers are not duped in the future. This element can not be denied. But, is this the principal motive behind defining plant varieties in this manner? And, are seeds and their genetic material intrinsically standardized and fixed in this manner?}

**Product Space: The Notion**

It is useful to consider IPRs as a regime of protection which “allows the agent to stake a claim in a carefully specified area of ‘product space’ where the idea is to be introduced (Swanson, 1995a).” It is also suggested by Swanson (1995) that this solution of surrogate rights avoids creating monopolies in information, and instead transfers the claims of the inventor to tangible products (and I would add, processes) which incorporate the novel information. However, it is through product/process patents that monopolies in information/knowledge are created. This understanding follows the general practice of patent applications, where the applicant indicates the ‘claims’ of the invention, i.e., the scope of application of the inventions, which is its technological territory (Merges & Nelson, 1990). The role of ‘claims’ in patent applications is to demarcate the (commercial) territorial limits of the protected invention in a manner that would make enforcement of the rights possible.

The underlying theme of the notion of product space is the effective degree of control offered by a grant of PBRs. Here a distinction is made between notions of physical possessions and the ability to use (and develop) and benefit from a particular resource, where the latter indicates the significance of control (Fowler, 1994). In the extreme sense, as Fowler (1994: 208) states, one may own a particular resource but effectively exercise no control. This typifies the control over genetic resources exercised by the British during the
colonial period; even under situations where they did not physically own particular crop species during the period of imperial rule. The situation has not changed much for genetic material under the category of primitive landraces and farmer’s varieties, which are deemed the ‘common heritage of mankind’ by the FAO’s International Undertaking, and hence freely exchanged. The issue of control in the sense advocated here reflects the tension in global exchange of germplasm when it is recognized that these resources are transformed into the raw materials for the production of ‘improved’ cultivars. The effective control offered by various informal rights does not translate into either recognition or reward from users of these resources. Hence, actual control over these categories of genetic resources are transferred to either the nations/institutions that hold them in *ex situ* collections, or to firms that use them to develop new varieties (Fowler, 1994).

The need for this notion is grounded in various aspects of the reality of the seed market. Firstly, it is actual legal practice that interprets the principles of patent law, and this free play has established certain principles that need to be appreciated. Beyond the physical embodiment of the inventors in products and processes, there are elements in legal statutes which impinge on the activity of the inventor and users, such as conditions/criteria of grant, licensing agreements, the length of protection, transactional fees involved in getting protection, to name a few. An incorporation of these aspects of legal practice and statutes into the analysis will give a better/deeper understanding of the widening degree of control offered to breeders with each epochal amendment to the legislation. This will clearly identify the immediate conflict between this grant of monopoly right and the interests of all other constituent groups involved in genetic resources. Additionally, it is necessary to place this degree and depth of control within the restructuring of the genetic supplies industries, which has been enabled by and has also reinforced this deepening degree of control.

135 The latter point is crucially relevant. Since the inception of these rights in the 1960s the seed industry has largely been ‘appropriated’ by an agro-food complex in the Goodman, Redclift and Sorj (1987) sense. Through the deployment of a variety of market strategies and the nature of crop development, the seed is tied into other farm inputs, e.g. fertilizer-responsive or herbicide-tolerant varieties. this effectively extends the economic control over a range of agriculture inputs. Thus, the actual locus of calculations is no more the independent plant breeder and the economic returns to plant breeding, instead it should be determined in terms of the affiliated markets that get tied in with the purchase of a specific plant variety.
The Product Space of Plant Varieties

The fundamental scope of PBRs, as legally defined, is limited the commercial exploitation of the reproductive material of the protected variety (see appendix for legal texts of relevant articles). The underlying principle, at least as expressed by the Committee on Transaction is Seeds, was to enable the breeder to earn an income from the commercialization of the propagating material of the protected variety (Committee on Transactions in Seeds, 1960). Inherent in this is an appreciation of the reproducibility of seeds and resultant duality in use, whereby the seed can be used as grain (for consumption) or as seed (for production). This Committee believed that granting rights on subsequent use of the protected variety would be similar to a ‘second’ royalty. Inherent in this perception is an unacknowledged realization of two properties present in any bag of seeds: (a) the seeds are processed to be uniform size cleaned, treated and weed free, and (b) the seeds are carriers of a unique genetic information, i.e., varietal improvement (Berian & Lewontin, 1986). The scope of protection contains the genetic element of the properties of seeds.

There is a double contingency in this notion of the scope of the rights. Here a specific act that infringes the rights of the breeder will necessarily (a) a commercial transaction and (b) the propagating material of the protected variety, i.e., the seed as ‘seed’. In this way, non-commercial use of other propagating material were clearly outside the scope of PBRs, while commercial use of other parts of the plants also remained non-infringing. These are important exceptions and provide the rationale for two very important cases: farm-saved seeds (FSS) and experimental use of protected varieties.

Secondary rights are permitted in special cases where the Minister feels the situation “might not have given the breeder an opportunity to earn a reasonable remuneration

136 Additionally, there is the obvious territorial contingency in that the transaction has to be in the state of grant, the rights being nationally circumscribed. For the sake of the present argument I have not incorporated this; though, it figures in my subsequent discussion of product space and degree of control.
This applied to the case of breeders of ornamentals and fruit trees, where the variety could be propagated for the sale of grafts, which would not infringe the basic right as defined above. To remedy this situation, the scope of the rights was extended beyond the reproductive material and includes parts of the protected variety (PVS Sch.3 and UPOV 1961/1978: art 5(4)). The reason for taking note of these secondary rights is to identify the presence of a clear awareness of situations this secondary scope of protection under a widened fundamental right, thus greatly enhancing the basic right of the breeder (UPOV 1991: art. 14).

This is the point where most studies on PBRs (and for that matter even theoretical discussion of patents) end. In what follows I develop the notion of the product space of plant varieties.

- **Variety Name**: It is standard practice to link each protected variety with a name, which becomes the generic name for the variety. The variety name must be used in all transactions involving the variety and is legally protected, though not on a basis comparable to trade marks. One of the strategies adopted by firms to supersede the variety name has been to enjoin a trade name, which effectively gives an indefinite monopoly to the breeder through the development of brand loyalty (Dworkin, 1983). This practice, while initially illegal, has now been permitted under the 1983 amendment to the PVS. The use of trade names further entrenches the breeder’s control over the

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137 The rationale of ‘reasonable remuneration’ has an uncanny knack of being invoked at a variety of moments without any precise indication of what exactly is reasonable. At each epochal change in PBRs legislation the proponents have argued for widening of scope of these rights so as to ensure the breeder earns a reasonable return. However, an no point in this debate have the proponents honestly identified the dimensions of what may be considered as reasonable. This ambiguity is in itself one of the virtues of the principle and a crucial element in its rhetorical use. This is discussed in detail in the Ph.D. where I demonstrate the construction of consensus and the efficacy of this rhetoric.

138 In fact Merges and Nelson (1990), while surveying literature on the economics of patent scope, conclude that this has received limited attention. Theoretical discussions have focussed on issues of length and breadth of protection in terms of social welfare, which these authors conclude are “issues that as practical matte are considered largely settled”. The case of PBRs is further neglected and hence this critique is more telling.
variety and also diminishes the significance of supplementary information provided to farmers on the performance trials of selected varieties, which is published using only variety names.

- **Period of Protection**: This determines the period of monopoly control over a variety. It was felt that any period of protection is necessarily arbitrary (Committee on Transactions in Seeds, 1960). Over the years both the recommended minimum period of protection, as well as the maximum period of protection as well as the maximum period of protection have been increased.\(^{139}\) There are additional elements in the legislation, which supplant this period. Once a variety is submitted for trials to determine a grant it is possible to get a protective directive, on the payment of a fee (in the UK), which provides protection identical to an actual PBRs to the breeder. This interim protection is optional and lasts until the time a decision is made on the application. The 1991 revision proposes to change this optional requirement to become a regular feature of the PBRs system. The UK additionally proposes to eliminate the relevant fee (Ministry of Agriculture, 1994).

- **Territoriality**: This element of the legislation defines the geographical area of exclusive monopoly rights. Since these are nationally circumscribed rights the geographical space of these rights are defined by the national boundaries of the state. In this sense, the rights are not international, as the UPOV only establishes national PBRs based on substantively similar principles (Nijdam, 1967). However, there are elements in UPOV that enables a widening of the rights so as to extend beyond the national borders. This is possible through secondary rights that produced outside the breeder against imports of grant (Royon, 1980, Dworkin, 1983).\(^{140}\) The impact of this provision is to protect the

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\(^{139}\) In the UK the minimum period of protection has been increased from 15-18 years to 20-25 years and the maximum period has increased from 25 years to 30 years. Where as under the UPOV the minimum period of protection has increased from 15-18 years to 20-25 years.

\(^{140}\) The 1878 revision of UPOV did not explicitly provide this extension but permitted it as a secondary right under article 5(4) which the UK utilized to implement this provision for ornamentals and fruit trees. This provision, while greatly widened, is generalized as a fundamental right under the 1991 revision (art. 14)
domestic market, but expands beyond domestic competitors. This widening of control so as the fundamental right (art. 14). There are additional elements. Here I note the provisions for rights of priority for a particular variety in all member states for up to 12 months (UPOV 1961/1978: art. 12, 1991: art. 11) This protects the ‘novelty’ of a variety and allows only this breeder to seek PBRs for the same variety in other member states. An additional four-year period of development is provided to the breeder, which protects the (commercial) novelty of the variety. Both these provisions effectively extend the monopoly control over genetic material over an extended geographical area that encompasses all UPOV member states.

- **List of Protected Genera:** An examination of the list of protected genera reveals the gradual progression of the ambit of PBRs legislation. The UPOV has stipulated requirements for providing PBRs in the recommended genera and the progression of such legislation by member states (1961/1978:art. 4). The 1991 revision requires members to provide protection to all genera and species. The economic implication of this increasing ambit of the legislation will be evident in the scale economies that accrue in R&D undertaken across a range of crops. With biotechnological developments and increasing control of plant breeding under in ‘appropriationist’ agro-industrial complex, this may translate into focussed work on select traits that work across a range of crops (Singh, R. B. 1991). Under a regime that enables the protection of traits/characteristics (and not the genes) this will effectively protect an entire research programme as has happened with the transgenic patents in cotton and soybean granted in the USA. Similar tendencies are revealed in the data on OECD field trials of genetically modified organisms (see table in appendix). With the removal of the ban on dual protection and this widened submit of the legislation the economic implications on research programmes may very well make the focus on varietal protection an obsolete instrument of intellectual property protection.
• **Essentially Derived Varieties:** In its original avatar PBRs had a unique provision of an experimental use license that went beyond patent law statutes in that it only permitted research use of a protected variety but also allowed the derived variety to be protected if it fulfilled the DUS conditions (UPOV 1961/1978: art. 5(3)). This went beyond the double contingency noted above in that the commercial realm of search with protected varieties would not be considered an infringement of the product space of the original variety. The rationale reflected the peculiarities of plant breeding material (Lange, 1985). Many legal expert have strongly criticized this notion while specifically focussing on the provision of marketing of derived varieties (Beier & Straus, 1985; Straus 1988; Byrne 1989, 19991; Crespi 1992). It is argued that the notion of ‘dependence’ in PBRs only requires a derived variety to be distinct in one relevant characteristic, thus allowing the incorporation of characteristics/trait from a protected variety (art.5 (3)).” The contingency directed primarily at hybrids, hence, provoking some to even evocatively call the UPOV a ‘copier’s charter’ (Byrne, 1989). Additional pressure was exerted on this clause with legal developments in the USA, who joined UPOV only in 1980, with the Chakravarty decision in 1980 and the Ex Parte Hibberd decision in 1985. Internal discussions within UPOV evolved a distinction in this research exemption by differentiating between experimental use and commercialization of such derived varieties (Gfeller, 1988). The revised Convention reflects this change by reducing the research exemption to a patent-line experimental use license and incorporating a clause defining essentially derived varieties (UPOV 1991:art.14 (5)).

It does not comes as much alarm that the new provisions under UPOV 1991 provide the

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141 The Ph.D. presents this provision as a strategic alliance in maintaining genetic materials as a local public good in the sense expressed by Callon (1994), as well as a fundamental manifestation of the technological paradigm of plant breeding which substantially determines the research programme as well as the avenues for appropriation. The latter notion is derived from the related works of Dosi, Rosenberg, Silverberg and Freeman.

142 An interesting aspect of this debate is the criticism made by activists like Pat Mooney on the loss of genetic diversity of cultivated species resulting from PBRs legislation, as well as the focussed use on improved cultivars as initial source for subsequent varieties (Mooney 1979, 1983, see also Vellve 1992). Strangely, some proponents of enhanced property rights eventually accepts this critique, but demanded extended rights; thus not facing up to the criticism of loss of diversity on the field (a good example being Straus 1988).
breeder with comparable protection to a patent, though without the exacting patent-
requirements of novelty and description (Byrne, 1993).

- **Derived Products:** Using the prototype of patents as the yardstick for comparison,
  increasing pressure has been applied during the 1980s for UPOV to give the breeder
  comparable protection. Under the driving force of biotechnological developments, the
  demands increased expanding the rights to contain the entire economic arena utilizing
  the protected variety, such as products derived from the protected variety, e.g. flour
  from milled grain, or juice from fruits (Straus, 1988). The degree of control granted by
  this widened scopes is only imaginable: a new variety is a protected in the market for
  varieties and also earning economic returns for the breeder in down-stream utilization
  of the harvested product of the variety. Further, placing this in the economic reality of
  an agro-industrial complex highlights the magnitude of control these new rights can
  confer on the breeder (or, rather the monopoly plant breeding companies involved in
  food, the potentialities of control being offered are alarming to say the least. The 1991
  revised UPOV convention provides the legal framework for actualizing this reality.

This is just a basis schema of defining the real extent of control offered under PBRs
legislation.143 An incorporating of the identified elements in the legislation provides a
closer approximation of the real degree of control breeders are able to exercise in plant
breeding material through legislative means. This degree of control over PBRs is
manifested in the conflicts of interests between the breeder and other constituents utilizing
plant varieties, or contributing to its production. The tension between breeders and farmers
is discussed in the final section of this paper.

**An Example of the Widened Degree of Control**

143 The Ph.D. proposes additional features to this notion by incorporating changes in the fee structures
related to PBRs, as well as redefinition to the DUS conditions for grant for PBRs.
Three groups have been identified as contesting the claims of a plant breeder. (i) competing plant breeders, (ii) specialist seed producers and (iii) farmers and gardeners (Godden, 1982). Each of these constituent groups are users of the plant varieties produced by the breeder and thus effected by the changes in the product space of the variety and degree of control exercised by the breeder. An example will elucidate this point. Earlier on I noted the subject matter of protection is the variety in its entirety. In this sense, it is not a specific gene or characteristic, nor the entire plant, but a unique combination of genes captured in a “snap shot” by the variety (Fowler, 1994:228). Thus other breeders can utilize the protected variety under the experimental use license and produce a competing variety by changing one or more genes of the unique combination of the protected variety. This is possible technically and permitted legally under the principle of dependence inherent in PBRs legislations (Lange, 1985). Such derived varieties diminish the degree of control granted to breeders.

The problem is greater then what is captured in this example. Private breeders focus on a narrow range of objectives. This reflects the market pressure to continuously develop new (improved) varieties to replace existing varieties, somewhat in a consumeristic mode of improved soap powder replacing the earlier less effective product. The narrow focus on selected characteristics and traits is reflected in the source of germplasm utilized, which predominantly exist high performing cultivars (Cook, Johnson & Allen, 1993; Poehlman & Sleper, 1995). Or, as one commentator concluded: “they begin with the best breeding products (Johnson, 1986).” Even public breeding demonstrates this bias of concentrating on selective traits and characteristics that have demonstrated successful application two genes for semi-dwarf growth habit inherited from the Norin line in Japan were incorporated into

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144 This characterization that I adopt from Godden (1982) is restricted to the commercial space of a plant variety as an end product. Specifically in terms of the farmer as provider of germplasm, it is possible to add an additional twist to the conflict between the farmer and the breeder. The analysis does not recognize the tension emerging from the free use of landraces by formal breeding programmes. I make reference to this conflict in the following section.

145 The continuous talk of the impact of breeders’ rights leading to increased innovation is entirely misdirected since it does not analyze the content of new varieties in agronomic terms. Further, as much as more varieties are produced after the provision of breeders’ rights, many such varieties are cosmetic variations of existing varieties and some are not maintained through out the period of grant.
the dwarf-wheats of the Green Revolution by Norman Borlaug, and within 20 years were in 50% of wheat cultivars worldwide (Cook, Johnson & Allen, 1993).

The economic consequence of this practice is apparent in the threatened product space of a protected variety and the constrained degree of control exercisable by a breeder. Since an experimental use license does not translate into economic returns to the breeder there is no avenue open for appropriating returns for this research use or its commercial end product. This inability is compounded by the legal possibility of producing a competing variety that is only a minor variation of the initial variety. The proposed change in PBRs legislation to extend the breeder’s control over essentially derived variety is directly poised to eliminate this practice in plant breeding.

With respect to farmers, the semantic change in farmers’ rights to privilege and exemption is only the epiphenomenon of the general ‘appropriation/substitution’ of the farm. While some UPOV member-states may continue with provisions on FSS, it is likely this provision will be accompanied by payment of a royalty, which in the UK may reach as high as 53% (Coghlan, 1991). Returning to the three ‘rival’ groups confronting the breeder in the market for plant varieties, it is noticeable that the expansion of property rights has greatly favoured the breeder. With respect to each constituent group, the breeder has been able to secure a greatly extended ambit of protection.

**Farmers’ Rights: Elements of the Global Tension**

Farmers’ Rights originate in the unfair global exchanged of PGRs between the north and the south where southern countries increasingly felt in the early eighties that genetic resources from their countries were freely appropriated without either recognition or reward. This contrasted with the presence of PBRs in the north. Beginning in 1981 at FAO, these efforts to restore balance in international flows of PGRs culminated in the
establishment of a non-binding International Undertaking on Plant Genetic Resources in 1983. Three basic principles underscore this Undertaking:

(i) Principle of common heritage whereby all PGRs are considered the common property of mankind,

(ii) Unrestricted access so as to ensure availability of PGRs “free of charge, on the basis of mutual exchange or on mutually agreed terms”, and

(iii) a wide notion of PGRs which included elite and breeder lines, as well as landraces and wild and weedy species (FAO, 1983). Northern opposition to this development was strong and several countries maintained their reservation to the Undertaking: Canada, France, Germany, Japan, Switzerland, UK and USA.146

Underlying this entrenched opposition was a conceptual resistance to widening the notion of ‘common heritage’ beyond what Sedjo (1988) called a “conventional usage”, i.e., the inclusion of elite cultivars and breeder lines. Seed companies were clearly opposed to any such move that would jeopardize their proprietary control of plant varieties: “to ask that an elite parental line which costs a company several hundred dollars to develop be exchanged for cultivators of limited or unknown potential is simply not reasonable, and seed companies will not agree to such an arrangement (Brown, 1988: 225).” However, this did not preclude their insistence on maintaining a policy of free access on landraces and farmers’ varieties, which is either rationalized in terms of these resources not being mined, and hence the entire stock is not appropriated (Sedjo, 1988). Or, also that these resources are natural, and do not require active and purposeful human intervention for their maintenance:

146 The opposition to the Undertaken on the part of northern countries has remained a characteristic feature of its evolution. At the first meeting of the Commission on Plant Genetic Resources in 1985, the US attempted in vain to coordinate a Northern-wide boycott. Recent discussions at the 4th International Technical Conferences of the FAO in 1996 to proceed towards the implementation of FRs have been frustrated by the US insistence that these rights are merely a ‘concept’ and have no legal underpinnings (Rangnekar 1996).
“They [i.e., developing countries] do not have to work to acquire the genetic diversity they possess, whereas breeding programmes require years of efforts and large commitment of resources (McMullen, 1987: 74).”

At the 25th session of the FAO Conference in 1989 two resolutions were forwarded “aimed to improve the participation of countries in the international undertaking (FAO, 1989).” Theses amendments to the Undertaking were a compromise solution between the North and the South where PBRs were accepted as compatible with the principles of the Undertaking, and the concept of FRs were introduced to recognize the role of farmers as providers of germplasm (Kloppenburg & Kleinman, 1988). It is the latter amendment, resolution 5/89 that has been widely heralded as a positive step towards restoring balance in international exchange of germplasm. The resolution is based on the recognition of the role of farmers as providers of and is linked to their participation in the sharing of benefits derived from the use of theses resources (see appendix) (Rural Advancement Fund International, 1989; Cooper, 1993; Shiva, 1993).

The Notion of Farmers’ Rights

The widely accepted notion of FRs is captured by the text of resolution 5/89 of the 25th FAO Conference. Theses rights are not located in individuals, but vested in the international community and aimed at protecting and rewarding the shared knowledge of farmers (Posey et. al., 1994b). The mechanism for reward and compensation was to be an international gene fund administered by the FAO. The underpinning for these rights emerge from a diverse group of advocates who emphasize the value of these resources and the knowledge systems that have developed and maintained this biodiversity (Rural Advancement Fund International, 1989).

Resolution 4/89 of the 25th FAO Conference clearly accepts PBRs, as provided by UPOV, as compatible with the Undertaking. There is no indication if this acceptance is linked to any particular text of the UPOV Convention. Thus, with the 1991 revision of UPOV a greater problem exists for FRs and the Undertaking. It is imperative that the on-going renegotiations of the Undertaking conclude with an explicit position on the nature of PBRs that are compatible with the principles of the Undertaking as well as with FRs that get implemented.
Advancement Fund International, 1989; Keystone Centre, 1991; Brush, 1992; Gupta, 1992; Shiva, 1993; GRAIN (Genetic Resources Action International), 1995). This value is realized as a source of stability for agriculture (Harlan, 1975; Wilkers, 1977; Plucknett et al. 1987), as well as important resources for a variety of pharmaceutical drugs (Reid et. al., 1993a; Rural Advancement Fund International, 1994; Swanson, 1995b), and the emerging development of biopesticides (Persley, 1990; OECD, 1992). However, only a negligible amount of this value ever finds its way back to the communities that have provided the initial source material and knowledge: in 1985 the market value of plant-based pharmaceuticals in OECD countries was US$ 59.4 billion, and less than 1% of this value has ever been returned to these communities (Posey et. al., 1994a). It is this stark reality of unrequited subsidy to modern agro-industry and pharmaceutical industry that has attracted the verdict of bio-piracy (Rural Advancement Fund International, 1994), and increased the realization of a fundamental contradiction in the dual presence of gene-rich regions and poor communities (Gupta, 1992).

Paralleling this analysis is a conglomerate of advocates emphasizing the urgent needs for a global effort at conserving the rapidly vanishing plant genetic resources (Plucknett et al., 1987; Hardon, 1989; Brush, 1994; Tribe, 1994). These advocates note the consequence of the widening adoption of ‘modern’ varieties by farmers in developing countries with the simultaneous loss of traditional varieties. As the geographical spread of HYVs widens they replace existing diversity, which remains an irreplaceable (Shiva, 1991). The consensus within this group is for global conservational efforts, which accepts the role of farmers as in situ managers of diversity, which will implement the FAO resolution of FRs (Brush, 1994). This mechanism would satisfy the dual interests of industrialized countries (who use these resources) and developing countries (who provide these resources). Obiously missing in this schema is any discussion of empowerment and rights in terms of the knowledge pertaining to the resources.

\[148\] Some of these varieties may be found stored in ex situ collections. However, the FAO’s State of the World’s Plant Genetic Resources (1996) study of such collections does not give the necessary confidence in either the coverage of such collections across crops, nor in the status of viability of such material.
Some Problem in Formalizing Farmers’ Rights

Probably the greatest problem in implementing FRs arises from attempts to erect the rights based on utilizing existing systems of IPRs have an assigned inventor, observers point out the impossibility of assigning ownership with respect to PGRs. With continuous hybridization and movement of PGRs, it would be difficult to settle claims of ownership over specific landraces (Hardon, 1992). This notes the pre-eminent problem with any type of property right: the need to elaborate acceptable notions of “defined persons having defined rights in relation to defined material (Greengrass, 1996).”

The second main problem arises with respect to the ‘value’ of PGRs. The prominent view characterize PGRs as public goods which are economically difficult to account for, and in the absence of any restrictions on use (physical or legal) it is difficult to appropriate the value of these resources (Sedjo, 1992; Brush, 1994; Swanson, 1995a). Here the issue is that it is difficult to appropriate the values streaming from conserving genetic information that is a public good. Inherent in this view is the presumption of treating landraces ‘common property’ in line with the original principles of the Undertaking. Another unacknowledged element in the argument is an adherence to the existing status quo of the distribution of these resources across a diverse array of institutions, public and private, in the form of ex situ holdings. In the absence of an agreed norm of practice on the terms of access and their proprietary status it is difficult to evolve a method for establishing economic values for these resources. One approach is to internalize the cost of these resources in agricultural resources. One approach is to internalize the cost of these

149 This analysis also used to explain the under investment by states in the conservation of biodiversity, since the investing state is not able to appropriate all the economic value created by this activity (Sedjo, 1992).

150 Some also contend that these PGRs are actually ‘raw’ materials which crucially depend on the investment of capital and time for their ‘potential’ values to be realized and generated (Sedjo, 1988).
resources in agricultural research budgets (Brush, 1994), which can be achieved by surrogate property rights (Swanson, 1995a).

The route suggested towards internalizing these costs is largely focussed at conservational activities, which hopes to bridge the gap between the interests of the north and the south.151 The objective is for industrialized countries to ‘compensate’ providers of genetic resources that will be a form of recognition of the global benefits that are generated by these resources. This is a non-market approach aimed at solving the opportunity cost problem of farmers deciding between planting low yielding and diverse crops/species, or planting monocultural HYVs. The preference for this scheme of in situ conservation for the implementation of FRs is based on the assumptions that landraces have little commercial value and these resources are also available from gene banks. Thus, The ability to enforce and benefit from formal rights may not be possible for farmers.

The necessity for an international gene fund is an urgent requirement (Keystone Centre, 1991). However, this is yet to materialize as there remain significant technical, financial and legal issues to be solved: (i) the nature of funding, should it be voluntary or mandatory, (ii) the linkage between financial responsibilities and benefit entitlements, (iii) method to hierarchize the relative needs and entitlements of beneficiaries, (iv) method of identifying farmers and local communities and channeling resources to them, and (v) who should bear the financial responsibilities for the fund (Commission on Plant Genetic Resources, 1995).

From this brief survey it appears that on all possible fronts barriers exist towards formalizing and implementing FRs. In the build up to the 4th International Technical Conference of the FAO in 1996 the American delegation insistently demanded that the agreed text only make references to “the concept of farmers’ rights.” This was based on the absence of any legal precedent of FRs. Developments in India towards being the first nation

151 This paragraph is based on Brush (1994).
to implement FRs will prove to be significant in changing this global disparity by providing a useful legal precedence (MS Swaminathan Research Foundation, 1996).

**The Tension between Plant Breeders’ Rights and Farmers Rights**

Reasons for this entrenched political resistance to FRs as the academic opposition are substantially located in the economics of the issue captured in the dynamics of the seed market and the practice of seed saving. At the end of each harvest the farmer has the option of disposing the harvest either as ‘grain’ for consumption, or saving it as ‘seed’ for subsequent production. This duality of combining the means of production with the means of consumption underpins the rationale for this age-old tradition of seed saving (Berlan & Lewontin, 1986; Kloppenburg, 1988). The fact of the matter is that, hybrids aside, the genetic quality of seeds deteriorates over a number of harvests and only then require replacement with fresh stocks of seeds. This seed replacement rate varies across crops and also depends on the local cultural practice of agriculture (Singh, Gurdev & Asokan, 1994). The implication of this for the seed merchant is obvious: the size of the market, which is determined by the total acreage sown, is diminished by the extent of FSS. For example, if farmers replace their stock of seeds by commercial purchase once every four years the replacement rate is 25%. To arrive at an accurate estimate of the size of the (commercial) seed market it is necessary to take account of the practice of FSS and the presence of lateral distribution mechanisms of seeds between farmers (Singh, Gurdev & Asokan, 1994). The import of this factor is simple: farmers are suppliers of seeds competing with seed merchants in the same market and place a downward pressure on seed prices.

There is an additional dimension to this issue that brings us back to the notion of product space of a plant variety. The breeders’ rights are defined in terms of the sale of seed as propagating material. This right materializes in the form of royalty income from seed merchants for each sale of certified seed of the protected variety. In this manner the reduction in sales of commercial seeds because of FSS reduces the breeder’s income
(Berlan & Lewontin, 1986). Further, the presence of the farmer as a competitive (and often a more reliable) source of seeds (from one’s own farm or exchanged with another farmer) is of similar genetic vigour, why should a farmer purchase a fresh stock, or even pay a second royalty for it. All the farmer needs to do with the harvested grain is to process them into seeds by hiring the necessary equipment. This practice proves to be economical not only for the farmer, but also for seed merchants undertaking this business since they are then not required to pay any royalty to the breeder. This places the interests of seed merchants and farmers against that of the breeder. In 1985 the French government outlawed the processing of farmer’s harvested grain into seeds by seed merchants.

The underpinning for this practice is a consequence of the biological, technical and legal realities of the seed. As Berian and Lewontin (1988. 1990) point out the seed is a carrier of genetic information, which reproduces itself within a reasonable degree of statistical variation. Each stock of commercial seeds fuses two technical realities that need to be properly distinguished: (i) the seeds must be of weed free, properly sized, of specified germination rates; i.e., factors established by seed certification regulations governing seed trade, and (ii) the seeds are the product of a unique combination of genetic factors that satisfy the DUS criteria for protection. It is the latter property of seeds that is the product of breeding and protected under PBRs legislation, thus legally permitting the practice of seed saving.

The inclusion of this practice as a central element in FRs is one manifestation of the oppositional tension with PBRs. Again the economic reality of the seed market brings home this point: in the mid eighties, the global seed market was constituted by farmers to the extent of 36 % (US$ 18 billion), the public sector accounting for 34 % (US$ 17 billion) and the private sector accounting for 30 % (US$ 15 billion), and even in the US farmer-
saved seeds accounted or 34 % of the market value of the seed market (Groosman, Linnemann & Wierema, 1991). In the EU the extent of seed- saving varies from a low of 5 % in Ireland to as much as 90 % of total seed demanded in Spain and Greece (van Gaasbeek et.al., 1994) [see the table in the appendix]. The attempt in the West is to eliminate this practice and two routes have been adopted. One option is to outlaw the practice through legal statute and here the 1991 revision of UPOV is the manifest approach. However, it is essential to note that this is based on a long process of gradual attrition. Even before the preparatory work for the 1991 revision began UPOV circles were discussing the possibility of eliminating this provision in PBRs legislation. A 1985 UPOV document drew attention to the political sensitivity of this issue:

The possibility of ‘saving seeds’ is of great importance for agriculture and it is doubtful whether it would be politically feasible at the present to restrict this practice in all countries. The assertion of the right to prohibit under general patent laws would probably lead to serious political difficulties (UPOV, 1985: 26).

While the final form of the 1991 Convention has left it open for legislating states to decide the exact form of this provision, it is possible to speculate that the alternative will be to economically eliminate this practice. Here the alternative will be to either restrict the practice to plant-back option which effectively reduced it to seed- saving for use on one’s own farm, thus eliminating provisions for seed exchange/sale, or to introduce royalty payments for saved seeds. Both these routes pressurize the practice by either eliminating the income stream from seed exchanges/sales or increase the cost of seed saving by introducing royalty payments. For example, in the UK farmers will shortly have to pay a royalty rate of up to 53 % on saved seeds (Coghlan, 1991).
In the US this has taken the route of litigation where a large seed company is pitted against a family-farmer, the Asgrow vs Winterboer case that began in 1988. The PVPA permitted farmers to save and sell seeds as long as they did not use the variety name and also required both farmers to save and sell seeds as long as they did not use the non-propagating material. There was no quantitative restriction on the extent of a permitted sale of saved seeds. Asgrow in its case disputed the practice claiming that a farmer can only save seeds to the extent they need to replant the next harvest. Importantly the source of propagating material as being derived from Asgrow protected soybean varieties was not in disputes. An initial decision by the federal court went in favour of Asgrow with the judge deciding that the crop exemption should be limited to the soybean acreage needed for the subsequent year (Hamilton, 1993). With the Winterboer’s appealing the decision at the US Court of Appeals the subsequent ruling reflected the spirit of PVPA where only statutory restrictions are placed on the crop exemption clause without defining any quantitative restriction (Hamilton, 1993; Shand, 1994). It is important to note that the Winterboer's were exchanging up to a maximum of 20% of their harvest. However, as Shand (1994) concludes the pressure to fall in line with UPOV and the force of large seed companies have forced Congress to change the statutes to reduce the crop exemption clause to only permit plant-back. At the end it appears that the initial court ruling has prevailed.

With limited commercial sales of certified seeds by private companies in developing countries, estimated at only US$ s billion in non-OECD countries, this is the main market to target for future development (van Gaasbeek et. al., 1994). In most developing countries these practices of saving and exchanging seeds are deeply ingrained and actually useful for the vitality of the biodiversity and culture of farming communities. It is central for any

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154 This paragraph is based on Hamilton (1993) and Shand (1994). Hamilton (1993) draws attention to the use of secret agents by Asgrow to purchase 20 bags of soybean seeds from the Winterboer farm in December 1990. An important point not noted in this paper is the ‘cost’ of enforcing these rights. In the case of PBRs the small number of farmers and the seed distribution networks enable seed companies to identify acts of infringement by farmers. This is significant in enforcing violations of the clause of crop exemption, and hence adds the necessary economic stimulus to the demand for legally enforcing these rights.
implementing act on FRs to retain this as a distinct element of the legislation without demanding royalty payments.

The other core element that must necessarily constitute FRs is the role of farmers as providers of germplasm which is the primary building block of agriculture. The FAO resolution notes this activity as a legacy of farming communities that is on-going and continuous, hence the scope of such rights would contain past contributions as well as present and future contributions resulting from acquisitions from farmer’s fields (in situ or ex situ). In line with developments in the Convention on Biological Diversity, some commentators have advocated the notion of Traditional Resources Rights (TRR), which is an encompassing notion going beyond ‘given’ definitions of intellectual property rights:

The concept of TRR can accommodate a wide range of relevant international agreements as a basis for a sui generis system of protection for traditional and indigenous peoples and their resources. There may be, in other words, much more to build upon in the international community than we have realized... this breadth is indeed the only way to approach Intellectual Property Rights and Traditional Resources Rights if equitable sharing and effective conservation of biological and cultural resources are to be attained (Posey et. al., 1994a: 7).

The demand for FRs is in many ways related and linked to the struggle for TRR. The issue at hand is not simply an allocation of returns to these communities or the creation of an international gene fund for conservational activities, difficult and complicated as each of these are in themselves. Rather, the articulation is for a scheme of benefit sharing tied in with a system of reward/recognition for the values created by these resources:

We are witnessing a rising tide of anger because for too long products developed, cultivated and conserved through generations of selective interbreeding are being appropriated in the name of foreigners... The ownership of genetic resource and, indeed, of medicinal plants is likely to precipitate major tensions between
biotechnology firms and the developing countries, particularly where such resources have been directly conserved and utilized by specific indigenous communities... It is important to recognize that the North has used germplasm resources from the South to produce new varieties of crops. Nearly all germplasm-derived innovations were patented without any income reaching communities from germplasm was sourced (Khalil, 1995).

This perception captures the mood of a number of commentators on the issue of biopiracy, or biodiversity prospecting depending on the adopted perspective. The tension is related to the sharing of the spoils created by the commercialization of products derived from PGRs and related knowledge. On the part of private companies the threat is to their current unquestioned degree of control over the entire process of acquisition of these are resources and their commercialization. One possible solution is material transfer agreements that are contracts for gaining access to biomaterials in exchange for mutually agreed sums of money (Reid et. al., 1993a). The Biodiversity Convention has fostered such bilateral agreements, though there is limited unanimity on the merits of such arrangements for local communities (The Crucible Group, 1994). However, the real threat to existing degrees of control is posed if general stipulation of TRRs over the biomaterial and associated knowledge in terms of the derived products get introduced. These bilateral arrangements prove to be effective by reducing lead time in identifying useful products and shortening the period of clinical trials (Moran, 1994). However, given the differences in economic power between the interacting groups and the lack of any enforceable system of rights for indigenous communities the bargain is effectively and actually biased against the community. Thus, Merck in its contract with InBio has stipulated the same samples can not be provided to any other organization for a period of up to two years, and further. Merck retains all rights over any commercial product that results from these products (Kloppenburg & Rodriguez, 1992; Pistorius & van Wijk, 1993). This is the significant manifestation of the degree of control multinationals are able to exercise in such deals as they remain outside of public security and the economic clout underpinning their bargaining power. The formulation of FRs and TRR are attacks on this entrenched political and economic power.
A final aspect of this conflict of interest between PBRs and FRs is reflective in a variety of academic approaches, which have essentially utilized the prototypical models of either patents or PBRs as the defining model for a *sui generis* systems of FRs (Brush, 1994), or required similar notions of inventiveness (McMullen, 1987; Sedjo, 1988).

The design of a *sui generis* systems of plant protection allowed under GATT will follow patterns already established, which do not allow protection for genetic resources per se as intellectual property. *Sui generis* systems will look like plant variety protection and utility patent protection in industrial nations; protection not designed for farmers... Germplasm resources have only recently been defined as national patrimony; their source is often ambiguous; they are often the result of discovery rather than invention; and collective invention is more important than individual property for plants: novelty or uniqueness, the result of non-obvious procedures, uniformity, and stability (Brush, 1994: 12).

The first point to be made is to clarify that there are no *a priori* reasons to begin with the existing models of IPRs as the starting point in giving content to FRs. Even a cursory comparison between PBRs and patents reveals the liberal changes advanced in protecting breeders in contrast to the criterions given in patent legislation. The specific evolution in the demands for protecting breeders in Europe in the fifties reflects the ‘agri-technical’ conditions of the subject matter of protection (Laclaviere, 1965), an aspect that is now being undermined by the 1991 revision of UPOV which makes the terms of protection similar/comparable to that of patents without demanding the exacting requirements for patent protection (Byrne, 1993). The differences between the two forms of protection are noted in the criteria of novelty, the disclosure requirements, and the notion of inventiveness. The historical development of PBRs in Europe also reveals the taxing resistance of the industrial patent lobby undertook the option of designing a *sui generis* system of PBRs (Laclaviere, 1965). In a similar analogy a *sui generis* system designed to complement the peculiarities of farmers’ varieties and the context of innovation.
The existing system of PBRs is inherently not designed to protect any other form of activity other than stabilized and homogenous plant varieties. This is because the conditions for grants are that of distinctness, uniformity and stability which is the generalization of the method of breeding for self-pollinated plants. This in effect discriminates against other methods of breeding (Berlan & Lewontin, 1986). It comes as no surprise that farmers’ varieties, which are generally heterogeneous, will not meet these criterions for protection. (Shiva & HollaBhar, 1993; Rao, 1996). This in itself is not a remarkable point, since UPOV is specifically designed to protect the rights of commercial breeders. However, it is necessary to note two important misreading by Brush (1994) captured in the quote above. Firstly, the novelty criteria in PBRs legislation is a very restricted notion as it only requires commercial novelty, i.e., it should not have been commercially transacted with the approval of the breeder prior to an application being made. Secondly, discovery of a variety does not preclude the person from gaining protection. Both these conditions contrast with patent legislation. Thus, to summarily dismiss the potential of protecting landraces on these grounds is demonstrative of shallow scholarly work. Further, it is a misconceived approach to contrast the case of protecting FRs and landraces in light of a system primarily designed for steam engines and light bulbs, or uniform and homogenous plant varieties.

This section has identified crucial factors in our contemporary socio-political and economic systems that are weighed against the actualization of FRs. It has also noted the biases in existing IPRs systems that do not appreciate the context of innovation in farmers’ fields, and actually cannot accommodate this form of innovation. This analysis then suggests the need to define a sui generis systems for FRs, which given the inherent conflict of interest with PBRs, will necessarily have to be a distinct piece of legislation.

Conclusion: Farmers’ Rights as a Distinct Right?

“The scope of protection of IPRs is generally as much a function of the political and economic power of those seeking protection as it is of wise or just economic policy.
Moreover, the utility of IPRs regimes is always a function of the enforceability of the rights (Reid et al., 1993b).

The paper has presented the case of analyzing PBRs from the perspective of the product space of plant varieties. This provides some important lessons useful for progressing the case of FRs: (i) the need to construct the notion of the subject matter of protection, (ii) the necessity of defining rights in a manner reflective of the nature of innovation and socio-economic context, and (iii) the benefits of maintaining a distinct identity from the dominant form of IPRs. To expand: firstly, plant varieties as the subject matter of protection were socially constructed by legislation. This formed the legal case of identifying distinct varieties and enabled the introduction of PBRs. Various elements of the legislation were introduced to reflect the dynamics of plant breeding, such as the farmers’ right to save/exchange seeds, the breeders’ exemption and the principle of dependence. While these have changed because of factors identified in the paper, the strategic use of these elements enabled the relevant bodies to create a distinct instrument of protection separate from patents.

These are some of the necessary steps needed for developing the notion of FRs. The focus of the papers also highlights the inherent tension between the demands for control and its expansion on the part of the seed companies and the interests of farmers. This is vividly captured in the dual role of farmers as purchaser of seeds and supplier of genetic material. To maintain balance between these conflicting interests it will be necessary to provide FRs through a separate and distinct instrument of protection. The unfortunate changes in the rights of farmers in the West (under UPOV) should not become a legacy for developing countries to grudgingly implement becomes of international obligations. It is felt that a change in global political forces can be effected through a legal precedent with India proceeding to introduce FRs as a legal right. This will place pressure on the discussions for renegotiating the International Undertaking.
Appendix 1: Legal Texts

**Plant Breeders’ Rights as Defined by UPOV 1991**

**Article 14 [Scope of the Breeders’ Rights]**

(1) [Acts in respect of the propagating material] (a) Subject to Articles 15 and 16, the following acts in respect of the propagating material of the protected variety shall require the authorization of the breeder:

   (i) Production or reproduction (multiplication,
   (ii) Conditioning for the purpose of propagation,
   (iii) Offering for sale,
   (iv) Selling or other marketing,
   (v) Exporting,
   (vi) Importing,
   (vii) Stocking for any of the purposes mentioned in (i) to (vi).

(2) [Acts in respect of the harvested material] Subject to Articles 15 and 16, the acts referred to in items (i) to (vii) of paragraph (1) (a) in respect of harvested material, including entire plants and parts of plants, obtained through the unauthorized use of propagating material of the protected variety shall require the authorization of the breeder, unless the breeder has had reasonable opportunity to exercise his right in relation to the said propagating material.

(3) [Acts in respect of certain products] Each Contracting Party may provide that, subject to Articles 15 and 16, the acts referred to in items (i) to (vii) of paragraph (1) (a) An respect of certain products made directly from harvested material of the protected variety falling within the provisions of paragraph (2) through the unauthorized use of the said harvested
material shall require the authorization of the breeder, unless the breeder has had reasonable opportunity to exercise his right in relation to the said harvested material.

(4) [Possible additional acts] Each Contracting Party may provide that, subject to Articles 15 and 16, acts other than those referred to in items (i) to (vii) of paragraph (1) (a) shall require the authorization of the breeder.

(5) [Essentially derived varieties and certain other varieties] (a) The provisions of paragraphs (1) to (4) shall also apply in relation to

(i) Varieties, which are essentially derived from the protected variety, where the protected variety is not in itself an essentially derived variety,

(ii) Varieties, which are not clearly distinguishable in accordance with Article 7 from the protected variety and

(iii) Varieties, whose production requires the repeated use of the protected variety.

(b) For the purposes of sub paragraphs (a) (i), a variety shall be deemed to be essentially derived from another variety (“the initial variety”) when

(i) it is predominantly derived from the initial variety, or from a variety that is itself predominantly derived from the initial variety, while retaining the expression of the essential characteristics that result from the genotype or combination of the genotype of the initial variety,

(ii) It is clearly distinguishable from the initial variety and
(iii) Except for the differences, which result from the act of derivation, it conforms to the initial variety in the expression of the essential characteristics that result from the genotype or combination of genotype of the initial variety.

(c) Essentially derived varieties may be obtained for example by the selection of a natural or induced mutant, or of a somaclonal variant, the selection of a variant individual from plants of the initial variety, backcrossing, or transformation by genetic engineering.

Article 15 [Exceptions to the Breeders’ Right]

(1) [Compulsory exceptions], the breeder’s right shall not extend to

(i) Acts done privately and for non-commercial purposes,

(ii) acts done for experimental purposes and

(iii) acts done for the purposes of breeding other varieties, and, except where the provisions of Article 14(5) apply, acts referred to in Article 14(1) to (4) in respect of such other varieties.

(2) [Optional exception] Notwithstanding Article 14, each Contracting Party may, within reasonable limits and subject to the safeguarding of the legitimate interests of the breeder, restrict the breeder’s right in relation to any variety in order to permit farmer to use for propagating purposes, on the own holdings, the product of the harvest which they obtained by planting, on their own holdings, the protected variety or a variety covered by Articles 14(5) (a) (i) or (ii).

Farmers’ Rights as Defined by the International Undertaking
Resolution 5/89

Farmers’ Rights mean rights arising from the past, present and future contributions of farmers in conserving, improving and making available plant genetic resources, particularly those in the centres of origin/diversity. These rights are vested in the International Community, as trustee for present and future generations of farmers, for the purpose of ensuring full benefits to farmers, and supporting the continuation of their contribution, as well as the attainment of the overall purpose of the International Undertaking in order to:

(a) Ensure that the need for conservation is globally recognized and that sufficient funds for these purposes will be available;

(b) Assist farmers and farming communities, in all regions of the world, but especially in the areas of origin/diversity of plant genetic resources, in the protection and conservation of their plant genetic resources, and of the natural, biosphere;

(c) Allow farmers, their communities and countries in all regions, to participate fully in the benefits derived, at present and in the future, from the improved use of plant genetic resources, through plant breeding and other scientific methods.

(d)

Appendix: Tables

Table 1: Seed saving in select Developed Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Seed</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark¹</td>
<td>1990s</td>
<td>Cereal</td>
<td>5 %</td>
</tr>
<tr>
<td>Netherlands¹</td>
<td>1990s</td>
<td>All seeds</td>
<td>20-25 %</td>
</tr>
<tr>
<td>France¹</td>
<td>1990s</td>
<td>All seeds</td>
<td>50%</td>
</tr>
<tr>
<td>United Kingdom²</td>
<td>1990s</td>
<td>All seeds</td>
<td>15 %</td>
</tr>
<tr>
<td>Country</td>
<td>Area under HYVs</td>
<td>Annual seed replacement</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------</td>
<td>-------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wheat</td>
<td>Rice</td>
<td>Wheat</td>
</tr>
<tr>
<td>Ireland$^1$</td>
<td>1990s</td>
<td>Cereal</td>
<td>Approx. 80 %</td>
</tr>
<tr>
<td>Portugal$^1$</td>
<td>1990s</td>
<td>Cereal</td>
<td>Approx. 80 %</td>
</tr>
<tr>
<td>USA$^2$</td>
<td>Mid-1980s</td>
<td>All seeds</td>
<td>32 % of total value</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(approx. US $ 1588 Mn)</td>
</tr>
<tr>
<td>USA$^4$</td>
<td>1986/7</td>
<td>Winter Wheat</td>
<td>60 % of total acerage</td>
</tr>
<tr>
<td></td>
<td>1987/8</td>
<td></td>
<td>55 % of total acerage</td>
</tr>
</tbody>
</table>

Sources:
$^1$ van Gaasbeek et al (1994)
$^2$ Pray and Ramaswami (1991)
$^4$ Knudson and Hansen (1991)

**Table 2: Proportion of area (%) under improved varieties and annual seed replacement rates, 1984**

<table>
<thead>
<tr>
<th>Country</th>
<th>Area under HYVs</th>
<th>Annual seed replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wheat</td>
<td>Rice</td>
</tr>
<tr>
<td>India</td>
<td>83</td>
<td>57</td>
</tr>
<tr>
<td>Pakistan</td>
<td>70</td>
<td>50</td>
</tr>
<tr>
<td>Turkey</td>
<td>90</td>
<td>Na</td>
</tr>
<tr>
<td>Argentina</td>
<td>100</td>
<td>Na</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Na</td>
<td>85</td>
</tr>
<tr>
<td>Thailand</td>
<td>Na</td>
<td>Na</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Na</td>
<td>96</td>
</tr>
<tr>
<td>Philippines</td>
<td>Na</td>
<td>85</td>
</tr>
</tbody>
</table>

Source: Derived from Groosman et. al. (1991)

Na = not available
References


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Recognizing and Promoting Creativity and Innovations of the Rural People: An Effective Way to Achieve Sustainable Development

Dattatrya Rangnekar

Introduction

The BAIF Development Research Foundation, a Non-Government Organization, has been promoting rural development extension and allied research for the last 30 years. It had small beginnings in western Maharashtra and south Gujarat, and now covers six states and works with 0.75 million farmers. It tries to create gainful self-employment for the rural families, especially the disadvantaged section; sustainable livelihood, enriched environment, improved quality of life and good human values through developmental research, effective use of local resources, extension of appropriate technologies and upgradation of skills and capabilities with community participation.

Prevailing systems and traditional practices are studied before deciding on interventions. Traditional systems are borne out of generations of experience and observations. Sustainability is a priority for small farmers, especially in rain fed semi-arid areas where the traditional systems are aimed at sustainable production and risk coverage due to vagaries of nature. BAIF lays stress on farming systems and traditional practices.

Many of the studies pertained to different aspects of livestock profusion and provided useful information to develop appropriate recommendations (Rangnekar, 1991, 1993, and 1996).

Farmer innovations are studied (i) to identify those that can be propagated for improving productivity (ii) training extension and participatory technology development. Care is taken to ensure that only average farmers are chosen and not the resource-rich.

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The paper discusses examples of widely accepted farmer innovations, which are found scientifically sound. In some cases laboratory support and field recording have been undertaken to verify the claims. In other cases information from literature or reports from other instituted has been used to corroborate findings.

**Innovative Practices in Animal Husbandry**

Dairy animals have for long been fed on cottonseed and cake and rice polish to improve milk production and fat content besides maintaining the health of the animal. Trials showed that protein and energy available from these materials could also be got from other byproducts at a lower cost. The concept of so-called “balanced” feed has also been pushed very strongly. Much to the consternation of the technical persons the farmers continued to use the above-mentioned material to “balanced” concentrates. Only for the last few years the beneficial characteristics of these materials came to be realized as possessing proteins and fats in a form, which is not easily degraded in rumen. Most of the modern feed mixtures now contain cottonseed related products, whose nutritive value was discovered by farmers’ generations ago.

Special feed mixtures generally containing oil, jaggery, grains, etc. are offered to animal before or after calving to meet increase in energy requirement. More interesting is the inclusion of anesse, ginger etc., in the mixtures offered after calving to prevent digestive disorders.

- **Utilization of fodder for animals**

Succulent leguminous green fodder mixed with cereal straw during chopping increases the intake among dairy animals during lactation. This practice came to the notice of the team in some parts of Rajasthan. This helps in saving on concentrates.
In many parts of western India sorghum straw is the dry fodder of choice and sorghum plant is offered to the animal without chopping. A critical study of the practice indicated that there is sound logic in the system. The farmer offers the whole plant first to productive animals i.e. milch animals or working bullocks. The leftovers are offered to the unproductive animal and whatever is finally left goes into the manure pit. This practice enables the productive animal to have more digestible part of the sorghum plant like leaves and upper portions of the stem that is better quality fodder.

**Innovative Practices Cropping Systems**

- **Mixed cropping**

Mixed cropping is a common practice in tribal areas. Some tribal farmers practice mixed sowing, the entire plot has a mixture of plants comprising cereals, and legumes. However, some farmers plant them alternatively. The common combinations being are maize and sorghum along with chick or pigeon pea. Such approach is very appropriate for rain fed area with low productive soils. The crops have different water requirements and stages of maturity. The farmer is assured of some production from one crop even if there are unfavourable conditions like low rainfall or disease and pest problem. The leguminous crops enrich soil through nitrogen fixation. Recent reports indicate that pigeon pea or chickpea improve availability of phosphorous from the soil. The crop combination also offers a better quality dry fodder, a mixture of crop residue from cereal and leguminous crops. Sowing is done only once and production continues till winter; thus, it saves labour. According to initial observations, the yield per unit area in rain fed conditions is higher in mixed crop compared to mono crop.

The farmers grow both local as well as improved hybrid varieties of cereals. The local variety is grown for consumption of both farmers and animals. The farmers consider straw of local variety to be superior to hybrid variety. Laboratory surveys also indicated that in many cases the straw of local varieties is cultivated for market.
The time of sowing and choice of crops are based on flowering of some forest and fruit tree, nesting and egg laying of some birds, etc. In some villages of Udaipur district the germination of some seeds of crops determined these things. The experiment is conducted in a temple where 4 to 5 earthen pots are filled with soil and the seeds are put. Then the pots are covered. After a fixed number of days the villagers gather to see the result, based on that the decision on the choice of crops and sowing time is taken. These aspects are being examined further to understand the system and corroborate the claims/inferences.

References


Not Having One’s Cake, Nor Eating It: Intellectual Property and “Indigenous” Knowledge

Arun Agrawal

“Knowledge is not simply another commodity. On the contrary Knowledge is never used up. It increases by diffusion and grows by dispersion”. (Uh huh)

-Daniel J. Boorstin, Librarian of Congress

“A Klee painting named “Angelus Novus” shows an angel looking as though he is about to move away from something he is fixedly contemplating. His eyes are staring, his mouth is open, and his wings are spread. This is how one pictures the angel of history. His face is turned toward the past. Where we perceive a chain of events, he sees one single catastrophe, which keeps piling wreckage upon wreckage and hurls it in front of his feet. The angel would like to stay, awaken the dead, and make whole what has been smashed. But a storm is blowing from Paradise; it has got caught in his wings with such violence that the angel can no longer close them. This storm irresistibly propels him into the future to which his back is turned, while the pile of debris before him grows skyward. This storm is what we call progress.

-Water Benjamin

1. Introduction

The Andaman and Nicobar Islands of India in the Bay of Bengal and home to several indigenous groups like the Onge, the Jarawa, and the Sentinelese. Over the decades, their

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A number of anthropological works have described the lives, societies, and world-views of some of these groups. See e.g., Cooper (1993a, 1993b), Mann (1979), Pandya (1990), Radcliffe-Brown ([1922] 1964). For a more comprehensive bibliographical review, see Chawla (1981).
numbers have dwindled, their lifestyles have changed, and some of them are facing extinction.\textsuperscript{158}

Recently one of the scientists testing various plants that the Onges use therapeutically discovered that they seldom suffer from malaria. Non-Onge populations, especially settlers, are far more prone to the disease. The tests revealed that a plant used by the Onge use against fever and gastro-intestinal disorders has anti-malarial properties as it contains a highly bioactive component against the \textit{Plasmodium falciparum}, the malarial agent. If the active ingredient in the plant can be isolated it may prove very useful for anti-malaria drugs, and very profitable for the pharmaceutical industry. The scientist belongs to the Regional Medical Research Centre (RCMC) of the Indian Council of Medical Research (ICMR), has not released the name of the plant the Onge use. The director of the RCMC would like the findings to be patented and publicized in his own name.\textsuperscript{159} The designs of the director, and the virtual erasure of the indigenous group as an agent in a struggle that is now reconfigured as between the Indian government and the RCMC, becomes especially ironic in light of pronouncements by Indian politicians. At a meeting of the Convention on Biological Diversity (CBD), the (the second Conference of Parties (COP-II) in Indonesia in November 1995), the Indian minister for Environment and Forests, Mr. Rajesh Pilot claimed that existing intellectual property rights regimes are insufficient to protect the interests of indigenous communities and that additional steps are necessary.

2. Property

Property can be defined as a relationship among actors with respect to thing (Bromley 1992). If I possess property in something, I possess the right and the capacity (an enforceable claim) to carry out one or more of a set of activities (access, use, consume,

\textsuperscript{158} See Mukerjee (1995)

\textsuperscript{159} The information I have used to describe the case is culled from Kothari (1995).
exclude, manage, even destroy) in relation to that object. I may, in addition, possess the right to delegate/ transfer my rights and capacities for a consideration. The right/ capacity to transfer is critical as a prerequisite to ownership. Rights and capacities are alienated in transfer and not objects or things. In visualizing property in this fashion, we automatically move beyond questions such as “Is property a bundle of rights (or powers)?” or “What is the bundle of rights that is crucial to constitute ownership?” What can own an element of a bundle? You can own all the elements in that bundle. Ownership of different rights and capacities will produce different kinds of effects in relation to some desired end.

Rights and capacities are always contestable - legally or through force and are often so contested through contradicting claims. It is at the sites of contestation that new allocations of property emerge. Rights and capacities are also always attenuated, but to differing degrees.\textsuperscript{160} Property is often viewed as falling into categories, while convenient as fiction to refer to broad classes of claims, are far too coarse to define the specificities of property relations. Further, such categorization often confounds two things: the allocation of particular sets of rights with the identity of actors in whom rights are vested. The distinctions between common private, and other categories of property, is more fruitfully made in relation and capacities that are conferred;\textsuperscript{161} “private” property may be attenuated rather than secure and complete, other forms of property may confer as complete a bundle of rights and capacities as “private” property (Agrawal, 1992).

In thinking the relationship between intellectual property rights and different form of indigenous knowledge resources a specific aspect of property has assumed valence and significance. By assigning to a person property in some object, the flow of benefits from that object can be allocated; that is, the incentive aspect of property. For property to serve as a mechanism for allocation, however, the following conditions must be fulfilled: a) the person must be a legally recognisable, b) the object must possess the capacity to create a

\textsuperscript{160} See Furubotn and Pejovich (1974: 4-6) and Barzel (1989) for a discussion of the motion of attenuation in relation to rights.

\textsuperscript{161} See McKean (1996) and Schlager (1990).
reliable flow of benefits, c) the assignment of property should be enforceable at a cost that is low in relation to the benefits from the object.

None of these conditions are easily fulfilled (if they are fulfilled at all) where property in indigenous knowledge resources is concerned. The paper seeks to address two other questions as well. First are there possible grounds, or common characteristics, that indigenous knowledge resources share, in spite of their phenomenal diversity? Second, do these characteristics, at some more fundamental level than practical difficulties in assigning benefit flow, vitiate well-intentioned attempts to use intellectual property rights as a device to “protect” indigenous knowledge? The provisional answer to both these questions is, “Yes”. I hope to provide a more nuanced and textured discussion in the course of reaching that conclusion.

3. Dilemmas of Indigenous People's Knowledge

In the past two decades, indigenous knowledge resources have moved from being seen as significant in their own right, primarily by anthropologists, to being identified as critical to the development of those who possess indigenous knowledge resources. As interest in “indigenous knowledge” has grown, a large and diverse group of scholars, policy-makers and business corporation officials, whose interests in indigenous knowledge is as diverse, recognize in them the possibility of profitable investment as well.

On the basis of their long-standing practice and use of particular biotic materials indigenous peoples can provide clues to resistant or productive crop varietals, insights into pest-control strategies and medicinal properties of plants, and point to other profitable opportunities. The knowledge or material is often available to a large number of people within a group, to the extent that the identity of the original “inventor” is unknown. The knowledge they possess may soon be lost forever as some of the groups are on the verge of
extinction. If utilized, to create products for a mass market, such knowledge it can yield significant profits.

This situation raises ethical and managerial issues that abound in ironies. If indigenous practices become valuable, those who have created this knowledge can lose them. Unscrupulous actor (read, large corporations) may gain the lion’s share by commercially marketing a valuable product based on the knowledge that initially came from indigenous peoples.\textsuperscript{162}

We have to consider how intellectual property rights could serve as a vehicle to promote the interests of indigenous peoples, and facilitate the production and circulation of indigenous knowledge—both within indigenous groups, and outside their social sphere. The Andaman case presents an identifiable group, whose claims to a specific bioactive agent are relatively uncontroversial. It shows the divergence of interest between national governments and specific indigenous communities\textsuperscript{163} by indicating the possible conflict between the Indian government and the director of the RCMC. It also raises questions about whether the Indian government will permit the patenting of the isolated anti-malarial active ingredient in the plant in the light of its anti-IPRs rhetoric and international fora, about who will own the patent on the basis of what claims (the Onge who have been using the plant and have known its properties? The scientist who “discovered” the plant? The director of the RCMC?) and, finally, about how potential benefits from the isolation of the active bio-agent will be distributed (what will the Onge become or how will infusion of cash into their hunting-gathering economy affect it?)

The likely loss of indigenous sources has prompted many advocates to suggest the use of intellectual ideas as property rights such as patents, to protect the rights of native populations. Such types of knowledge exist mostly in the South and the people have no access to laboratory science skills. So such populations often possess knowledge of

\textsuperscript{162} See Greaves (1994)

\textsuperscript{163} See Soleri et. al. (1994: 25-6) for the possible conflicts between interests of the local communities and the nation state. Such conflicts have been widely noted elsewhere as well (see Kloppenberg, 1996: 3).
agricultural or medicinal plants but do not have the capacity to actually manipulate these plants to isolate the appropriate bio-active agents, or gene sequence that confer specific characteristics. The questions that arise are: who possesses the rights to the benefits that might become available as the commercial value of indigenous knowledge resources rises? How are these benefits to be shared among the different parties? The ethical dilemmas would be less severe were indigenous populations not so much involved in the maintenance and protection of extant germplasm resources.

Advocates of intellectual property believe that property right will help indigenous populations gain the greater share of benefits from the uses to which their knowledge will be put (Greaves, 1994; Posey, 1990; Reid et al., 1992; Sedjo, 1988). This belief is based on the idea that innovations and knowledge are appropriate for patents and other forms of intellectual property (Sedjo, 1992; Vogel, 1994). The overall argument goes as follows: Unless inventors are rewarded for their efforts and investment in trying to create a new product that is useful to the society, they would have no incentives to innovate. If inventions become common knowledge, the returns on investment will be uncertain (Burge, 1984:27). Most economists would back indigenous knowledge on intellectual property grounds. Ethical and moral arguments, based on the notion that ownership of innovation rewards the inventor for the labour s/he has invested in his/her product, have been also made in favour of intellectual property.

4. Indigenous Knowledge and Intellectual Property

Profit motive becomes the primary objective of protecting indigenous knowledge. But there is a vast variety in forms and practices that could properly be classified as “indigenous knowledge”.

The different aspects and forms of indigenous knowledge possess quite different characteristics. Cultural practices shared and developed collectively but in uneven fashion by the members of a given community, make sense primarily in the context of the
community. Technical knowledge too develops collectively, but may be easily transferred to other contexts, when its utility in treating human, livestock, or crop diseases, raising productivity, or addressing some other specific objective is obvious. Biotic materials are listed as knowledge because their discovery often hinges on access to indigenous knowledge. Native populations have been instrumental in ensuring the continued existence of many crop cultivars and landraces by their conscious manipulation of flora around the World (Denevan and Padoch, 1987; Oldfield and Alcorn, 1991; Posey and Balee, 1989). An enormous range of plants that provide medical and food benefits might be extinct (or, at least far less common), were it not for the interventions of marginalized indigenous populations. Genetic materials, “discovered” through bio prospecting, occupy an even more ambiguous position since little human intervention might have occurred to ensure their continued existence. Ethical issues like compensation are, nonetheless, raised because such prospecting takes place chiefly in tropical countries by researchers from developed countries.

In their comprehensive collection of more than 70 papers about indigenous knowledge (Warren, Slikkerveer, and Brokensha, 1995), there is scarcely a paper that concentrates on “cultural practices” of indigenous peoples, thinks of indigenous knowledge in relation to the circumstances in which they are created, examines how abstraction (from the Latin abs = trahere + away + pull; to draw away, to take out) from their context might affect them, or addresses the uses to which such abstracted knowledge might be put.\footnote{See Perdue (1994)}

Intellectual property instruments such as patents or copyrights are poor tools to further the interests of indigenous peoples because of common characteristics that various forms of such knowledge share. In other words, intellectual property rights, especially in the forms of patents and copyrights, are institutions that are likely to fundamentally alter the existing social grounds from which indigenous knowledge innovations stem, and in the process transform precisely those characteristics of indigenous knowledge that currently marks them as different.
Scarcely any indigenous legal system contains provisions for safeguarding intellectual property. In making a more or less uncoordinated search of customary law in different times and places, I came across many descriptions of laws on land and marriage relations, adultery and inheritance, tax evasion and abuse of office, but references to protection of ideas seldom appeared (Bohannan, 1957; Holleman, 1952; Hooker, 1980; Fallers, 1969; Lewin, 1947; Schapera, 1938; Wilson, 1961). The absence of legal institutions to protect ideas and innovations is a feature of native cultures. Their social practices around innovations are likely to be co-operative in orientation, and resemble public goods in their characteristics. Brush, says of Quechua potato agriculturists, "they are rightly proud of their knowledge of potato agriculture and their wealth of potato diversity. Potato varieties are exchanged without concern for proprietary control ... Likewise, these peasants use varieties from scientific breeding programmes, without an intellectual property link anywhere in the chain between peasants and geneticists" (1996:150). He makes similar comments about exchanges in Turkey and Mexico. Or see Nabhan et al. who remark, "Many useful plants have left one cultural context to find a home in another. Few have been retained as the patrimony of only one family lineage, one farmer's field, or one medicine woman's bundle." (1996:187) Richards (1996) implicitly points to the freedom with which genetic materials were exchanged when he describes selection of rice varieties in West Africa.

If learnt by those who were not supposed to know it, legal recourse cannot be sought within the framework of customary law. Because indigenous knowledge is usually shared widely within a given group, secrecy is not likely to help “protect” indigenous knowledge from external uses. A second feature of indigenous knowledge resources is important as well. Dominant groups have expanded and expropriated the more fertile and higher-rainfall regions; indigenous groups have been pushed to the margins of development. They live beyond frontiers. Residing in forests, semi-arid and variable rainfall areas, and on the outskirts of irrigated and intensively farmed areas, these groups are and have been forced to survive in relatively isolated social and spatial environments. If developments and social
change have taken place unevenly around the globe, they are the peoples inhabiting the regions where Klee’s angel of History looks back on the “ruins” in his wake (Benjamin, 1968). In these environments, the indigenous populations have created institutional forms, cultural repertoires, and technical innovations. These are valuable to those who are interested in using and protecting indigenous knowledge. If these peoples could generate knowledge that seems valuable today, it is partially due to the lack of interest that they received from powerful social actors within the heart of capitalism and capital-intensive technological industries.

The extension of intellectual property protection to indigenous knowledge may result in erosion of indigenous knowledge and marginalization of indigenous populations that it is supposed to redress. Increasing reliance on capital and knowledge-intensive production, the constant search for a wider field of raw materials and market operations that are ever more dependent on intellectual products, the expanding circle of consumptive exchange based upon manipulation of symbols, all hinge upon the possibility of property rights in ideas and innovations. The intellectual property system, traceable to the beginnings of the industrial revolution, has similarly, continually helped expand the realm of what could be considered a commodity.

The appropriation of intellectual products from indigenous innovation will further reduce the diversity in productive relations and activities upon which indigenous innovation depends. One of the lessons of history of technological innovation is the multiplying requirement of capital for new innovations and more efficient production. The commodification of biodiversity and technical aspects of indigenous knowledge, thus, consumes its very source.

The urge to craft something novel and original, which would be an inalienable product of one’s labour and intellect, is ultimately to be traced to the transcendental will to realize

Ironically these are the areas which are seen to constitute the mega-diversity spots in the world (Alcorn, 1994; Balick et. al., 1994; Juma, 1989). In other words, there is a strong spatial correlation globally between biological and cultural diversity.
oneself. In several accounts, where indigenous peoples want nothing except the recognition of their contribution to the creation of a particular product, this very dynamic of the innovative self is at work (Soleri et al., 1994).

What is important to note, however, is that the legal personae that intellectual property rights offer are very different in nature from the demands of an aesthetic, “transcendental” self. The patent confers a negative right, which for the period that it is operative, would prevent others from benefiting from the fruits of the inventor’s labour. Unlike the self-realizing subject, whose work of art can never be alienated from him/her, the rights granted by patents are clearly alienable, as also are the benefits that might accrue from such rights. They are property. Nothing prevents them from being transferred for a consideration.

Certainly, these and other notions of what it means to constitute the self may be historically contingent. But the nature of the current historical contingency, in creating the notion of what is valuable in the indigenous, is quite unprecedented in the interactions of indigenous groups with those who are non-indigenous.

The loss of a collective orientation may not be a foregone conclusion. It depends on the manner in which rights are created, how communities as legal persons are constituted, the identity of the actors who enter into contracts, and the extent to which community representatives are accountable to community members. But as we have already seen, identifying individual indigenous innovators is likely to be extremely difficult owing to the hitherto collective and co-operative orientation of indigenous innovation. For the same reasons, enforcement of intellectual property, where property is vested in collective actors, is likely to be a quite difficult matter. As intellectual properties create incentives to align rewards with efforts, the co-operative orientation of indigenous knowledge production is certain to be undermined.

In making the argument that indigenous knowledge are in some respects, indeed, in some foundational respects, likely to be altered by the resort to the patents and copyrights system
it is important not to ignore the history of changes and exchanges, transformations and modifications, and shifts and resistance, that have marked them already. Had indigenous peoples not possessed remarkable capacities to change through the dynamics of their own social processes as well as in response to external influences, the work would already be a far more flattened one. What Tsing says, taking about Meratus travel and the negotiations between local and global discourses, might well be an allegory for negotiations between indigenous and non-indigenous cultures: “Meratus travel opens transcultural conversations that bring extra local concerns into local negotiations of leadership, gender and community. Travel creates heterogeneous Meratus histories situated unevenly within wider historical movements. The local character of Meratus travel does not isolates Meratus culture. Rather, Meratus travel stimulates critical reflection on the cultural specificity of metropolitan travel agendas” (1993:150).

The current concerns about the erosion of indigenous knowledge are, at root, concerns about the acceleration in the interactions of various indigenous groups with their non-indigenous neighbours. Ultimately, these concerns are driven by the terms on which indigenous peoples interact with their more powerful neighbours and with the bureaucratic and political actors in the nation - states in which they are re located.

Clifford, in his essay, “Ethnography as Allegory,” speaks of the ways in which certain grand themes persist within the ethnographic imagination (1986). To the allegorical themes he skilfully delineates- The noble vs. The corrupted savage, co-operative vs. Conflictual cultures, cultural loss vs. redemption, the exotic Other vs. The universal essence of Man - one might add “resistance and adaptation in response to intrusion vs. erosion and destruction as the result of contact”. In the literature on indigenous knowledge all of these allegories come together, seemingly in a welter of confusion, but perhaps also unconsciously crafted to match already existing visions. This creates the central paradox in textual representations of indigenous knowledge and peoples in relation to intellectual property rights. If all descriptions of indigenous knowledge are already prefigured, what credence can we place on these descriptions?
The allegorical readings to which one might subject the account of the “indigenous,” during the process of writing as well as in the moments of interpreting the written, also create effects of their own. To borrow a word from Saunders and Hunter (1991), such readings flatter the possibilities inherent in the trajectories of change all social groups undergo. The more important questions seem to relate to the terms and conditions under which change, or “negotiation”, takes place. Allegorical readings, however, shunt indigenous peoples and their actual experiences of the margins of the theoretical imagination in the very moment that the use of the “indigenous” allows them to be constructed. The choice, then, cannot possibly be between the allegories of “intrusion, resistance, and adaptation,” “and contact, erosion and loss”. Allegories are all equally inattentive to history.

In the context of intellectual property and indigenous knowledge, the lesson of history seems to be that patents and copyrights constitute an unprecedented alteration in the terms on which indigenous peoples have created innovations. The introduction of intellectual property is likely to force innovation towards a calculus of costs and benefits that is privately rather than collectively oriented.

I believe indigenous peoples, and those who wish to further the development of their knowledge are caught on the horns of a dilemma stemming from the current intense interest in their knowledge and cultures. Without control over their intellectual products, their knowledge stands to be appropriated without any material benefits reaching them. But by taking resource to intellectual property, even if some individuals, within indigenous groups capture gains as individual persons, their existing arrangements of knowledge production will be radically transformed. Ultimately, we must conclude that “indigenous” knowledge cannot survive as long as powerful economic and political actors are interested in its exploitation for commercial purposes.

Acknowledgments
I thank Sabine Engel, Julie Greenberg, Anil Gupta, Nancy Peluso, Kimberly Pfeifer, Steven Sanderson, James Scott, and the twins Holly and Amanda for troubling but provocative exchanges on this subject. The series of speakers at the Fall and Spring colloquia of the Program in Agrarian Studies at Yale University, excited many trains of thoughts which I am sure I have mish-mashed in unrecognizable ways in this paper. My apologies and gratitude to them. James Scott’s and other scholars continuing attempts to distinguish between different forms of knowledge troubled my earlier conviction that there is nothing at an epistemological level that can distinguish between any two categories of knowledge. Continuing conversations with the fellows at the Programme in Agrarian Studies - Paul Alexander, Jenny Alexander, Mary Beth Mills, Pauline Peters and Jesse Ribot have been useful for this paper. They should, therefore, share some of the criticism to which I will be subjected during the presentation of this paper. I thank them for this unvolunteered sharing of burdens.

References


**A Cooperative for Production and Marketing of Fruits and Vegetables at Sonai, District Ahmednagar (Maharashtra): A Model Linkage from Grassroots to State Capitals**

S. R. Gadakh and Y. S. Nerkar

The Co-operative movement in Maharashtra with its diversified base, coupled with enlightened leadership and membership, has earned a name for its success in technical and business terms as well as for providing a driving force in the rural and urban settings. Such institutions, based on the principle of mutual help, self-reliance and democratic

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166 Assistant Professor and Vice Chancellor  
Mahatma Phule Krishi Vidyapeeth, Rahuri 413 722, District Ahmednagar, Maharashtra
management, have played a vital role at the grassroots level in the realization of the goals of rural development and social equity. Co-operatives have diversified areas of operations like production, processing, marketing, service, etc. Economies of scale, vertical integration and bargaining power are supposed to be the major features of co-operative marketing societies in getting better price for farm produce.

The present paper seeks to delineate the overall performance and the spectacular strides made in the rural economy through the marketing of fruits and vegetables by the Shri Shanenshwar Fruits and Vegetables Co-operative Marketing Society since its inception.

**Genesis**

The village Sonai comes under Mula River Command and is located eastward at a distance of 20 km from the campus of the Mahatma Phule Krishi Vidyapeeth, Rahuri. In most of the command areas in Ahmednagar district, sugarcane is the predominant cash crop. Since 1988, the growers have conducted adaptive trials and demonstrations of various varieties of vegetables developed by the Mahatma Phule Krishi Vidyapeeth. These varieties were specially developed as per the market demands. It was the bumper crop of bitter gourd, improved variety of Coimbatore White Long with an intercrop of Cucumber (Poona Khira) on the farm of the Chairman of the Society, which attracted the neighbouring farmers to grow vegetables which subsequently posed the question of how best to market the surplus produce.

Owing to the problems experienced in marketing of vegetables to distant markets, the farmers started thinking of creating facilities like transport. This paved the way for establishing the present society. The Mahatma Phule Krishi Vidyapeeth helped the farmers in establishing the society and rendered all possible help in developing the linkages.

**Society**
The Society, viz., Shaneshwar Fruits and Vegetables Marketing Society, Sonai, came into being on 7th November, 1990 with an initial membership of 136 covering 23 villages of Newasa tehsil of Ahmednagar district in Maharashtra with the following objectives:

- To arrange for sale of fruits and vegetables in the distant city markets.
- To arrange for the supply of agricultural inputs (seeds, chemicals, fertilizers, equipment, packing materials, etc.) at reasonable prices to the members.
- To spread/disseminate the modern cultivation practices amongst the farmers.
- To provide guidance regarding pre- and post-harvest technology.

Activities of the Society

- The Society has a shop for supply of agricultural inputs, especially seeds, chemicals, packing material, etc. at a reasonable price. The quality seed material, timely operations, grading of proper packing ensure quality and fetch good price for the produce.

- At the beginning of the summer and Kharif seasons, group discussions of farmers are arranged with the university scientist and the merchants. The crops to be grown are decided as per market demand. Quality seed, produced under expert supervision is supplied to the members.

- In addition, every year, the Society arranges field visits to university farms. Scientists, government officials and bank officers have good liaison with the farmers. They visit the fields during the crop seasons.

- Meeting between merchants and the growers are arranged to get more remunerative prices. Major stress is given on grading and packing of market friendly varieties. Merchants’ tricks like late payment, rate fluctuation and weight reduction are excluded.
and good merchants are contracted to increase the producer’s share in consumer’s rupee.

- When production starts, the growers are given training for handling, grading and packing of produce. The Society keeps check on quality grading of the produce. This ensures higher prices for the produce in different markets, and maintains reputation of the society for the exportable produce.

- The Society has developed a system through which marketing of fruits and vegetables is arranged to ensure better prices. The Society has collection centres at three locations in the tehsil. The fruits are transported to markets at Mumbai, Surat, Delhi, Ludhiana, Amritsar, Calcutta, etc. At these markets, the Society has contracts with the traders. Option is also left to the members to sell their produce to other middlemen. In this case, the Society does not take the responsibility of payment. For transport of produce, the Society makes contract with the transporter once for a period of six months. For the daily supply of produce to the markets in the early hours, the Society and the merchants give special incentives to the drivers. Due to early arrival (before 6.00 a.m.), the produce fetches more price by nearly 10 to 15 thousand rupees per truck.

- Recently, the Society has purchased a shop in New Mumbai Vegetable Market for direct sale of the produce, avoiding the middlemen.

- The Samrat variety of bottlegourd, Hirkani and Green gold of bittergourd, Himangi of cucumber, Krishna of brinjal, Phule Jyoti of chilies are the prominent varieties, which scaled the peak of highest yields and returns as well (Tables 1 to 4). The Samrat bottlegourd has given the highest ever returns of Rs.1,75,000 per acre, whereas the Green Gold variety of bottlegourd and himangi of cucumber have each fetched Rs. 1,20,000 per acre within a span of seven to eight months. The crops are raised on a bower system. In case of fruits also, the society lays major emphasis on grading and
packing. Fruits sold by the society (pomegranate, grapes, ber, citrus, etc.) fetch better prices in Delhi market.

Thus this endeavour is an ideal example of agricultural production chain: development of market driven varieties → quality production → post harvest technology → transport → marketing.

Special characteristics of the Society

- The Society treats the farmers, whether member or non-member, on par as only 2 percent marketing commission is charged for both the categories. Most of the growers are small farmers, the average size of the plot being half to one acre.

- Politics is kept away from the working of the Society.

- Growers have special faith in the Society’s marketing, for it ensures better prices.

- The Society has shouldered the responsibility of crop, right from sowing to payment of the produce.

- The Society has developed strong linkages with the scientists, Government agricultural officers, bank officials and merchants. This is a valuable asset of the Society.

- The Directors of the society do not charge the society for official tours undertaken. The self-less working of Directors and full faith of growers have turned the Society into a society of high morale and achievements.

- The Society has ventured to start such endeavours of growers at eight different places.
• The annual turnover of the Society has reached to the sum of Rs.1.75 crores.

• The Society has been educating farmers from other villages, districts and states for the establishment of such societies in their areas. The Mahatma Phule Krishi Vidyapeeth, Rahuri has played a pivotal role in this regard.

**Future line of Action**

• The Society intends to established sale counters of fruits and vegetables initially at district places like Pune and Ahmednagar. This is to ensure a direct link of the producers with the consumers, safeguarding the interests of both. Presently, the Society has one such sale counter at Sonai and the response to such a venture. is encouraging.

• The Society plans to export fruits and vegetables on its own.

• The Society undertakes quality seed production of vegetables and in the near future, the work will be taken on commercial scale.

• The Society intends to encourage the farmers to increase the acreage under commercially important fruits and vegetables.

• The Society intends to undertake processing of surplus fruits and vegetables.

• It is proposed to have computer network for market intelligence up to the consumer’s level.

• The Society intends to encourage setting up of such societies by farmers in other areas. It is proposed to set up a network of such cooperatives for mutual help, mobilization of produce and encouraging competition.
Table 1: Acreage expansion of fruits and vegetables in the jurisdiction of the society

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Table 2: Average yield and returns from fruits during last six years

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<th>S. No.</th>
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<th>Pomegranate (Tonnes/acre)</th>
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<th>Citrus (Tonnes/acre)</th>
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Table 3: Average yield and returns from vegetables during the last six years

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<tr>
<td>1</td>
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<td>25</td>
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<td>14</td>
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</tr>
<tr>
<td></td>
<td>(Tonnes/acre)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Rate for quality produce (Rs./Kg)</td>
<td>Minimum</td>
<td>Maximum</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>3</td>
<td>Total returns (Rs. ‘000)</td>
<td>Average</td>
<td>Maximum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
<td>175</td>
<td>30</td>
<td>100</td>
<td>15</td>
<td>120</td>
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</table>

Table 4: Extension and interaction activities of the society

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<td>1</td>
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<td>12</td>
<td>12</td>
<td>8</td>
<td>12</td>
<td>10</td>
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<td>62</td>
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<tr>
<td>2</td>
<td>Farmers rally and field visits</td>
<td>8</td>
<td>10</td>
<td>16</td>
<td>8</td>
<td>6</td>
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<td>3</td>
<td>Farmers tours</td>
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<td>25</td>
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<tr>
<td>4</td>
<td>Farmers-Merchants meet</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>8</td>
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</tbody>
</table>
Looking from Within: Adding value to Chiuri

Pramod R. Dahal and Teeka R. Bhattarai

Introduction

Chiuri (*Diploknema butyracea*) or the butter tree grows in the sub-Himalayan region of Roxburgh Nepal. The tree is a treasured resource of the Chepang tribe. They give the tree as dowry. The tribe has different names for several varieties of this versatile tree. The fruit is eaten in times of scarcity.

Marketing the fruit at peak ripening is a problem as it is costly. It will result in loss of seeds that are used for extracting cooking oil.

The fruit pulp was collected in Kandrang, Valley of central Nepal to make a squash called ‘RASILLO’. It was produced on a trial basis. Preliminary study showed good market.

This product makes use of under-utilized resource, enhances the value of Chiuri, and supplements income of the farmers.

Chiuri occurs in the Mahabharat hills of Nepal (500-1400 m above sea level). Work is being done on Chiuri in Nepal, India and in western laboratories (SEACOW 1996; Shanmugasundarm and Venkataraman, 1985; Manandhar, 1978; Thapa 1987; Reddy and Prabhakar, 1994). Chepangs have the strongest socio-economic relationship with the tree.

Chepangs (Chgyobang) inhabit the steep terrain of the Mahabharat range and are one of the most studies groups of Nepalese. Chiuri is a multipurpose tree for a subsistence livelihood of this tribe.

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167 Food Technologist & Resource Manager, School of Ecology, Agriculture and Community Works (SEACOW)
This paper presents an overview how adding value to Chiuri influences the life of the Chepangs of the Kandrang Valley.

*The Chepangs and the Chiuri:*

Chiuri evolved from buffalo. According to a Chepang, a buffalo escaped from her shed at night and grazed on millet until she was full. As it was dark the buffalo lost its way and fell off a precipice and lay suspended. Nobody could pull it up. So it died the carcass rotted. And at that very place the Chiuri tree grew. Hence, the Chiuri fruit has white juice; the milk of buffalo and the fat (butter) obtained from seeds is buffalo butter. The small black grains found inside the fruit (in the pulp) are millet that was eaten by the buffalo on that night. The Chepangs consider Chiuri to be a milch buffalo.

*Nomenclature:*

Among the Chepangs, Chiuri is called “Yoshi” (yo - Chiuri and shi - tree). Domesticated or cultivated Chiuri is called Rang Yoshi as opposed to Ban Yoshi found in the forest. They have different identification to natural varieties (Table 1).

*Table 1. The Chepangs’ classification of Chiuri*

<table>
<thead>
<tr>
<th>Variety</th>
<th>Characteristics as used in identification by the villagers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thara Yoshi</td>
<td>Male Chiuri tree which flowers but does not bear fruit</td>
</tr>
<tr>
<td>Early variety</td>
<td>Ripens in April, lower fat yield, fleshy mesocarp and thick juice with strong</td>
</tr>
<tr>
<td>Wayo</td>
<td>Ripens following tomyo in May, more fibrous mesocarp and thinner juice with mild flavour</td>
</tr>
<tr>
<td>Langyo</td>
<td>Ripens following wayo in June, more fibrous mesocarp and much thinner juice with mild flavour. Includes two other varieties Malvayo : Flavour resembling banana; Vantayo : Large vanta (brinjal) like shape.</td>
</tr>
<tr>
<td>Chetyo</td>
<td>Ripens after langyo in July, fibrous mesocarp and thin juice with mild flavour</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Jaayo</td>
<td>Ripens at the last (August), blackish-yellow fruits, fibrous mesocarp, thin juice and mild flavour</td>
</tr>
</tbody>
</table>

**Distribution system:**

Ban Yoshi is both individual and collective property. It is treated as parental property. It is distributed equally among family members when a family splits. The right of the owner to harvest fruits and seeds is reserved upto Shrawan (mid-July) after which it becomes common property. Although Rang Yoshi is considered domesticated, owner of the tree is not necessarily the owner or the user of the field. Chiuri tree can be exchanged, sold or acquired, independent of the land on which it grows.

**Multiple Technologies - Multiple Utilization:**

The Chepangs have time-tested technologies for harvesting and processing different products of Chiuri. Drilling a hole in the trunk collects the sap. Glue is made of it for trapping birds. Fruits are plucked or brushed depending on intended use. Ghee is extracted from the seeds using a wooden device called *hepuwa*. Pulp is not processed for consumption even though villagers have adequate knowledge and skill to distil *rakshi* (local alcohol prepared by using *marcha*, the native yeast) and to squeeze Chiuri syrup (tobacco sweetener).

During peak season, only a small portion of fruit can be used. People prefer staple food as far as possible. Chiuri ghee as a substitute of cooking oil and as medicine for chapped skin, taeniapedis, etc. Surplus ghee is sold locally or at the roadside market. Cake (the by-product with pesticidal properties) is used as manure and fish poison.

People relish Chiuri nectar. In the flowering season, people harvest Chiuri honey, larvae and pupae not only from domestic hives but also from the forest. Besides these, people
catch bats, the meat of which is a delicacy among the Chepangs. It is also used as a protein supplement.

**Role of Chiuri in Economy**

Chiuri generates the hard-needed cash within the village to buy purchase minor essential household supplies such as salt. People sell Chiuri honey and surplus ghee without marketing techniques.

Among several derivatives of Chiuri, a large amount of fruit-pulp, which can fetch income, is being wasted, as they do not have the technology to utilize it.

**Initiatives:**

The School of Ecology Agriculture and Community Works (SEACOW) - laid emphasis from the beginning on ‘local resources management with goals of long-term sustainability’. One of them was to mobilize existing hydro resources. Expertise of Intermediate Technology Development Group, Nepal (ITDG, Nepal) was requested to conduct a micro hydro survey under GEF fund for setting up micro hydro plant in the valley. The survey revealed that even without the provision of other end uses of electricity, the use for lighting alone would make people worse off. An area where hydropower could be used immediately was for installing an electric oil-press to extract Chiuri ghee. The quantity of oil seed produced in the area and an overall study of the Chiuri derivatives was undertaken.

**Study on processing possibilities:**

We realised that Chiuri was losing its importance in the Chepang community. As the tree did not yield cash, people regarded their relationship with it as a symbol of backwardness.

A part of the SEACOW programme started with a view to adding value to Chiuri. This was focused on the study of processing possibilities of the pulp based on existing technologies.
Chiuri juice was extracted using *Chepuwa*, the traditional device for extracting ghee. Average juice yield was found to be four per cent out of average pulp content of 48 per cent of the whole fruit. This yield is satisfactory.

Several products such as dried fruits, juice drinks, squash etc. were tried out of pulp collected in Wasbang village. Their organoleptic qualities and the applicability and economic viability of the adopted technology were evaluated.

Finally, squash was assessed to be a product that could be processed out of available pulp. Formula for Chiuri squash was finalized and named “RASILO” {rich in *ras* (juice)}. Study is being carried out on its shelf life.

The selling price of a bottle of RASILO (excluding tax), manufactured in a plant with a capacity of 200 bottles per day, was put at Rs.29.93 ($0.52). This was calculated as the optimal one. The total capital investment was calculated at NRs. 1,83,000 ($3193) and working capital of NRs. 88,500 ($1544).

SEACOW aims to use RASILO to empower the people until they are able to mobilise, control their resources and handle relevant activities. Training was conducted in this valley, which included discussions and practices on processing possibilities of their marginal resources, techniques of food processing, concepts of value addition.

**Theoretical Dilemma**

Some doubts were raised on the shelf life. It was also felt that the juice extraction would not conform to high hygienic standards.

**The Ideal**
SEACOW aims to enterprise within the following broad framework:

- Not to use the activities that causes extinction/ over-exploitation of Chiuri
- Minimum of 50 per cent of the total profit should go to the primary producers
- That it does not exploit labour
- Not to launch the activities and develop technological options that have detrimental effects on ecology and biodiversity
- Methods of production to marketing should be transparent and empowering
- Create profitable small-scale business that people can comprehend
- Adopt a method for egalitarian distribution of the benefit

Lessons

*Enhancing the value of Chiuri:

Local people relish the squash “RASILQ” in the off-season. They are happy to find such product prepared from their endogenous resource, Yoshi. They have started speculating that they might have many other neglected resources in their forest that could be processed too.

*Supplementing income:

The cost breakdown of the product is given in appendix 1. It shows that Primary producer i.e. the owner of Chiuri juice gets Rs.4.2 ($ 0.075) for an amount of juice present in a bottle of squash. This comes to be around 15 per cent of the retail-selling price. The production of 1,000 bottles of squash needs 8640 kg of Chiuri juice. Since, there are 235 households in Kandrang Valley, distribution of 8640 kg juice among these households corresponds to about 37 kg/household. The owner receives Rs.444.00 ($ 7.75) on supplying this quantity of juice. This comes to be around 14 per cent of total average cash income of 3,080/family year (SEACOW, 93). 37 Kg of juice can be obtained from about 90 kg (about 3 doko) of
fully ripe, wholesome fruits (average yield of fruits per tree is 6 doko). Extracting juice has no effect on the seeds for yielding ghee and people can utilize them in their usual way.

All these activities were carried out with the involvement of the people. Procedure was made accessible to them. Preliminary study showed good market for “RASILIO” that strengthened people’s confidence.

References


Appendix

Appendix 1; Cost breakdown of a Bottle of “RASILO”

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost(Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juice</td>
<td>4.32</td>
</tr>
<tr>
<td>Sugar</td>
<td>8.31</td>
</tr>
<tr>
<td>Acid</td>
<td>1.24</td>
</tr>
<tr>
<td>Other ingredients</td>
<td>0.18</td>
</tr>
<tr>
<td>Bottle and cap</td>
<td>5.80</td>
</tr>
<tr>
<td>Label and gum</td>
<td>1.33</td>
</tr>
<tr>
<td>Personnel cost</td>
<td>1.90</td>
</tr>
<tr>
<td>Overhead cost</td>
<td>3.21</td>
</tr>
<tr>
<td>Building rent</td>
<td>0.31</td>
</tr>
<tr>
<td>Depreciation of equipment and furniture</td>
<td>0.15</td>
</tr>
<tr>
<td>Interest of the taken loan</td>
<td>0.47</td>
</tr>
<tr>
<td>Total cost of RASILO</td>
<td>27.21</td>
</tr>
<tr>
<td>Community Development Fund (10 per cent)</td>
<td>2.72</td>
</tr>
<tr>
<td>Selling price of the Institute</td>
<td>29.93</td>
</tr>
</tbody>
</table>
Conservation of Forest and its Biodiversity by using Plantation Grown Processed Eucalyptus Timber

S. L. Dabral

The Indian forests, which are spread over tropical to alpine climatic zones, are rich in biodiversity. They are the primary source of timber, fuel wood and raw material for forest-based industries. The forests are dwindling due to increasing human and cattle population. The demand and supply gap of forest products is increasing daily. Restocking the forests and promoting agro-forestry are the only remedies. The choice of tree species for agroforestry is limited, as the trees have to be fast growing, should not compete with crops for water and nutrients should not host pests and diseases and should not attract birds. Eucalyptus is most popular species and vast plantations exist in Punjab, Haryana, U.P., M.P., Maharashtra, Karnataka, Gujarat, etc.

Eucalyptus is mainly used as fuel wood, scaffolding material and in places around paper mills as pulpwood. These uses do not bring attractive returns to the growers. Eucalyptus timber sawn under conventional method suffers from defects like cracking, splitting, warping, etc. If these defects are rectified eucalyptus could be used as timber for construction, furniture, doors and windows.

The Indian Council of Forestry Research and Education (ICFRE), Dehra Dun, has developed cost effective technologies to overcome the defects mentioned above. The technologies include radial and balanced tangential sawing, seasoning, preservation, ammonia plasticisation (for bending), and ammonia fumigation (for improving decorative value). In this paper, the properties of unprocessed Eucalyptus timber have been compared with other popular timber species and their suitability classifications for different uses have been given. The properties and suitability reclassification for Eucalyptus after its processing has been worked out.

Dy. Director General (Extension), ICFRE, Dehra Dun

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168 S. L. Dabral

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The use of eucalyptus as timber will enhance the income of the farmers to the extent of 50% or more internal rate of interest from the present 25%. Adoption of Eucalyptus will go a long way in conservation of existing natural forests and their biodiversity and restoring the ecological balance.

**Introduction**

There are 77.01 million hectares of recorded forestland, which works out to 23.42% of the geographical area of the country. According to the 1995 assessment by the Forest Survey of India (FSI), the actual forest cover is 63.96 million hectares (19.46% of geographical area). This includes forest cover in the recorded forest area and outside it. Out of the 19.46% total forest cover, the dense forest cover is only 11.73%. The forest cover is not evenly distributed in the country and it is far below the 33% envisaged under National Forest Policy. Ninety million domestic animals graze in forests, which is far beyond their carrying capacity. Besides, fire is the other single largest source of injury to the forest. There is a decrease of 507 km² in forest cover according to the assessment by FSI over a period of two years (1995 assessment).

*Growing stock, Demand and Supply*

The estimated growing stock for the country is 4741 million m³ and the annual increment is 87.6 million m³ as per estimate made by Forest Survey of India. Annual production of wood is 0.7 m³/ha that compares poorly with the world average of 2.1 m³/ha. Due to loss of forest cover this productivity too is adversely getting affected. Current annual production of fuel wood in the country is 40 million m³ against the estimated demand of 235 million m³. The industrial demand for wood is 27.58 million m³ against the production of 12 million m³.

*Biodiversity*
There are 221 ecologically stable forest types available in India in tropical, subtropical temperate and alpine climates. Over 45,000 species of plants occur in the countries which are 7 % of the species of the world, of which 1500 plants species are endemic to India. Animal species found are about 81,000, representing over 6.4 % of the fauna of the world. A vast living marine life flourishes in its offshore exclusive economic zone. Bamboo species numbering 113 occur in the country, which is the largest bamboo resource of the world. Bamboo forms an understory in tree forest cover over an area of 9.57 million ha. 7 % of mangroves of the world occur in India.

What measures can save forest, environment and biodiversity from degradation?

Reforestation and afforestation of degraded areas, social forestry schemes are going apace. Green felling and use of wood as fuel, building furniture etc are discouraged. No conservation measures will work unless people are provided wood according to their requirement. The solution lies in producing timber and fuel wood by raising plantations of fast growing species in private areas under agro forestry and social forestry on community lands in the villages, roads and canal sides and homestead, etc. For growing trees on private land, suitable motivation like remunerative price is needed. This is possible only when the farm grown trees are also used as timber and not merely as firewood species. No doubt the need for firewood is very large but it fetches low price and, therefore, firewood plantations are not popular with the farmers.

Eucalyptus remains the single largest preferred species. Eucalyptus at short rotation is categorized as juvenile wood and can be used for making doors, windows and furniture and also as construction wood will reduce pressure on the forests. The processing has vast potential to provide employment opportunity in form of small scale/cottage industry. Wood is a unique bio-product and dissuading people from using it (by switching over to non-bio products like fossil fuel and metal) is fraught with dangerous consequences in the long run. CO₂ released in atmosphere by burning a felled tree is absorbed fully by the new tree raised to replace it. Felling and regenerating trees maintain the CO₂ cycle in nature and, thus, the
ecological balance. The industries that consume fossil fuel emit 652 million tonnes of CO$_2$ per annum in India. This emission of CO$_2$ in India (by a rough estimate) is equivalent to destruction of 13,039 km$^2$ of mature forest per year.

**Suitability of Eucalyptus as timber:**

The following tabular statement gives suitability of *Eucalyptus tereticornis* as timber as compared to other popular timber species:

**Table 1: Suitability Indices for various Timbers with Teak as 100**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Timber</th>
<th>Weight</th>
<th>Strength as beam</th>
<th>Stiffness as beam</th>
<th>Suitability as post</th>
<th>Shock resisting ability</th>
<th>Retention of shape</th>
<th>Sheen</th>
<th>Hardness</th>
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<tr>
<td>1</td>
<td>Teak</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Padauk</td>
<td>105</td>
<td>100</td>
<td>105</td>
<td>105</td>
<td>105</td>
<td>115</td>
<td>130</td>
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</tr>
<tr>
<td>3</td>
<td>Sissoo</td>
<td>115</td>
<td>90</td>
<td>80</td>
<td>80</td>
<td>140</td>
<td>80</td>
<td>135</td>
<td>130</td>
</tr>
<tr>
<td>4</td>
<td>Chir</td>
<td>85</td>
<td>70</td>
<td>85</td>
<td>75</td>
<td>80</td>
<td>65</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>5</td>
<td>Mango</td>
<td>95</td>
<td>70</td>
<td>80</td>
<td>75</td>
<td>100</td>
<td>95</td>
<td>105</td>
<td>90</td>
</tr>
<tr>
<td>6</td>
<td>Deodar</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>85</td>
<td>60</td>
<td>85</td>
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<td>60</td>
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<td>100</td>
<td>65</td>
</tr>
<tr>
<td>8</td>
<td>Bijasal</td>
<td>115</td>
<td>105</td>
<td>95</td>
<td>95</td>
<td>135</td>
<td>75</td>
<td>115</td>
<td>135</td>
</tr>
<tr>
<td>9</td>
<td><em>Alzizia procera</em></td>
<td>95</td>
<td>85</td>
<td>80</td>
<td>85</td>
<td>140</td>
<td>75</td>
<td>130</td>
<td>105</td>
</tr>
<tr>
<td>10</td>
<td><em>E. tereticornis</em></td>
<td>110</td>
<td>75</td>
<td>70</td>
<td>65</td>
<td>115</td>
<td>60</td>
<td>90</td>
<td>115</td>
</tr>
</tbody>
</table>

It will thus be seen that Eucalyptus compares well with many of the popular timber species listed above. The classification of the above species for various purposes is as under;
Table 2: Utility Classification of Various Timbers

<table>
<thead>
<tr>
<th>S.No</th>
<th>Timber</th>
<th>Construction</th>
<th>Door/ window shutters</th>
<th>Door/ Window frames</th>
<th>Furniture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Teak</td>
<td>II</td>
<td>S</td>
<td>I</td>
<td>S</td>
</tr>
<tr>
<td>2</td>
<td>Padauk</td>
<td>II</td>
<td>S</td>
<td>I</td>
<td>S</td>
</tr>
<tr>
<td>3</td>
<td>Sissoo</td>
<td>III</td>
<td>S</td>
<td>I</td>
<td>S</td>
</tr>
<tr>
<td>4</td>
<td>Chir</td>
<td>III</td>
<td>II</td>
<td>II</td>
<td>III*</td>
</tr>
<tr>
<td>5</td>
<td>Mango</td>
<td>III</td>
<td>II</td>
<td>II</td>
<td>II*</td>
</tr>
<tr>
<td>6</td>
<td>Deodar</td>
<td>III</td>
<td>I</td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>7</td>
<td>Toon</td>
<td>III</td>
<td>II</td>
<td>II</td>
<td>II</td>
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<tr>
<td>8</td>
<td>Bijasal</td>
<td>II</td>
<td>II</td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>9</td>
<td><em>Alzizia procera</em></td>
<td>III</td>
<td>S</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

S - Super grade. I,II,III are the grading as standardized by ISI

* - Timber species to be treated

# - Durability with treatability not known. (ISI). Also refer Table 3 (a).

Constraints in using eucalyptus as timber and technological innovations to overcome them

Eucalyptus was primarily grown to meet the demand for firewood, pulp, props, or poles for construction activities. Sale of Eucalyptus fetches 25% interest rate of return (IRR). However, if Eucalyptus could be used as timber for making doors and windows and furniture, the returns from sale of trees would be to the tune of 50% (IRR). Besides defects like splitting, eucalyptus timber is subject to white ant attack. Suitable sawing technique, seasoning and preservative treatments can improve the quality of Eucalyptus timber. Bending technique makes it possible to produce attractively designed furniture at economic price with no loss of wood. Ammonia fumigation technique can be used for enhancing decorative value of wood. In expensive doors, windows and furniture will find popularity among middle and low-income group, schools, offices, etc. Various processes to enhance
the suitability of eucalyptus for construction, door/window shutter and furniture are as under:

(a) *Removing mechanical defects in eucalyptus by radial sawing:*

Radial and balanced tangential sawing techniques were found to be most successful. Radially sawn Eucalyptus becomes comparable with other superior timber and is free of defects like cracking, splitting, bending etc.

(b) *Seasoning:*

Seasoning of wood is one of the critical processing requirements to ensure satisfactory service from manufactured wood products. Freshly cut wood contains a large quantity of moisture, which starts evaporating immediately after cutting. During evaporation timber undergoes shrinkage causing cracking, splitting and warping which can, however, be largely eliminated under controlled conditions of drying. Controlled drying of timber is called seasoning.

Seasoned timber is lighter as well as stronger in most of the strength properties. Seasoning also improves impregnation of preservatives, gluing, finishing painting and polishing as well as electrical and thermal insulation properties of wood.

*Seasoning of eucalyptus:*

Central heart portion in Eucalyptus is appreciably weaker than rest of the wood, which cracks and often collapses during seasoning. Therefore, special care has to be taken for defect free drying of Eucalyptus in steam-heated kiln. Freshly sawn timber of Eucalyptus should be properly stacked in the kiln over battens. The stack inside the kiln should be uniformly weighted on its top using a load of at least 400 kg per square metre. The following seasoning schedule is followed for drying 25 mm are first air seasoned for 60 to
90 days to a moisture content of about 25-30 % and then kiln seasoned to a moisture content of 12 %.

Table 3: Schedule of Seasoning of 25 mm thick Eucalyptus planks

<table>
<thead>
<tr>
<th>Moisture content of the wettest timber on air inlet side %</th>
<th>Temperature (°C)</th>
<th>Temperature (°C)</th>
<th>Relative Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dry bulb</td>
<td>Wet bulb</td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>43</td>
<td>40</td>
<td>82</td>
</tr>
<tr>
<td>50</td>
<td>45</td>
<td>40</td>
<td>77</td>
</tr>
<tr>
<td>35</td>
<td>49</td>
<td>43</td>
<td>69</td>
</tr>
<tr>
<td>25</td>
<td>55</td>
<td>45</td>
<td>55</td>
</tr>
<tr>
<td>20 to final</td>
<td>60</td>
<td>45</td>
<td>42</td>
</tr>
</tbody>
</table>

In addition to initial and final steaming for 4 hours and intermediate steaming for nearly 4 hours at 55° was given during the process of seasoning in a steam heated kiln.

(c) Preservative treatment:

FRI has been able to overcome the refractory problem of Eucalyptus by giving preservative treatment. This is a simple soak treatment in a new preservative system using ammonium hydroxide as a base solvent for copper sulphate and arsenic trioxide. This process yields good penetration (i.e. 10 kg/m³ in outer shell) of the preservative in the heartwood in 16 days. The recommended dose of 4 kg/m³ for doors, windows and furniture could be achieved in simple soaking with adequate penetration in 8 days.

(d) Plasticisation of Eucalyptus for bending:

Furniture of attractive designs is made by use of bent wood. For bending thick pieces of solid wood softening with steam or plasticising with chemicals is essential. Only a few
Indian tree species are amenable to steam bending. FRI, Dehra Dun, carried out research on wood bending through vapour phase ammonia plasticisation. This technique has been found useful for wood bending in case of Eucalyptus.

(e) *Enhancing decorative quality by ammonia fumigation:*

The utilization of eucalyptus for uses other than pulp and paper was made possible through extensive research on wood processing. Wood working properties of Eucalyptus are comparable to teak and the surface of this wood takes up polishes to high gloss levels. Its introduction for quality furniture manufacture has been made possible by evolving a simple, inexpensive and effective technique of ammonia fumigation which brings out the latent figures and provides to it a walnut look, suitable for high class timber works.

In ammonia fumigation, end products are exposed to ammonia vapours prior to polishing at root temperature in an airtight fumigation box or chamber for 12 to 48 hours or even more depending upon the depth of the shade desired. This cost of these treatments works out to be about Re. 1.00 per furniture item like chair, table and also for doors. For handicraft items (turnery) the cost is much less and varies from 10 to 50 paise per item.

**Upgrading utility classification of Eucalyptus after treatment**

**Table 4(a): Suitably indices for door/window shutters with teak as 100%**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Group II species</th>
<th>Group II (b) species</th>
<th>Before treatment</th>
<th>After treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength coefficient</td>
<td>&gt;= 70</td>
<td>&gt;= 60</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Weight</td>
<td>75-125</td>
<td>75-125</td>
<td>110</td>
<td>110</td>
</tr>
</tbody>
</table>
Thus, eucalyptus before treatment comes under Group II (b) and after treatment Group II.

* Natural durability classification:
I. Timbers having average life of 120 months.
II. Timbers having average life to 60 to 119 months.
III. Timbers having average life of 59 months and below.

# Treatability classification:
a) Heartwood easily treatable.
b) Heartwood treatable but complete penetration of preservatives not always obtained.
c) Heartwood only partially treatable.
d) Heartwood refractory to treatment.
e) Heartwood very refractory to treatment penetration being practically nil from side or end.

Table 4(b): Suitability indices for furniture with teak as 100%

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Group I species</th>
<th>Group II species</th>
<th>Group III species</th>
<th>Before fumigation</th>
<th>With fumigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
<td>&gt;= 75</td>
<td>&gt;= 65</td>
<td>&gt;= 50</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Weight</td>
<td>85-110</td>
<td>70-120</td>
<td>60-130</td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td>Grain, texture, finish, polish, general appearance</td>
<td>Very good</td>
<td>Good</td>
<td>Satisfactory</td>
<td>Satisfactory</td>
<td>Good</td>
</tr>
</tbody>
</table>
Conclusions

Eucalyptus as construction wood without any processing already compares well with teak, padauk, and Bijasal. (Table 2). With preservative treatment it can be recategorised under group II, and can be compared with Chir, Mango and Toon for making doors and window shutters which are already in wide use in villages in the respective zones. Eucalyptus furniture has been made on trial basis by ICFRE. From appearance and polish they compare well with Group II species like haldu (Adina cordifolia) deodar (Cedrus tiliifolia), rubber wood (Hevea brasiliensis) kunju (Holoptelea integrifolia), sandan (Ougeinia oojeinensis), pali (Palaquim ellipticum), makai (Shorea assamica), hollock (Terminalia myriocarpa), toon (Toona ciliata). Use of eucalyptus after processing and treatment as timber will have profound and positive impact in reducing pressure on forests and conservation of biodiversity.

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The author is grateful to Shri S.S. Rajput, Head of Division, Wood Products Division, FRI, Dehradun, and Shri S.C. Pant, Scientist of Directorate of Extension, ICFRE, Dehra Dun for their valuable help in writing this article.

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Bridging the Innovator-Firm Gap for Commercialization of Grassroots Innovations:
Drawing Lessons from a Study of a Targeted Technology Financing Scheme in India

Ganesh N. Prabhu

Some grassroots innovators in India distribute their innovations freely for others who cannot either sell their innovations on their own or interest industrial firms to do so. This poses a problem. This inability may be due to lack of contacts with firms and knowledge on how to go about it. Even when the information gap is met, the reluctance of the industrial firm to take up the entire financial and technical risk of the project can reduce the chance of the innovation’s marketability.

Thus, there is need for a new institution or an existing institution to provide additional financial, technical and administrative resources to the entrepreneurial firm and the innovator. The institution can act as a bridge between the grassroots innovator and the firm. What should be the nature and role of such an institution? What resources should it have and how should it build these resources?

This paper proposes tentative answers to important questions on the scope of such aid based on an earlier successful innovation technology-financing programme in India. The programme was initiated by an Indian developmental financial institution and targeted at supporting industrial firm-technology institution joint-technology development projects to facilitate long-term interaction between the two organizations.

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Such initiatives can promote indigenous knowledge from the grassroots and bridge the innovator-firm gap, reward grassroots innovators and facilitate entrepreneurship targeted at sustainable development.

**Introduction**

Information gaps in marketing grassroots innovation are often met in an ad hoc manner - by accident through an expensive search process. Even after the gap is met, lack of financial resources and inability of the grassroots innovator or the industrial firm to reach the market persists.

This paper seeks to suggest tentative answers to important questions by deriving lessons from an earlier study (Prabhu, 1996a) based on a successful innovations technology-financing programme in India. It may be mentioned here the programme itself was not the focus of that study, it merely provided the research site for the study. The programme, called the Sponsored Research and Development (SPREAD) programme was initiated by the Industrial Credit and Investment Corporation of India (ICICI), an Indian Developmental Financial Institution (DFI) and targeted a private or public institution which provides promotional and medium - and long-term finance to public or private development oriented and bankable projects (Pandey, 1983).

This programme and its implementation have important lessons for supporting grassroots innovations for sustainable development. Such initiatives can promote of indigenous knowledge from the grassroots, bridge the innovator-firm gap, and reward grassroots innovators.

This paper first presents the Indian context of the technology financing programme and the support structure that exists in the country for Technology Institution (TI) firm. It then presents the background and structure of the SPREAD programme, ICICI’s experience, including the project selection process and the activities subsequent to the sanction. The
benefits as seen by both sides are considered and the potential contribution of the programme.

**The Indian Context for the Programme**

India has many TIs that cater to diverse areas of specialized technology development and industrial research. Many TIs have several new products and processes but their record of technology transfer to the industry for commercial exploitation has been poor (Alam and Langrish, 1984; Lall, 1992). Before the economic liberalization of 1991, TIs supported financially by the government were under no compulsion to sell their technology to earn revenue. There was little incentive for Indian firms to use indigenously developed technology as they faced little or no competition from the latest technology. Goods made by them were through low-cost and often outdated technology imports. After liberalization, the government-supported TIs have started interacting with institutions, which are profit-oriented like universities and those dealing in technology research and development.

They are seeking more commercial outlets for their R&D output and expertise. Indian firms have to pay more for technology imports due to rapid currency devaluation. This in turn has made them to go in for low-cost R & D. Firms and TIs are now eager to establish mutually beneficial linkages. The Indian government and DFI s have also taken an active role in promoting such arrangements.

The grassroots innovators, like the TIs in the case above, seek commercial outlets for their innovation. There is first the information gap. Then there is the need for upgrading the grassroots innovation and diffusing it over a larger user population to make it commercially viable. There is, therefore, a strong case for external support.

**Support Structure in India for TI-firm Interaction**
The government has supported interaction between industrial firms and TIs by subsidizing financing of TI-firm R&D contracts by giving a higher tax credit for R&D expenses paid to TIs compared to in-house R&D expenses. A similar incentive from the government can boost commercialization of grassroots innovations.

The major DFIs in India give conditional grant or concessional loans to firms for technology development and enterprise creation activities with the help of Indian TIs. Under technology development, DFIs provide firms and TIs multiple and complementary types of support (Prabhu, 1994) like
(a) Educational support by training entrepreneurs and technical personnel in India and abroad,
(b) Technical support (consultancy and development of project profiles),
(c) Information support through making people aware of business opportunities,
(d) Infrastructural support by providing expensive common testing facilities to groups of firms on rental basis,
(e) Planning support – e.g., assisting in the development of feasible and efficient project plans.

Besides these there is the managerial support like assistant in the administration of projects and turnarounds. Financial purchasing interactional is the other types of support. The DFI also adds value (Lam, 1991) by collaborating with the firm in implementing the venture by actively providing managerial and knowledge support throughout the product/process development and possibly the market launch period.

The DFIs should explore the possibility of supporting both grassroots innovators and firms in the important process of commercializing grassroots innovation for sustainable development in a similar manner.

**Background and Structure of the Programme**
The ICICI was selected by the Indian government and the World Bank as an agency to implement US$ 200 million Industrial Technology Development Project (ITDP) being funded by the World Bank. The objectives of the ITDP are “to provide functional support for technology imports, to strengthen the science and technology imports, infrastructure and make it relevant to industry and to promote innovation financing” (Najmabadi and Lall, 1995 p.90). One of the programmes under ITDP is the US$ 15 million SPREAD programme, a pilot programme of the World Bank. This description of the SPREAD programme and the ICICI in its implementation presented subsequently in this paper draws extensively from interview with ICICI officers implementing SPREAD programme and interviews with project participants conducted for the study (Prabhu, 1996a). The ICICI brochure on the SPREAD programme, the appraisal and documentation formats and a World Bank assessment report (Najmabadi and Lal, 1995) are also used. Verbatim references to these sources are avoided, except where necessary.

The SPREAD programme is unique in that the World Bank has attempted such a scheme for the first time. The ICICI manages a revolving fund. The objectives of the programme (ICICI, undated) are:

(a) To encourage industrial firms to increase their R&D activities,
(b) To foster closer links between industry and technology institutions,
(c) To utilize the existing infrastructure in technology institutions to the fullest extent possible,
(d) To assist industrial firms in improving the cost effectiveness in R&D projects and
(e) To assist industrial firms in shortening the R&D project cycle.

A similar support programme for the commercialization of grassroots innovation for sustainable development could probably be started with the aim of encouraging industrial firms to substantially increase their R&D activities based on grassroots innovations.
The types of projects that are eligible for SPREAD support are (ICICI, undated): new product or process development, improvements in an existing product or process and upgrading a technology developed by a TI. Funding is possible for pre-feasibility studies, laboratory trials and prototype building and pilot plant operations. The projects should have feasible and quantifiable objectives, should not take more than 18 months to two years and there should be a clear division of activities between the industrial firm and the TI. The firm contributes 50 per cent of the investment, while the ICICI contributes the rest as a conditional loan to be written off at the discretion of the ICICI if the project fails. The maximum assistance for a firm is Rs.15 million on condition that it does not exceed the net annual increase of the average R&D projects. It is charged at the rate of six per cent per annum during the project implementation and at 15 per cent per annum on conclusion of the project- to be repaid over up to ten years after commercialization. Disbursement of fund is closely coordinated with the successful achievement of benchmarks given in the proposal and agreement (ICICI, undated). This basic structure can be adapted without any major change in the case of a similar support programme for the commercialization of grassroots innovations for sustainable development.

**Experience in Programme Implementation**

The SPREAD Programme was started in 1991. The ICICI gave low cost loans to over eighty-five firms in its first four years. As these loans are repayable conditional to project success, the ICICI takes part of the project risk and acts as a catalyst for the joint activity. The ICICI also adds value to such R&D project through managerial support using expertise developed over multiple projects and specialized training (Prabhu 1996a). The SPREAD programme has met with some success in the task of reducing the gap between the potential existing in the TIs and their exploitation by firms (Business India, 1993).

The ICICI organized a seminar to which industry CEOs were invited to launch the Programme. Similar seminars were also organized through ICICI’s zonal offices in a number of cities. The ICICI team also participated in seminars organized by the industry.
They prepared brochures on these programmes and sent them to all major industrial clients of ICICI which were doing R&D, industries, which had the Department of Scientific and Industrial Research (DSIR) recognised R&D units and industry association. To update their list for sending brochures on a continuous basis they check which companies are recruiting R&D professionals and follow up on companies through magazines and industry association publications. TIs also send them a report, which name firms involved in consultancy projects. The ICICI is actively promoting the scheme to firms and TIs (Business India, 1993). The larger firms are in regular contact with the ICICI as it is their institutional investors. This applies to other financial firms, too. ICICI representatives are on the board of such firms. These firms come to know about the SPREAD programme through these contacts. Other firms not having contact with the ICICI, come to know about the SPREAD programme through articles in industry journals or association circulars. As the programme was new, the ICICI did not have a wide choice of proposals in the initial years of the programme (Prabhu, 1996a). The publicity mechanism for a similar support programme for grassroots innovations has to be different.

The implementing organization would have to seek the help of regional and national level networking organizations such as NGOs with linkages with innovators spread across the country.

The SPREAD programme is implemented by a team headed by a general manager of the technology group at ICICI, Mumbai. It administers the programme along with other technology development programmes. The general manager monitors the evaluation of SPREAD project proposals from firms. They are placed before the ICICI approvals committee of which he is also a member. He is assisted by four project coordinators from ICICI each of whom is allotted roughly a quarter of the projects, according to their interest and technological competence. They have basic engineering qualification and between four and five years of industrial experience in new product development, engineering, production, quality control and technology transfer. Projects from fields other than those of
their basic technical qualification or experience are evenly distributed. The coordinators seek the help of each other and other technically qualified and experienced people within and outside ICICI. They help the firm develop the project and once approved monitor the progress and control disbursement of funds according to the norms of SPREAD (Prabhu, 1996a).

In the case of support programme for grassroots innovations, the programme implementation team should not only have basic technical and managerial qualifications and experience, but also some experience of grassroots organizations. This would help them develop a deeper understanding of the social and ethical dimensions of the grassroots innovation process (Pastakia, 1996).

**Project Selection Process**

The firm holds discussions with the ICICI coordinators to assess the eligibility of the project before preparing a preliminary proposal (Prabhu, 1996a). The brochure given to the firm includes a proforma for preparing the preliminary proposal by ICICI in its preliminary proposal for financing under the SPREAD programme (given in the Box below).

**Box: List of preliminary Proposal Details (ICICI, undated)**

| Name and address of firm, brief particulars of the firm, latest audited annual report, research and development done by firm including major areas of R&D brief description of R&D facilities, current R&D budget, number of persons engaged in full time R&D activities, major R&D achievements, brief particulars of R&D projects sponsored in the past by the firm with technology institutions, project title, uses of project process, innovative content, name and designation of person in charge of R&D programme in firm, name and address of TI, key persons in the TI who will be involved in the project, major steps involved in the R&D project, break-up of major activities to be undertaken by |
the firm and the TI, aim of the project in quantitative terms, economic justification for undertaking the project, outlay on project at firm, outlay on project at TI, schedule of implementation of R&D project, cost of commercialization of R&D project, time required for commercialization, and expected sale from the commercial venture.

The ICICI team normally rejects a proposal if the development content is low and if material availability is likely to be a problem. Care is taken to see there is no duplication of the product. In order to push through a proposal, there should be clear division of responsibility between TI and firm and the gestation period should be two or three years. The market should be established.

Another important thing is the promoter’s background should be good on the financial front. Smaller firms are required to identify the customers and have a dialogue with them. The ICICI checks whether the basic guidelines are being followed. The project is screened on programme guidelines. Based on their experience, the ICICI team also assesses the technical feasibility of the project.

During the first few projects under the SPREAD programme, ICICI realized the difficulties in using a common format due to industry and technology differences. So instead of expanding the common format, customized formats were then developed for subsequent projects. While the detailed proposal formats are customized to each firm and project, the customization is largely with regard to the project technology. The other details are largely common across all formats (Prabhu, 1996a).

The ICICI project coordinators visit the firm, examine the facilities at the firm and meet the project participants. They look into what the firm is currently doing, the quality levels, capability, R&D structure, organization etc. They also talk to the customer if needed. They then visit the TI jointly with the firm personnel, meet the TI scientists and examine the TI’s facilities.
Then the ICICI project coordinator and the general manager prepare the project appraisal report with their recommendations. It is circulated among the sanctioning board members - consisting of directors of technology industries and ICICI directors ten to fifteen days before the board meeting. The project it then discussed and if needed the firm and/or TI representative is asked to make a presentation. The board questions the project appraisal team or the industry representative who attends the meeting to try and get the entire picture. The board meeting is only at the final stage of project selection. Separate meetings are also held later with some board committee members, if necessary (Prabhu 1996a). “In selection we look at a large number of variables such as promoter, company, scientist, product, market, background and given this high complexity there is no clear model to guide us about which project to approve,” said one of the programme coordinators (Prabhu, 1996a).

A similar approach is essential in the case of grassroots innovations. Under the SPREAD Programme, the firm approaches the ICICI after it has contacted the TI and finalized the project. In the latter case, the programme implementing organization is approached directly by the grassroots innovator or his or her representative organization and the implementing organization has to identify the potential firm for commercializing the innovation. It would also have to maintain a strong database and network with both potential firms and potential grassroots innovators.

**Activities Subsequent to Sanction**

After the project is sanctioned, the firm has to open a separate “no lien” bank account for the loan with its own balance of contribution. It also receives a format for the preparation of quarterly progress reports. This format lists the technology and feasibility report based milestones and also lists issues that are peculiar to the project. It also covers the site monitoring of the project, frequency of meeting and the concurrent transfer of technology. The ICICI coordinator through visits to the company and the institute monitors the project
once in six months. Tripartite meetings are usually held. The firms also take the initiate action in case of delay.

The ICICI helps in the formulation and structuring of the project both for capital and operating costs. They help in the formulation of the project team and setting up of the monitoring structure in an advisory capacity. They can also set conditions for future disbursement. In case the firm is contracting a TI for the first time, they set guidelines on the scope and type of the memorandum of understanding they should build in terms of what should be covered - time, financing, responsibility etc. In one case, the ICICI even identified the customer for a firm. In another case, they found a buyer firm to take up the product for commercialization when the firm, which built it could not do so.

**Benefits of the Programme**

The ICICI sees the benefits of the SPREAD programme to the industry as (ICICI, undated):

(a) Support for projects at all stages of the R&D cycle starting from laboratory and pre-feasibility studies to prototyping and pilot plant operations,

(b) Facilitating access to the large pool of scientific talent and the extensive laboratory facilities of the technology institutions in the country,

(c) Help in obtaining greater mileage out of the company’s R&D budget through substantial savings in capital investments in major facilities and employment of personnel,

(d) Encouraging small scale industries to undertake R&D programmes which they would not be in a position to do on their own, and

(e) Help in establishing a continuing relationship with technology institutions, which can significantly expand the scope of the company’s R&D activities.
Similar benefits may be seen in the case of a similar support programme for the commercialization of grassroots innovations for sustainable development such as:

(a) Support for innovative sustainable development projects at all stages of the project cycle starting from laboratory and pre-feasibility studies to prototyping and pilot plant operations,

(b) Facilitating access to the large pool of indigenous knowledge and innovative talent among the grassroots in the country,

(c) Help in obtaining greater mileage out of the company’s R&D budget through substantial savings in capital investments in major facilities and employment of personnel,

(d) Encouraging small scale industries to undertake sustainable development commercialization programmes which they would not be in a position to do on their own, and

(e) Help in establishing a continuing relationship between grassroots innovators and industrial firms.

The SPREAD financing benefits seen by firms are varied. Prior to the SPREAD programme (and other technology development programme of the ICICI which were initiated at about the same time), there have been no schemes in India for specifically financing R&D projects by firms. Therefore firms and TIs in general were not familiar with the special requirements of project proposal preparation and reporting for R&D projects. Firms could avail of venture capital financing and other types of project financing in which one of the components of the project cost was for R&D, but it did not require any different treatment. In this study (Prabhu, 1996a), it was found that the firms which had relatively low risk - high investment projects or a portfolio of projects, saw the primary benefit as getting a loan at a low interest rate which enabled them to expand the scope of their project or enlarge their new product development portfolio. The following are the major advantages in going in for SPREAD financing as:
(a) Low interest rates,
(b) Repayment over a longer period, and
(c) The loan being free of the need to hypothecate their assets.

Potential Contribution of the Programme

By financing TI based R&D projects for industrial application, development financing through DFI s fill an important gap (Jequier and Hu, 1989, Bhatt, 1993) for both firms and TIs as one of the components of the infrastructure supporting technological entrepreneurship (Van de Ven, 1993). A DFI can also act as an intermediate organization (Shin, 1993) in implementing promotional industrial development policies of the government. External financial aid can encourage R&D work in some high growth - high risk areas, where both firms and TIs find it difficult to either single handedly, or jointly, take the entire investment risk. The entry of technology financing through DFI s may reduce the risk and investment for low internal resource firms till they are willing to take up the high risk - high return R&D project jointly with TIs. Also such financing can be channeled consciously by the DFI into priority sector research and can therefore complement venture capital financing by supporting priority projects, which may not be easily acceptable under usual venture capital financing norms.

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Profiles of innovators

Karimbhai Sumara- traditional herbal healer

Karimbhai Sumara (58) hails from Veerampur village in Banaskantha district, Gujarat. He currently treats 40 patients per day, some of his patients coming from Rajasthan, Maharashtra and Gujarat. Karimbhai thinks he does not have the right to charge any fee for the treatment he provides. Patients who have traveled a long way are provided with both food and shelter. Now, Karimbhai finds it difficult to cope with the workload, particularly as he is not getting any younger.

Genesis

Karimbhai’s father was a potter and also an expert in herbal medicine. Karim used to accompany his father on his frequent visits to the jungles to collect clay and on these trips his father imparted valuable knowledge about different herbs to him. Karimbhai recalls how his father would prepare the extracts and mixtures. He used to help his father out in grinding, powdering and mixing medicines.

Busy Practitioner

Until three years ago, Karimbhai was a potter and used to take time off from routine chores to collect herbs and to treat patients in the village. But then he became a full-time practitioner of herbal medicine as he was not able to attend, on a part-time basis, to the swelling rank of patients who required his attention.

Karimbhai often leaves home just after midnight to walk about 15 km in hilly terrain through jungles to pick up the right herbs. The trip takes up to five hours and he is able to start treating his patients as the morning dawns.

He treats a gamut of diseases like heart ailments, arthritis, diabetes, skin disorders, cold and cough, asthma, fractures, genitor-urinary-tract infections, intestinal ulcers etc. and even cancer. Karimbhai usually consults the diagnostic reports for fasting sugar in urine and blood, lipids profile etc. before he starts his treatment. In addition, he has also developed his own way of diagnosis by interpreting the patient's symptoms and trying to find out the
root causes for abnormal conditions. His own classification of the abnormal condition of an organ or deviation from homeostasis is based on what is considered as "hot" or "cold" in *ayurveda* system. Karimbhai’s family consists of his wife, four daughters and three sons. All members of the family are involved in one way or the other in the in preparation of medications.

Some of the practices he uses:

**Leucorrhea**

In this condition there is excess bleeding during menstruation. For this take *Mal/Nagli* (Finger millet, *Eleusine coracana*) (250 g) and soak it in water (500 ml) overnight. Next morning cook the finger millet with the same water in which it was soaked until the water reduces to 100 ml. Decant the water. This cooked finger millet is given to the women having this problem and the water is should also be drunk. This practice should be repeated twice and this cures the problem.

**Dermatitis**

The symptoms are itchy eruptions on the skin, itching sensation, redness of skin and wounds caused because of fungal infection.

A paste is made of a sufficient amount of the roots of Chitrak (Ceylon leadwort, *Plumbago zeylanica*) using water and this is applied on the infected area.

*Alternative treatment*

Bark and wood of Rohida (*Tecomella undulata*) is soaked in water for two days. This is then distilled and the distillate collected is applied on the eczema.

*Alternative treatment*
Bark of Kerda (*Capparis decidua*) and leaves of Mamejava (*Enicostemma littorale*) are taken in equal proportion and ground to paste using a little amount of water. This paste is then applied on the eczema affected part.

**Diabetes**

Symptoms of this illness include sugar intolerance and infected wounds. Usually patients come with either laboratory reports or diagnosed by doctor.

Roots of Awalkanti/Shatavari (Asparagus, *Asparagus racemosus*) and Chitrak (Ceylon leadwort, *Plumbago zeylanica*), leaves of Mamejava (*Enicostemma littorale*), rhizomes of Amba Haldar (*Curcuma amada*), seeds of Kharhadiya/Sarpankho (*Tephrosia purpurea*) and Gugal (Indian bodelium, *Commiphora wightii*) are all taken in equal proportion. All of these are ground to the powder/paste form and with the help of water, pills are made weighing approximately 5-5 g each. 2-2 pills are taken orally twice a day. Continuation of this practice for a month, results in the decrease of the sugar level by 100 points at the end of a month.

**Psoriasis**

The symptoms include boils/inflammation on the entire body and itchy eruptions.

Collect the fruits of Vinchhuda (*Martynia diandra*) and air dry them. Coarsely grind these and soak for 2-3 days in water. This solution is then distilled. Distillate thus collected is used internally and externally. Take one tea spoonful of it orally once in a day and apply this distillate on the infected parts 2-3 times a day. This will cure psoriasis within two months.

**Varadh/Pneumonia in Children**

This condition which occurs only in children and has the symptoms of severe cough and cold is called Varadh.
Seeds of Kasundara (Stinking weed, *Cassia occidentalis*) (50g) and Jayfal (Nutmeg, *Myristica fragrans*) (four nos.) are ground to the powder form. One tea spoon of the powder is administered orally twice a day. This cures varadh within a week.

**Arthritis**

Joint pain, stiffening of joints, inability to stand straight, pain while walking, etc are the common symptoms.

Bark of *Saragva* (Drum stick, *Moringa oleifera*) (200 g) is ground and boiled with water. The entire amount of water is then allowed to evaporate and the paste collected thus is mixed with Amba Haldar (*Curcuma amada*) paste (100 g) and black pepper powder (100 g). These three ingredients are mixed well and pills are made of 5-5 g each. 2-2 pills are taken orally twice a day.

**AIDS**

Symptoms include loss of resistance (frequent fever), blackening of nails, weakness etc. This illness is diagnosed pathologically.

Equal amount of dry roots of Avalkanti/Shatavari (*Asparagus, Asparagus racemosus*), Amba Haldar (*Curcuma amada*), Kdvi Dodi (*Leptadenia pyrotechnica*), Dodi (*Leptadenia reticulata*), Chitrak (Ceylon leadwort, *Plumbago zeylanica*) and Athani (available in forests of Rajasthan only, Latin name not known) are mixed and ground to powder form. Ten grams of this powder is taken orally twice a day. He has cured more than 8-10 patients of HIV/AIDS till date. And according to him, it takes not more than three months to cure the patient completely.

**A nature-lover…**

An ardent advocate of environmental conservation, Karimbhai’s work in this field is three-pronged and includes monitoring the abundance or scarcity of the various herbs vis-à-vis
their demand and cultivation of those plants that are becoming scarce as well as those needed in large quantities, educating the youth about the importance of diversity and about ways of utilizing the bounty of Nature without disturbing ecological balance and processing of medicinal plants in such a manner that a stable supply position is maintained and also in a manner, which assures consistent potency of their extracts. In 1999, Karimbhai founded an NGO named Aravalli Vikas Mandal which has been rendering creditable service to the flora and fauna of the ranges. He has also featured in a documentary film commissioned and telecast by British Broadcasting Corporation (BBC) to honour experts in indigenous knowledge.

**Future Plans**

Karimbhai has joined with three more herbalists and applied for financial assistance under the Technopreneur Promotion Program (TePP) of the Department of Science and Technology (DST) so that the market potential for his blood-pressure medications can be systematically assessed. He is quite hopeful of getting the needed funding and dreams of the day when the true potential of the herbs of Aravalli ranges could be realised.

**Premjibhai**

Premjibhai has developed a technique for plantation of tree crops using which trees can be grown in places where there is a scarcity of water and they can be maintained in drought prone areas (like Kutchh, Bhuj and region of Saurashtra) as well. He made plastic pipes of diameter 7 inches with the height of approx 1-1.5 feet for this purpose. Pipe has two holes on opposite sides at the top.

**Method of plantation:**

1) Make a pit of around half a foot.
2) Put the pipe in it, plant besides the pipe and cover the pit with the soil.
3) Then fill the pipe with the mixture of sand, soil and gravels.
4) Put a small piece of branch across the two holes and take out the pipe.
5) Now pour water on the sand, it will reach directly to the root zone of the plant.
6) Every time when plant is given water through sand, it will reach directly to the root zone.

**Advantages:**

1) Plantation can be done in drought prone areas and places where there is scarcity of water.
2) There is no loss of water at all by using this technique of plantation.
3) The rate of successful plantation can be increased using this method.
Profile of Amrutbhai Agrawat:

Amrutbhai Agrawat, an artisan by profession lived in a remote village of drought stricken Junagadh district of Gujarat. His early life was a struggle as he lost his father when he was only 12 year old and was forced to work as a farm laborer to survive. However his innovative instinct and inquisitive mind made him a local expert in repairing diesel engines, hand pumps, storage bins etc without any inputs and training.

His outstanding capability impressed the local people and they helped him to set up a small manufacturing workshop that could help him look for more innovative avenues. Amruth Bhai developed many new agricultural products some of them were successful and he could sell them to most of the farmers in his region. However Amruth Bhai wanted to develop innovations that could stand out on their own and that can make a significant difference to the society at large. He was not satisfied by the minor improvements he was making in all kinds of regular improvements. Egged on by his instincts, Amruth Bhai joined the Honey Bee Network and became a regular member. The Honey Bee Network that is a database of innovative people and a vehicle for people to people linkages also covered the innovations by Amruth Bhai. In his discussion in various meeting with honey bee amruth bhai disclosed his desire to develop a tilting bullock cart.

The Innovation

Carts driven by draught power is the most important form of transportation and haulage mechanism in rural India. Despite the importance and its demand, the cart industry is a tiny sector industry and only local artisans with traditional skills have been developing carts for ages. The design of cart has not undergone any change except some small modifications done time and again to suit local needs.
Amruth Bhai shared with SRISTI his observations and his proposed course of action in making a new innovative cart that can provide multiple use and may change the way people look at carts.

In the dry regions of Saurashtra farmer use the bullock carts to ferry farmyard manure and tass (weathered rocks) to the fields. The manure and tass is then spread in the furrows to economically employ the instead of spreading it in the entire field. The operation reduces the manure consumption without decreasing the expected yield of the crop. The modus operandi to spread the manure is simple but tedious. Farmers download the manure in one corner of the field and then woman and children apply the manure in the furrows. The work normally is done during the month of June when the heat is unbearable.

Amrutbhai felt distressed seeing women and children toil in the heat. He felt that this operation could be converted into a more efficient and less tedious by improving he design of the cart.

Amruth Bhai shared his design with SRISTI, which provided him with the fund to work on the idea. It too amruth bhai one year to develop a prototype that could solve this problem.

The cart was developed in 1997 but only a few units could be sold that to mostly agriculture universities. Despite is positives cart was expensive and needed inputs to not only reach a product stage but commercial enterprises stage also.

During the last 35 years he has developed several other innovative implements viz Janak Santi- a multi purpose tool bar, ‘Mini Kaliyu’ - a ground nut digger, a sharp blade for harvesting ground nut, wheat sowing box, water drawing pulley etc. SRISTI, an NGO operating from Indian Institute of Management, Ahemdabad has supported his research on Aaruni bullock cart and innovative water drawing pulley and helped in dissemination of his other implements for last seven years. He is one of the most active members of Honey Bee
network. His contribution has been recognized of the by several agencies. He got prestigious Sardar Patel Agricultural Research Award-1997 from the Government of Gujarat. Gujarat Grassroots Innovation Augmentation Network, a green venture promotion fund has been supporting Amrutbhai in commercializing the product. Lists of the awards received by him are as under.

Awards received by Shri Amrutbhai Agrawat

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Name of the Award</th>
<th>Date &amp; Place</th>
<th>Awarded by</th>
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<tbody>
<tr>
<td>1</td>
<td>Trophy and certificate for the development of farm implement. in Lok Vignan Sanklan Competition</td>
<td>July 21,1995 IIM , Ahmedabad</td>
<td>Department of rural development Ahmedabad</td>
</tr>
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<td>2</td>
<td>An interview broadcast in Gujarati- “Khet Ojaro - Mara Anubhav “</td>
<td>November 8,1995 Rajkot</td>
<td>All India Radio Rajkot</td>
</tr>
<tr>
<td>3</td>
<td>Trophy &amp; Certificate for the appreciation of the participation in the 'KRISHI MELA&quot; Agricultural Fair</td>
<td>November 9,1996 Bangalore</td>
<td>University of Agricultural Sciences Bangalore</td>
</tr>
<tr>
<td>4</td>
<td>Trophy &amp; Certificate for participation in International conference on Creativity and Innovation on Grassroots</td>
<td>January 11-14,1997 IIM , Ahmedabad</td>
<td>Indian Institute of Management Ahmedabad</td>
</tr>
<tr>
<td>5</td>
<td>Sardar Patel Agricultural Research Award - Certificate &amp; Cash Prize of Rs. 25000/-</td>
<td>January 30,1997 Gandhinagar</td>
<td>Agricultural Co operation &amp; Rural Development Department Govt. of Gujarat</td>
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Profile of Shri Khimjibhai Kanadia

Khimjibhai Kanadia (62 years), a retired schoolteacher, has more than 50 ideas and innovations to his credit, all of which have potential to reduce drudgery and improve work efficiency. Whenever he makes it big by successfully implementing any of his own several ideas, the innovator wants to establish a Trust where innovators would be enabled to transform their ideas into products without facing any financial constraints.

Khimjibhai Kanadia lost his parents at a very young age. When he was eight years old, his parents died. He has two elder sisters and a younger brother. His uncle brought him up and got him educated up to middle school, after which he took up a job. He began studying for secondary school certificate (Class X) apart from helping out his uncle on the farm while performing well in the job. In 1962, he sat in the secondary school examination, he secured first place in the school examination. Continuing with part-time studies, he appeared for Primary Teachers' Certificate (PTC) examination in 1965. The certificate secured him the job of a teacher in 1967 in Dhuleta village, Idar taluka. In the meantime, he worked for a private organisation in Rajasthan, marketing handicrafts.

Khimjibhai got married at the age of 15. As he and wife Shantaben found it difficult to make both ends meet from his meager income from the job, they opened a tailoring shop to supplement the family income. Despite having to struggle for long hours to eke out a living, Khimjibhai started a night school for promoting adult literacy in the village.

Khimjibhai concedes that his family members have contributed very significantly in turning his wild ideas into useful innovations. His wife Shantaben and their four sons have been as responsible as himself in fructifying his dreams. Shantaben accompanies him on all business missions. Khimjibhai is proud that she is aware of all the technical aspects of the innovations.
Three of the four sons currently hold responsible government jobs. One son, Rajinikar, assists him fulltime to run the workshop and to market the Kushal sprayer, Kittanal and other devices.
Arvindbhai Ranchhod Patel has developed an automatic, portable spraying device which is light weight, simple in construction and very easy to operate.

**The innovation**

The proto model of the auto sprayer developed by Arvindbhai utilises the normal body movement of walking as an energy input to accentuate the to and fro movement of a dead weight, which in turn drives a piston that generates enough pressure for spraying.

Arvindbhai used an iron tank to store the liquid. He selected iron because the pressure generated in the tank is very high and a weaker material may not be able to withstand that pressure. A piston assembly is attached in the middle of the tank with an extended spindle coming out of the tank. A spring is provided on this extended portion of spindle. The piston is attached to a weight of almost 5kgs on the upper side, which rests on this spring.

The sprayer is mounted on the back of the user, like a regular knapsack sprayer. When the user walks with the sprayer mounted on his back, jerks are transmitted to a dead weight, which rests on the spring. Due to jerks of walking, the spring is compressed, pushing the piston downwards. Once the spring reaches the bottom, it bounces back /rebounds and pushes the weight upward, thus pulling the piston upward and one stroke is completed. The cycle continues and pressure is generated in the tank due to subsequent strokes of the piston. This pressure is used to spray the liquid in the tank through the nozzle of the dispensing unit.

Arvindbhai has now modified the configuration of the auto –compression sprayer and made a new model in which the oscillation rate of the dead weight is intensified. Two storage tanks have replaced the single one as used in the previous design. The dead weight is placed in the intermediate gap between the tanks connected by a common pipe. To avoid
alignment problem the dead weight is hung at the bottom instead of the top as in the previous design. In this new model, a pipe guides the spring to avoid oscillation. Each tank has a capacity of seven and a half litres and thus the total capacity of the device is 15 litres.

**Genesis**

In case of conventional sprayers, spraying is done by continuous pumping by hand. This monotonous work tires the user after some time. In addition shortage of labour is a big problem for farmers especially as spraying has to be done at a particular time, failing which the pest attacks can be a serious problem.

Arvindbhai tried to think of some means by which the monotonous job of hand movement could be avoided. In conventional sprayers the basic means of oscillation is done by hand. He observed that during walking, parts of the body also generate different kinds of motion and he felt that this motion could be utilized for the oscillation of the piston in the cylinder. Arvindbhai hit upon the unique idea of magnifying these jerks by using some additional weight. So he used a spring and additional weight to magnify these jerks to generate requisite pressure in the tank to spray the pesticide. This device thus works on the concept of dead–weight oscillation, which causes the reciprocation of the piston and results in spraying action. GIAN and SRISTI have been trying to ensure that innovations in pest control devices use herbal pesticides rather than chemical alternatives.

**Advantages…**

The main advantage of the device is that it does not require any extra energy/torque for spraying. It is extremely energy efficient, easy to operate and produces an extremely fine spray. It is also easy to repair and requires less maintenance. There is no comparable pump available in the market which works on a similar principle. This device eliminates the tiresome and repetitive manual pumping action needed in standard back mounted pump-sprayer units.
Commercialization
The cost of this sprayer is expected to be around Rs. 3500. Patent application has been filed by NIF. The technology has been licensed with the help of GIAN (W) to an entrepreneur in Ahmedabad on non-exclusive basis. The entrepreneur is helping Arvindbhai to convert the crude model into final working prototype. It is possible to license this technology to other entrepreneurs as well.

The market feedback report is also very encouraging. Farmers have shown willingness to buy this product even if it is costlier than the conventional sprayer. It also has immense potential in national and international markets. Arvindbhai also has plans to provide two spray nozzles to get double the output after increasing the pressure by piston-chamber optimization. Then the operator can cover two parallel rows simultaneously and thereby cut down the operation timing by half.

Passion for Creating
A serial innovator, Arvindbhai’s innovations include a solar water heater, a novel tyre-inflating pump, a water cooler and a fridge that runs without electricity. An ardent advocate of non-conventional forms of energy; he wants to explore a revolutionary, though hazy at the moment, idea of a mechanised bicycle that would make high-speed personal transportation incredibly inexpensive.

Harnessing the Sun
One day in 1978, while on his way from Ahmedabad to his village, Vanch, Arvindbhai met Prof. A.R.Patel of L.D. Engineering College, Ahmedabad. During the course of their conversation, the topic of solar energy cropped up. Arvindbhai developed a fascination for
solar energy, which drove him to fabricate a 50-litre solar water heater in 1985. He used HDPE/PVC for the storage tank and straw of *bajra* (pearl millet) for insulation. Between 1985 and 1990, he made eight different models for trying out different materials and correcting the flaws or deficiencies he came across until he was fully satisfied. He has sold two-dozen solar water heaters of different capacities, 50, 100, 200 and 500 litres.

**Pride and satisfaction…**

In 1993, his solar water heater was shown on television. Doordarshan featured it in its 20-minute program *Gram Jagat*, which is targeted at the rural audience of Gujarat. This gave Arvindbhai the recognition he was yearning for. He recalls it as the happiest moment of his life. It was a sort of fulfillment of his ambition that people must look up to him with respect. Although he has been subsequently interviewed many times on television, it was the *Gram Jagat* program that gave him the break and inspired him to pursue his spirit of innovation.

**Auto air-kick pump**

Arvindbhai has also developed a novel auto air-kick pump, to inflate tyres of scooters and motorbikes, which uses the built-in kick-start mechanism of the vehicle. The compression obtained in the air in the cylinder of the engine while cranking is utilized and the compressed air is transferred to the tube with the help of this device. It is handy, portable, light in weight, compact in size, easy to use, flexible, self-repairable and the best alternative to a spare wheel. Arvindbhai believes that every scooter or motorbike rider should have this gadget and maintain optimum tyre pressure on daily basis as this contributes to fuel conservation also. He was awarded for this innovation in the second national competition for grassroots innovations and traditional knowledge of the National Innovation Foundation. GIAN has helped him in commercialising this technology.

‘Natural’ Water cooler
The idea of the water cooler had come to Arvindbhai when he was suffering from severe fever once. His wife used to apply a cold pack to his forehead repeatedly to give relief from the high temperature. He used this vapour-absorption principle for getting drinking water cooled. The cooler is useful for supplying cold drinking water in hot summer, particularly in areas where availability of electricity is absent or erratic. Arvindbhai developed his no-electric-power, ‘natural’ water coolers in three different capacities of 5, 10 and 20 litres. He sized the components to ensure that the temperature of the water at outlet was at least 5 to 10 degree Celsius lower than the ambient temperature. About 20 units have been sold and are in use. GIAN and SRISTI have helped him in commercialising this novel water cooler.

Harnessing wind power…

The idea of harnessing wind power struck Arvindbhai one day in 1996 when he was looking at clothes drying in the wind. He used a curtain, a rod and an air pump to fashion a rough model of a wind tunnel. After several experiments and fabricating different models, he came out with a horizontal “Low Air Thrust Multi-curtain System”. The device, Arvindbhai visualises, can be beneficially used for pumping water, heating water, inflating tyres, drip irrigation and even for running a grinder/juicer. He obtained a provisional patent for this device in 1997.

Kite reel holder

Even his children have been instrumental in triggering off ideas in Arvindbhai for new innovations. Normally, while one person flies a kite, another person holds the reel, allowing it to unroll as per requirement. Once during the kite festival, his daughter refused to hold the reel for her brother who was flying the kite. To settle the children’s quarrel, he designed a new reel holder to wind kite thread. With this new holder, a person can fly a kite...
without an assistant to hold the reel. The holder, which is made of a light metal, allows the thread to wind and unwind easily and it moves in the wind direction.

**User-friendly tongs**

When posed with the problem of developing user friendly tongs for the kitchen, Arvindbhai developed some tongs which are very simple and consist of an adjustable knob, guide shaft and holding loops. All the parts are made of aluminium and it is quite easy to handle as well as quite reliable and adjustable with the facility to use the device for variable size of utensils.

**The struggle for formal support…**

Arvindbhai had contacted various agencies, which are supposed to encourage application of renewable sources of energy and assist in the development of equipment in the sector. He appealed to establishments like Gujarat Energy Development Agency (GEDA), Department of Science and Technology (DST), Council for Advancement of Peoples' Appropriate Rural Technology (CAPART), etc seeking funds for validating and perfecting his innovations. But there was no positive response and he became extremely frustrated.

In May 1998, he saw an advertisement released by the Ministry of Non-Conventional Energy Sources (MNES), Department of Science and Technology, which invited innovators to seek any assistance they desired. He wrote a letter to the department giving details. Unaware of how the bureaucracy functions through countless cogs and wheels, he went himself to Delhi thinking that it would expedite matters. He went straight to the Prime Minister’s official residence where he met one of the personal assistants to the PM. This PA was considerate enough to mark the letter to the concerned ministry. The Central ministry forwarded the letter to GEDA, asking the Agency to look into the matter. Accordingly an engineer from GEDA, R N Pandey was asked to see the innovations and submit a report to New Delhi and he visited Arvindbhai in August 1998. He also recommended changes to a
water-cum-air cooler developed by Arvindbhai and told him to focus on one application. On his advice, Arvindbhai modified his innovation accordingly.

**And finally success…**

Arvindbhai acknowledges that after his initial struggles, various organisations stepped in and helped him to different extents to realise his dreams. Notable among them were Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI), Gujarat Grassroots Innovation Augmentation Network (GIAN), Sardar Patel Renewable Energy Research Institute (SPRERI), L D Engineering College, and Rural Technology Institute (RTI), Gandhinagar. He says that the last-mentioned three organizations were very helpful in product testing.

**Encouragement from his wife…**

Arvindbhai’s wife Jaishree is a schoolteacher who holds a Masters in Arts and a Bachelor’s degree in Education. His wife admits that at first she considered him over enthusiastic about his innovations and would often ask him to start on a new job as all this work on innovations did not earn him good money. But her views regarding her husband’s zeal for innovation changed once he got recognition from SRISTI, NIF and National Research Development Corporation (NRDC.) She says of her husband, “When he gets an idea, nothing can distract him till the idea becomes a reality. He always wants to do something different, what no one has ever done. He is always found at home working on his products. Earlier, neighbours thought that he was up to nothing; now they often inquire what’s up. Particularly, when they see something unusual in our courtyard.”
Personal profile

Arvindbhai Patel (48) hails from Vanch, a village 10 km from Ahmedabad in Gujarat. The youngest in a family of three sons and three daughters, Arvindbhai had only his own motivation to pursue his studies as no one else in his family had any formal education. After completing school in 1972, he got admission at Shri Vivekanand College, Ahmedabad for the undergraduate course in Commerce. But after struggling hard for a year trying in vain to cope up with college studies in English medium he had to eventually quit. He then enrolled himself in an artisan-training course conducted by state-run Industrial Training Institute (ITI), but could not secure admission in any of the more preferred trades. He ultimately was admitted in the trade of horology (watch and clock mechanism) but he did not complete the course. Thereafter, for two years, he worked in an automobile garage in Ahmedabad where he received practical training as an automobile mechanic. In 1980, he got an opportunity to travel to Saudi Arabia where he worked on the latest models of automobiles. After finally coming back to India in 1984, this accomplished technician and fabricator has been pursuing his passion for innovations. He has a son and a daughter.
Shri Bhanjibhai nanjibhai Mathukia

Bhanjibhai (70 years) has been tinkering with machines from his childhood. Living close to Gir forest, he also respects the rights of wild life and often talks about the needs to conserve the lion are habitual. He has continued to dream, innovative and build upon traditional knowledge as well. He is very soft spoken and man of few words has inspired thousands of farmers, artisans and young people. He owns about 50 bigha land.

Though he has not having any formal education with him, Bhanjibhai has developed several other innovations and is in the process developing few more. He developed small three & four-wheel tractor, bullock, innovative design of checkdam, modified seed drill etc. He was a part of delegation, which went to South Africa at the invitation of commonwealth Science Council, and South African government to transfer technologies and help build capacity of counterpart small farmers and artisans. He was honored by SRISTI and also at the International Conference on Creativity and Innovations at Grassroots held at IIM-A. January 1997. He has also received “ Sardar Patel Agricultural Research Award “ given by Agriculture department of Gujarat Government. On December 17th, 2002, Honorable President of India, Shri A.P.J Abdul Kalam, honored him by giving National Grassroots Technological Innovations and Traditional Knowledge Award 2002 for the “Development of innovative Check dam” and Small 10 HP three and four wheel tractor. Shri Bhanjibhai has also developed a small bullock operated sprayer for spraying pesticides in the field.

Shri Bhanjibhai has one son (Shri Pursottam) and wife in the family His son is running small workshop fabrication workshop in Visavadar town of Junagadh district.
Genesis of NIF

The National Innovation Foundation (NIF) has evolved to meet a long felt need for recognizing, respecting and rewarding innovations and outstanding traditional knowledge at the grassroots. Honey Bee network had triggered a movement about fifteen years ago to scout, spawn and sustain unaided creative and innovative urges in unorganized sector of our society. Accordingly, the Department of Science and Technology, Government of India, set up NIF three and a half years ago under the chairpersonship of Dr R.A. Mashelkar, Secretary, DSIR and Director General, CSIR.

NIF provides an institutional platform for the knowledge-rich, economically poor people. It is expected to help the unsung heroes/heroines of our society who have solved a technological problem through their own genius without any outside help. It is committed to making India innovative by documenting, adding value, protecting intellectual property rights of the contemporary unaided technological innovations, as well as outstanding examples of traditional knowledge on a commercial as well as non-commercial basis. A National Register of green Grassroots Technological Innovations and Traditional Knowledge is also being developed for the purpose. NIF also seeks to develop a new model of poverty alleviation and employment generation by helping convert grassroots innovations into enterprises with or without value addition through institutional science and technology.

NIF has also taken upon itself the onerous task of grappling with complex issues like intellectual property rights. The unfortunate truth in India is that while most innovators generously share their knowledge, innovations and practices, whether based on local resources, traditional technologies and tools or modern materials or tools, they do not always derive the benefits of such sharing. That is the reason why many of them remain poor. Their children do not want to pursue the knowledge path, consequently, traditional knowledge gets eroded and society loses a very valuable source of local solutions. May be, giving creative people their due will restore the respect for traditional knowledge and help in blending it with modern science and technology. In the process, valuable intellectual property may be produced. As of now, framework for protection of intellectual property of grassroots innovators and traditional knowledge holders at low transaction costs is absent in India and elsewhere.

Evolution of Honey Bee Network

Honey Bee network found it totally unfair and unethical that the only resource in which poor people were rich, that is, their knowledge, is taken away from them without any attribution, accountability or reciprocity. Honey Bee network also believes that if many of
these knowledge rich people are economically poor, it is not because their knowledge is of lesser consequence or that they are incapable of generating creative and efficient solutions (though, in some cases, this might well be the reason). Their conditions can also be explained by various policy and institutional factors, apart from the lack of supporting platforms for strengthening their problem-solving capabilities. The Honey Bee Network has been making efforts all these years to develop a platform of this kind and has prepared a database of thousands of innovations and traditional knowledge, all with the name and addresses of the knowledge providers (see Annexure I for more details, also see www.sristi.org).

NIF and Honey Bee – Working in tandem

Today, NIF and the Honey Bee Network work in close cooperation on various issues. In fact, the basic building block of NIF is the Honey Bee philosophy evolved over the last 15 years. The honey bee collects pollen from the flowers, in the process linking one flower to another and thus enabling cross-pollination. Similarly, the Honey Bee Network strengthens people to people learning and networks by pooling the solutions developed by people across the world in different sectors and links. The network acknowledges the innovators, knowledge producers and communicators so that they do not remain anonymous. Further, the network strongly believes in sharing knowledge among the providers of innovations in their own language. It also ensures that a fair share of benefits arising from commercial exploitation of local knowledge and innovations reaches the innovators and knowledge providers.

Benchmarks of progress

NIF (www.nifindia.org) began its first national campaign in March 2000 to scout innovations and outstanding traditional knowledge and has completed three national campaigns so far. It has achieved several major milestones in the last three years. Beginning with about 1600 innovations and traditional knowledge examples in 2000-2001, NIF scouted about 13,500 such creative examples during 2001-2002 and another 21,500 during 2002-2003. About 37,000 innovations and traditional knowledge examples were, thus, scouted from over 350 districts of the country. In addition, NIF has access to another 6000 traditional knowledge examples in the Honey Bee database managed by SRISTI (Society for Research and Initiatives for Sustainable Technologies and Institutions), which are to be transferred to NIF after further verification. The challenge before us is to help incubate these technologies to generate commercial and non-commercial opportunities for their diffusion to improve productivity, generate employment, overcome poverty and conserve environment. The interest on the corpus fund of Rs 20 crore, provided by the Department of Science and Technology, used for running the Foundation, is hardly sufficient to meet the challenge, given the declining interest rates and rising aspirations of the creative people of India.

NIF organizes Award Functions to honour the award winners of each round of national campaign to scout innovators and traditional knowledge holders. Shri K C Pant honour...
the creative innovators and traditional knowledge holders in the first round and honourable President of India, Dr A P J Abdul Kalam honoured the innovators in the second round function held in December, 2002 (see www.nifindia.org for the list of awards and brief presentation about these awardees).

**Objectives of NIF**

The main objectives are:

To help India become an innovative and creative society and a global leader in sustainable technology by scouting, spawning and sustaining grassroots innovations and outstanding traditional knowledge.

To ensure evolution and diffusion of green grassroots innovations in a selective, time-bound and mission-oriented manner so as to meet the socio-economic and environmental needs of our society.

To provide institutional support in scouting, spawning, sustaining, and scaling up grassroots green innovations and helping their transition to self-supporting activities; seeking self-reliance through competitive advantage of innovation-based enterprises; and/or application of people-generated sustainable technologies at the grassroots level.

To build linkages between excellence in formal scientific systems and informal knowledge systems and create a knowledge network to link various stakeholders through applications of information technologies and also otherwise.

To promote wider social awareness and possible commercial and non-commercial applications of the know-how generated as a result of the above and encourage its incorporation in educational curriculum, developmental policies and programmes.

**Organisation of NIF**

The governing council of NIF is chaired by Dr R.A. Mashelkar, Secretary, DSIR, and Director General, CSIR. It has several other distinguished members, such as Prof. V.S. Ramamurthy, Ms Ela R. Bhatt, Dr Vijay L Kelkar, Dr Mangala Rai, Dr E.A.S. Sarma, Prof. Kuldeep Mathur, Prof. Bakul Dholakia, Prof. Inderjit Khanna, Ms Lalita D. Gupte, Shri P. K. Laheri, Shri Anand G. Mahindra, Shri Arun Sharma, Shri T. P. Vartak and Prof. Anil K. Gupta, who is also the Executive Vice Chairperson of NIF (see organisational chart, Figure 1).

NIF has a Research Advisory Committee, with two sub committees, one including institutional scientists, designers and technologists, and another including informal
grassroots innovators and traditional knowledge holders. Dr Pushpangadan, Director, National Botanical Research Institute, Lucknow, chairs the research advisory committee.

NIF has had to face several constraints in its functioning but it has relentlessly pursued its goal, regardless of the many bottlenecks. In fact, during the first year, we had no staff. For half of the second year, NIF had only two national coordinators. In the third year, we got a Chief Innovation Officer and within six months of that, the organization roped in other National Coordinators as well. However, the achievements could not have been possible without the support from SRISTI (Society for Research and Initiatives for Sustainable Technologies and Institutions) and other Honey Bee Network collaborators such as SEVA and CCD, Tamil Nadu; PEDES, Kerala; PRITVI, Karnataka; SRISTI-GIAN Kendra, Uttaranchal; Chayan, West Bengal; Ama Akha Pakha, Orissa; Makhir, Himachal Pradesh, and individual farmer innovator collaborators like Shri Sunda Ram etc.

**Organizational Framework**

![Organizational Framework Diagram]

**Building the Value chain around Grassroots Innovations:**

**A. Scouting and Documentation**

Scouting and Documentation of the innovations is the first step towards the fulfillment of the mission of NIF. Scouting involves extensive fieldwork, travel in rural and urban areas,
search for ‘odd balls’ -- the experimenters – and local community and knowledge experts in the society. The process aims at:

- To coordinate with various governmental and non-governmental agencies to mount a national campaign to scout innovations with the help of grassroots level functionaries of education, agriculture, rural development, small scale industry, Panchayati Raj institutions, etc.
- To screen, document and verify the claims about these innovations through various networks of scientific and other institutional initiatives as well as through Honey Bee collaborators, existing databases and field visits.
- To generate and experiment with material and non material incentive mechanisms for innovators and traditional knowledge holders.
- To provide assistance in forging decentralised networks of inventors/knowledge experts to strengthen the Honey Bee Network.
- To obtain Prior Informed Consent (PIC) of the providers of knowledge.
- To share the innovations permitted by the knowledge providers to be put in public domain through Honey Bee newsletter and other media to enrich the repertoire of the local communities and informal knowledge experts and to support Shodh Yatras in different parts of the country.

**NIF’s initiative regarding Prior Informed Consent (PIC)**

While disseminating the innovations and traditional knowledge, one has to take care that one does not put the innovation of creative people in public domain without the informed consent of the knowledge providing individuals and communities. It is true that innovative culture can not be created in the country without such dissemination. How much information about an innovation can be disseminated becomes an important consideration in this process. While pursuing Scouting and Documentation function of NIF, getting PIC posed one of the biggest challenge. The concept being new, most people were not aware of the implications of the PIC.

It is now accepted worldwide that knowledge of the local communities and individuals should be accessed and used only through their prior informed consent. The issue of informed consent is not easy. NIF took a lead in this regard and started developing a form for Prior Informed Consent (PIC). In the first round of the contest, the PIC form that was used revealed several areas of improvement. Subsequently, after discussions with the collaborators and knowledge providers, a new form has been developed. It is obvious that for the people whose knowledge rights have never been even acknowledged, the concept of PIC is not only new but also intriguing. A detailed note has been prepared which highlights the plus and the minus side of saying, ‘yes’ or ‘no’ to various choices given in the form. For instance, if an innovator suggests that his knowledge may be shared widely through Honey Bee newsletter and/or on website or through other public channels, we have to explain the advantages of doing so and also the disadvantages from the IPR perspective. After sharing these implications the knowledge provider is well within his rights to say yes or no to this
or other options (see Annexure VII for PIC form for traditional knowledge holders, innovators and also a note explaining the implications of the PIC).

Till date we have received more than 450 consent forms from the innovators/TK holders who participated in the second competition. Apparently, as is evident from the figures, the majority of the innovators do not mind sharing their addresses with the interested members. About 92 per cent of them have agreed to share their addresses with others if necessary. Out of these, 50 per cent of the innovators have permitted use of their innovations free of cost, if it is on an individual basis. Regarding technology transfer, the option related to the choice of assigning technology, where the innovators are supposed suggest their preferred proportion of sharing benefits, has not been properly answered in many cases. It may, therefore, be inferred that either the innovators do not have yet proper clarity about their preferences or they are unable to understand the framework behind the suggested benefit-sharing model that NIF wants to set forth. In any case, since PIC framework is a new concept and has never been practiced except in medical sciences, we have to recognize the need for explaining this framework to people at grassroots level- a task that demand tremendous additional resources.

Further, it is considered necessary to have a mutual understanding between the innovators and NIF about flexibility in the conditions that have been already specified in the form. If any need arises to modify any of the conditions specified in the consent form, NIF would like to have an agreement with the innovators authorizing NIF to change the options on their behalf with their prior consent. Likewise, if the innovator wants to cancel/modify his/her conditions specified in one’s consent form, they can do so with prior notification to NIF.

Since PIC is a new concept, considerable investment will have to be made in creating awareness among various stakeholders. At this moment, we have no hesitation in accepting that complexity of the form and the options in the background note are not easy to follow by most people in villages. Thus, we have not achieved the kind of success in this endeavor which would have made us proud. In the absence of any major effort to create awareness about PIC, NIF’s effort will remain limited in their overall impact. NIF will, however, continue to make efforts to make this process as transparent and effective as possible.

S and D function has faced many other challenges such as communication with thousands of knowledge providers in local language, working with very small transient team of staff, pursuing with various collaborators about the need to improve the quality of documentation, getting their PIC, creating awareness about the National Register, networking with various state governments to create awareness about national campaigns, and matching expectations of Honey Bee network and NIF’s capacity to deliver with all its limitations. Information is disseminated to all the district collectors, MPs, and a large number of NGOs, educational organizations and other potential partners who can help us uncover the hidden genius of our society. The kind of traditional knowledge scouted by NIF is briefly discussed in Annexure XIII and some examples of creative traditional knowledge and contemporary problem solving are given in Annexure XIV.
S and D function has also supported dissemination function so far by way of coordinating the media coverage of NIF’s activities by BBC world, NDTV, Zee. Star and many other channels as well as print media (see ‘NIF in News’ at www.nifindia.org website).

**Biodiversity Register (PBR) and National Register at NIF**

The MOU with IISc is still under discussion but MOU with eight traditional knowledge holders of the Mala village community has been signed on June 14, 2004 between NIF and traditional knowledge holders of Mala community mediated by IISc professionals. This signing of MoA was endorsed by the entire Village Assembly which had one of its regular meetings just prior to the signing of the MoA. The Secretary of the Village Council endorsed the MoA on behalf of the council.

*(Further details on the Scouting and Documentation function of NIF are given in Annexure No II, how the innovations and traditional knowledge have been scouted, what has been the contribution of network members and how this function has progressed so far is summarized in this Annexure)*

**B. Value Addition and Research & Development**

Most of the innovators and/or traditional knowledge experts need optimization in design and/or product formulation through blending with modern science and technology inputs. Market prospects for many innovations will be very low without proper value addition. Efficiency gains can be made by creating technology networks. Research and Development is a key focus of NIF. It provides a platform for the synergy between formal and informal science and technology, institutions and knowledge system. The tasks involved include:

- To coordinate with public and private sector R & D and educational institutions, people’s organisations and rural and urban innovators themselves to add value to local innovations.
- To develop product development plans and help the grassroots innovators mobilise funds from TePP and other such programs within and outside the country.
- To build product development teams on contractual basis to get the products and/or services developed through licensees ensuring appropriate benefit sharing arrangements.
- To set up and help coordinate GIANs in different regions along with other national coordinators.
- To obtain help of eminent scientists and technological experts from various fields as a part of the Research Advisory Committees, or otherwise which will guide the activities of NIF.
- To analyze the database/national Register along with other National Coordinators, external researchers and other collaborators, and study the patterns in the nature of knowledge systems, networks and exchange mechanisms at grassroots to develop strategies to strengthen knowledge network of creative people.
**R & D linkages**

NIF has established linkages with several premier research and technical institutions at the national level for promotion and dissemination of the potential technologies. NIF has been working closely with various institutions like IIT Mumbai, IIT Delhi and IIT Kanpur to involve students and faculty to work for innovations having commercial potential (see Annexure VIII for list of projects supported, and Annexure IX for value chain flow chart).

**Inter-Institutional Research Collaboration:** NIF is trying to tie up collaborations and sign MoUs with institutes to add value to selected innovations and traditional knowledge. GRIDS (Grassroots Innovation Design Studio) has been set up by GIAN West at NID, Ahmedabad, through a grant from Gujarat Government. Further, IDC, IIT, Mumbai, and IIT, Kanpur, Delhi and Guwahati have also expressed keen interest in this regard. The mechanical engineering department of REC, Surat, IIT Chennai, TEC, Madurai, UAS Bangalore etc, have also shown keen interest to take up projects from NIF.

In order to institutionalize the linkage between the formal scientific research institutions and informal scientific knowledge developed by the people, discussions had been pursued for a long time about the way this goal should be met. Accordingly, CSIR and NIF signed an MoU on June 29, 2004 at CSIR headquarters.

**Valorizing traditional knowledge about biological diversity:** An MoU has been signed between National Botanical Research Institute and NIF to start collaborative work for screening herbal innovations/traditional knowledge. A very large number of entries related to herbal technologies have been received at NIF. One of the major bottlenecks has been the value addition and screening of biodiversity based traditional knowledge since it requires access to high throughput screening systems.

**C. Business Development & Micro Venture**

Value chain for green grassroots innovation will require financial support at different stages of product cycle. Support is required for improving the attributes of the innovative product/prototype through R&D linkages. This initial market assessment has to be followed by micro venture and innovation fund support for converting innovations into products, and products into enterprises. The various activities needed for the purpose are:

- To coordinate with various entrepreneur/industry associations, management institutions and incubators to mobilise mentoring and management support for grassroots innovators and TK holder.
- To involve private and public sector industrial and financial institutions and associations in linking innovations with investment and enterprise at individual or group level.
- To help promote various innovations and outstanding TK through market and non-market channels.
To encourage various industry associations and other developmental bodies to set up mechanisms for licensing innovations for business development and equitable benefit sharing with the innovators and TK holder.

To help raise resources for pursuing various activities and developing innovation value chain.

To support the operations of the National Micro Innovations Fund through public and private participation and mobilize the incubation fund and venture capital for innovators and TK holders.

To develop business plans, market research plans, reports and training material as well self learning material for GIANS and others involved in promoting innovation based entrepreneurship.

Business Incubation and Venture Assistance

To commercialise the innovations, a framework has been developed (see Annexure IX) to build the value chain around various innovations and traditional knowledge. It is necessary to form mentoring teams around each product for which business development has to be done. One has to locate willing entrepreneurs or business managers who would help in market research, business planning, developing a proposal for raising micro venture finance and, eventually, help convert innovations or traditional knowledge into commercial ventures. Students’ Club for Augmenting Innovations (SCAI) at grassroots are being set up in large numbers in many Business Schools all over the country. As of now, 19 SCAI chapters have been set up in various B-Schools across India. SCAI at grassroots is envisaged to be a voluntary network of students cutting across all disciplines to help promote and actively take part in the mission of NIF. This network of students will help grassroots innovators in market feasibility reports, financial calculations, streamlining supply chains etc. Similar SCAI clubs are being set up in technology institutes, agricultural universities and pharmacy colleges. NIF had organized a countrywide Business Plan contest 'DISHA' for developing business plans for grassroots innovations and traditional knowledge practices along with a group of students under SOMA (Students' Organization for Managerial Assistance) at IIM Ahmedabad. The response to DISHA was fairly good. Therefore, a DISHA- 2004 is proposed to be launched in September 2004.

Micro Venture and Innovation Fund (MVIF)

In his budget speech in 2002, the Finance Minister had announced his decision to establish a micro venture and innovation fund. National MVIF of Rs 4 crore for ten years has been launched on the eve of Gandhi Jayanti this year with the help of SIDBI, to be managed by NIF. Since then, a total of 109 projects are under different stages of incubation, which have been or will be supported from MVIF.

The synopsis of the investments Sanctioned & Disbursed, Sanctioned & yet to be Disbursed, Proposal under process, Shortlisted for next six months are given in table 1.

Summary of Investments
Table 1
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<tr>
<th>Head</th>
<th>Number</th>
<th>Amount (Rs.)</th>
</tr>
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<tbody>
<tr>
<td>Number project sanctioned and funds disbursed</td>
<td>35</td>
<td>Rs. 5, 80, 129 (Disbursed)</td>
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<tr>
<td></td>
<td></td>
<td>Rs. 12,29,896 (Sanctioned)</td>
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<tr>
<td>Number of projects under process</td>
<td>07</td>
<td>Rs. 4,39,462 (Proposed)</td>
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<tr>
<td></td>
<td>08</td>
<td>Rs. (Estimated)</td>
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<tr>
<td>Number of Projects to be taken in next six months</td>
<td>26</td>
<td>Disbursed: 13</td>
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<tr>
<td></td>
<td></td>
<td>Sanctioned: 04</td>
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<tr>
<td></td>
<td></td>
<td>Under Process: 02</td>
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<td></td>
<td></td>
<td>Hold: 10</td>
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<td></td>
<td></td>
<td>Closed: 02</td>
</tr>
</tbody>
</table>

Details of these Projects are given in Annexure X (a) to X (e).

With an objective to share common understanding of evaluation criterion for short-listing of projects and process flow of incubation, a workshop was organized at IIM, Ahmedabad on February 13 2004. Several experts from incubation business and management education were invited to share insights with the participating members of NIF and GIANs. See Annexure XI (a): MVIF Incubation Process and Performance Tracking System at NIF and Annexure XI (b) : New Initiatives in Business Development

Similar technologies were shortlisted from NIF database and bundled together in the form of portfolio. Benchmarking within the portfolio and with the existing products in the market were undertaken with an objective to attract potential buyers of the technologies.

With the help of MVIF ten technologies are being explored for cross-regional application of Innovations ( see Annexure XI (c) : MVIF support for Cross-Regional Application of Innovations).

D. Intellectual Property Rights Management

The only resource, as mentioned earlier, in which poor people are rich is their knowledge. Protection of the intellectual property rights and generating incentives for them becomes necessary to ensure knowledge based approach to work. The activities necessary to achieve this goal are:

- To help in prior art search so that innovators can maintain their competitive edge.
- To coordinate with various intellectual property institutions and attorneys to mobilize pro bono or paid help for grassroots innovators to file patents, trademark and other means of IP protection and also directly file applications on their behalf.
- To provide assistance to innovators to enter into licensing arrangements with entrepreneurs for transferring technologies.
• To help pool part of the license fee obtained from the innovators towards an innovation fund for supporting innovators.
• To screen ongoing patents on Indian traditional knowledge so as to oppose the improperly granted patents, particularly dealing with knowledge/innovations/practices entered in the National Register.
• To pursue with the government authorities, the possibility of NIF providing the certificate of inventions/unique Traditional Knowledge accompanied by medium term protection so as to reduce transaction costs of the IP offices and the innovators.
• To coordinate with WIPO and other international patent offices to secure IP protection for grassroots innovators globally, wherever applicable.

**Benefit sharing**

Recognizing the vital importance of protecting intellectual property and ensuring that nobody misuses traditional knowledge by ignoring the real knowledge holders, NIF has set up an Intellectual Property Section. The section, consisting of a National Coordinator and fellows, conducts prior art searches in order to analyse the innovations and to assess their viability for getting patents and other means of intellectual property protection. The IP section drafts the patent specifications and other related legal documents.

Some of the premier Intellectual Property firms and IP institutions, like Anand & Anand, New Delhi and Surana & Surana are providing pro-bono help for filing patents for innovators. Other firms like DP Ahuja & Co (HQ at Kolkata), Subramaniam, Nataraj & Associates (Delhi) and L.S. Davar & Co, New Delhi, are providing professional services on nominal professional charges. NIF has also been able to file several patent applications in United States with the help of SRISTI through a law firm, Testa Hurwitz & Thibeault LLP Boston (USA). It is hoped that the coming year would see more firms taking interest in working with NIF on pro bono basis.

To facilitate the protection for grassroots innovations, the IPR section has been working with the law schools around the country. Students from NALSAR University School of Law, Hyderabad, have worked with NIF for the last two years. One of the leading law schools of the country, West Bengal National University of Juridical Sciences (NUJS), has already expressed interest in working with the IP department of NIF. Efforts are also underway to establish Intellectual Property Law Clinics in various law schools.

NIF as well as its associates GIANs, have already filed 59 patent applications, two design and two trademark applications in India and USA. Many applications are ready for filing (see Annexure XII for the list of patent applications filed). The IP section has also been providing advice on related aspects of Intellectual Property Law, drafting of legal documents like NDA, MoU, transfer of technology agreements, etc, for other institutions like Centre for Innovation, Incubation and Entrepreneurship (CIIE), IIM Ahmedabad, and all GIANs.
E. Dissemination and Database Management through Information and Communication Technology (ICT) applications

The entire effort of scouting and documentation leads to the development of a database of innovations and traditional knowledge aimed at building the electronic National Register. The process involves using various information technology and database applications for horizontal networking among innovators and traditional knowledge experts as well as other stakeholders. In addition to this, the multi-lingual approach to the database development is the main task ahead. The activities involved are:

- To develop and maintain the multilingual National Register of Innovations (contemporary innovations and traditional knowledge), database management, electronic networking, web based management of value chain for grassroots innovations, coordination with various regional language portals and managing National Grassroots Innovation and TK Management Information System. National Register also serves the purpose of protecting the IPRs of knowledge holders.
- To develop multi language, multimedia kiosks at various public places, educational institutions and local bodies and help establish decentralised Indian language databases of innovations and Traditional Knowledge.
- To coordinate dissemination and publication activities of NIF in various languages on line as well as imprinted format.
- To help in diffusion of innovations and traditional knowledge on sectoral and regional basis to trigger experimental and innovative ethic
- To manage the archive of all communications and maintain effective touch with latest trends in technologies which can be harnessed in support of grassroots innovators, develop an effective management information systems, design and develop softwares in open source for use by GIANS and other collaborators, maintain websites of NIF and all other collaborators etc.

Dissemination:

NIF has taken up several steps to create wider awareness about innovations at grassroots. Some of the steps included use of IT such as:

a) A multi language, multimedia Honey Bee data base has been contributed by SRISTI to NIF. This has been widely distributed by NIF, along with information on the awardees of the first national competition, to various stakeholders around the country and outside.

b) NIF has co-sponsored a portal on innovation, viz. www.indiainnovates.com, being developed by students at IIM-A, as a part of their course requirements. This portal has already generated very encouraging response from IIM-A alumni around the world, who were requested to help in building a value chain around green grassroots innovations and it may eventually become a one point stop for any individual innovator in India.
c) An experimental village kiosk was set up by the Honey Bee network in a village in north Gujarat to learn about the complexity involved in IT applications in villages to promote use and exchange of information about innovations. NIF is exploring the possibilities of replicate this experience in several villages where our collaborators are working and where other institutions are setting up their kiosks. NIF is also seeking linkages with some NGOs for the purpose of kiosk installation at a number of places.

d) The NIF website, www.nifindia.org, is being made more interactive so that users can get information quickly and easily. Besides, the following sites are maintained and updated by NIF.

www.gian.org; www.indiainnovates.com; www.scai.org.in. The following domain names are reserved by NIF which point to one of the sites of network.


e) The software for the National Register has been developed and various collaborators have also been provided the database entry modules in local languages with the help of the Honey Bee network and SRISTI.

f) Demo Software for Technology Exchange (for online bidding for technologies) has been put up at the web site for testing. SRISTI has helped in maintaining this as well as knownetgrin innovation database so far, on the website with more than 1300 innovations and traditional knowledge examples. NIF will take this effort forward.

g) A web-based three-language innovation/traditional knowledge entry module has been put on the web site. However, so far only 141 entries have been received through the Web, all in English. About the same number of entries has also been received through email.

h) Two state government websites, viz, Punjab and Maharashtra, have linked to the NIF site to diffuse our work widely. However, efforts will be made to pursue such linkages with all the state governments and other institutions.

The dissemination of technologies which are either already matured for technology transfer to potential entrepreneurs, or which can be easily matured, has been taken up quite earnestly. NIF participates in various exhibitions and fairs for the purpose. It has participated in the Indian Science Congress held in Pune, New Delhi, Lucknow, Bangalore and Chandigarh. In addition, it has participated in the National Agricultural Machineries Exhibition, organised by Karnataka State Department of Agriculture, Ahmedabad chapter of CII, IIT Workshop, Guwahati, Gram Shri Mela, Wardha and MINDBEND organized by SVNIT, Surat.

as English language, Honey Bee newsletter are sent to as many entrants in the national competitions as possible. This is a part of our ethical and professional responsibility to help forge lateral linkages among innovators and traditional knowledge holders and also to promote sharing of public domain knowledge with local communities and individuals. An information system is being developed for internal use, as well as for use by various stakeholders. The idea is also to develop an on-line incubator for mentoring and valorizing the innovations and traditional knowledge.

Adding value to innovations and traditional knowledge and building their value chain

Grassroots Innovations Augmentation Network - GIAN

After having documented thousands of innovations and traditional knowledge examples, it was obvious that recognition and documentation of people’s knowledge was not going to be enough. A need to ensure commercialisation of viable innovations, so that their benefits are shared widely among the community members, was felt. In addition, many innovations and traditional knowledge would require non-commercial diffusion for wider social gain such as technological innovation for check dam or pulley for drawing water from well, or making tiles for roofing in rural areas etc. Such an entrepreneurial approach would hopefully provide motivation to people to innovate further. But the transition of an innovation into product, and, later, into enterprise requires input of formal science and technology, design, handholding support for project planning and management, finance, and marketing intelligence.

To achieve this goal, a nodal agency was required that would not only upscale these innovations but also would act as a clearing house of ideas by facilitating interaction among the innovators, entrepreneurs, and investors. Accordingly, the first Grassroots Innovations Augmentation Network (GIAN) was established in Gujarat in March 1997 with the help of Gujarat Government with the primary objective to link innovations, investment and enterprise. This idea was mooted at the International Conference on Creativity and Innovations at Grassroots (ICCIG), January 11-14, 1997, held at IIM Ahmedabad, where the need for a micro-venture promotion and finance support system to cater to the need of grassroots green innovators was recognized.

Mission of GIAN and its objectives

GIAN aims at sustaining the spirit of innovation, encouraging experimentation and nurturing creativity at the grassroots level of knowledge-rich, economically poor people, through transition of innovation into enterprises and facilitating diffusion of grassroots
green innovations through commercial as well as non-commercial public, private and voluntary channels. Its main objectives are:

- To identify grassroots innovations from Honey Bee database that can be scaled up
- To establish links with research and design institutions to add value so that efficiency can be enhanced and socio-economic and environmental efficiency can be enhanced
- To protect the Intellectual Property Rights of Innovators and operationalise their prior informed consent
- To mobilize resources to strengthen the capacity of grassroots innovators in undertaking large-scale expansion of their innovations
- To undertake technology, design and managerial research activities for scaling up the innovation to product stage
- Link innovations with enterprise and investment
- Provide project development and entrepreneurial support to innovators or innovations-based entrepreneurs
- To disseminate information about innovations and innovative products through various means such as exhibitions, media and workshops
- To organise entrepreneurial development and capacity building workshops in collaboration with expert institutions for innovators and first generation entrepreneurs
- To influence policy at micro and macro level to make it more responsive to the needs and expectations of green innovators

Establishment of New GIAN Cells

- GIANs have so far proved an effective arm in reaching out to innovators at far-flung places. Absence of GIAN in south of India, which incidentally contributed maximum number of entries to our National Register, had been felt for long time. NIF had made several efforts in last one year and first GIAN cell at SEVA (Sustainable Agriculture Environmental Voluntary Action), one of NIF’s collaborators based in Madurai, Tamilnadu, was established on June 23, 2003. With the support from regional technical institute (Thiagarajar College of Engineering), NIF has planned to relocate its GIAN-Madurai cell at TCE campus. The cell has been inaugurated on 23rd August at TCE under the initiative of SEVA. The Chairperson and Principal of Thiagarajar College of Engineering will be the Chair and the Convener of the cell respectively. Other members include two nominees of NIF, representative of SEVA, President of Innovator’s Association of TN, conveners of other GIAN cells and industry representatives.

- The GIAN-Karnataka cell was established at SSIT, Tumkur. The first steering committee meeting was held on July 14, 2004 at SSIT Campus in Tumkur. This GIAN cell is chaired by the Vice Chancellor, VTU (Visveswaraiah Technological University). The steering members comprise the innovators, two nominees of NIF, members of
PRITHVI and Management of SSIT, Tumkur. The cell has been assigned some projects for technical incubation of innovations from Karnataka and some neighbouring states.

(Further details on three GIANs are included in Annexure No III. Progress of projects supported by GIAN West is given in Annexure IV, GIAN North in Annexure V and GIAN North East in Annexure VI)

Creating Innovative culture in the country:

NIF’s initiative in respecting, recognizing and rewarding the innovations and traditional knowledge

To reward the creativity of individuals or communities who have achieved distinction in improving quality and productivity without the aid of formal institutions, NIF has conferred national & state awards earlier annually and now does it biennially. The broad categories are mentioned below:


Apart from the honour of including the outstanding innovations/tradition knowledge examples in the National Register, the first best three innovations would be awarded Rs. 1,00,000, Rs. 50,000 and Rs. 25,000 each in different categories. In addition, three Individuals and organizations who make extraordinary contributions in scouting grassroots innovations and traditional knowledge will also get awards of Rs. 50,000; 25,000 and 15,000 respectively. There would be consolation prizes of Rs. 7,500 each depending upon the number of entries and incremental inventiveness. Special awards would be given for innovations and outstanding traditional knowledge of women. The outstanding entries would also be widely publicized in the Honey Bee Newsletter and through other media. Summary and/or details of the innovative practice documented in the Register will be displayed at the web sites of NIF with the permission of the innovators/knowledge providers.

Award Functions

Since its inception, NIF has hosted two award functions in New Delhi. NIF bagged laurel from various stakeholders for organizing such ceremonies to reward grassroots creativity.
These awards are a part of NIF's mission to make India innovative and a global leader in sustainable technology.

The First Award Function

*November 29-30, 2001, New Delhi*

National Innovation Foundation activated itself by launching the first competition for scouting grassroots technological innovations in 2000. The first competition received 948 entries from 24 states and union territories including 1600 innovations and outstanding examples of traditional knowledge. In terms of subject wise classification, maximum entries were received in the area of herbal based animal health practices (298) followed by herbal medicines (207) and plant protection (175). In addition, there were entries dealing with small scale industries, mechanical devices, energy generation and conservation, agricultural practices, plant varieties, artisanal, etc. About 87 innovative ideas were submitted, three of which were being given prizes.

The awards were announced on 14th June 2001, in Ahmedabad, Gujarat by Dr. R. A. Mashelkar, Chairperson, NIF.

The First Annual Award function honouring the outstanding green grassroots innovators and traditional knowledge holders was organised by National Innovation Foundation and was held at IARI Auditorium, New Delhi on 29th and 30th November 2001. In this ceremony, 89 outstanding innovators and traditional knowledge holders and 17 scouts were awarded for contributing towards the first national campaign for grassroots innovations and traditional knowledge.

Hon'ble Shri K. C. Pant, Deputy Chairman, Planning Commission conferred the honor to the awardees. Dr. R.A. Mashelkar, Secretary, DSIR, Government of India & Chairperson, NIF shared the vision of NIF. Prof. V. S. Ramamurthy, Secretary, Department of Science and Technology presided over the function. Large number of other guests from various disciplines, viz., scientific institutions, planning commission, NGOs and other stakeholders of NIF and Honey Bee Network members were present in the function along with innovators and their family. The awards function was followed by a discussion on "Policy and institutional issues in scouting, disseminating and augmenting grassroots innovations" on 30th. (visit www.nifindia.org/award_ceremony.html for more details).

The Second Award Function

*December 17-18, 2002, New Delhi*

The Second National Grassroots Technological Innovation and Traditional Knowledge Award Function, hosted by National Innovation Foundation (NIF), was held in New Delhi on 17 and 18 December, 2002. The receipt of 6228 entries having 13533 innovations and traditional knowledge examples in second year from over 300 districts is a testimony to the countrywide impact NIF has made. 52 outstanding innovators and traditional knowledge
holders and 5 scouts were awarded for contributing towards the second national campaign for grassroots innovations and traditional knowledge (visit www.nifindia.org/secondaward/category.htm for list of national, state, scout and other awards).

Honourable President of India Dr A P J Abdul Kalam has been kind enough to grace the occasion and confer national and state level awards on innovators, traditional knowledge holders, students and communities. In a warm gesture, the president invited the innovators over for tea the next day at the Rashtrapati Bhavan.

**Challenges before NIF**

NIF has faced a number of challenges and the going has not been very easy so far. We have endeavored to tackle several complex issues, many of which have been looked into for the first time in this country. For instance, the protection of intellectual property rights is extremely important to us. Our appeals for developing an alternative intellectual property protection system specially tailored for small innovations and traditional knowledge have not yet been responded to by the policy makers. About ten years ago, a concept of INSTAR (International Network for Sustainable Technology Applications and Registrations) was proposed by the Honey Bee Network to ensure protection of people’s knowledge globally. A specific intellectual property right system needs to be set up to authorize NIF to issue certificates of short-term (say 10 years) protection.

We hope that national policy makers would recognize the urgency of taking steps in this regard so that even slightest prospect of biopiracy can be avoided. The passing of Biodiversity Act by the Parliament provides an opportunity to take this issue forward. Meanwhile, NIF is continuing its modest efforts to protect the IPRs of grassroots innovators within India and abroad through conventional channels.

With thousands of innovations and traditional knowledge examples waiting to be valorized, incubated and converted into enterprises, we need a very large scale effort of investment in adding value to these. A small scale effort has already been made by GIAN-Gujarat set up in 1997 in collaboration with Gujarat Government. It has succeeded with a very small investment base but through many grants from TePP (Technopreneurial Promotion Programme) of Department of Scientific and Industrial Research and Department of Science and Technology. The patents have been filed, technologies have been licensed within India on district and state basis and internationally. New ventures have been created without following any bureaucratic process of incubation with a team of just two – three people. Two more GIANs have been set up. But real change will come when we will have many such GIANs in different parts of the country.

Moreover, our attempts to get the concept of PIC going are still in the nascent stage. Considerable work needs to be done in this area before we can make a dent in this arena, especially in the rural areas, where it is most needed.
Meanwhile, it is obvious to us that the larger the number of people whose lives we touch, the greater is the moral burden on our shoulders and the higher the societal expectations. When this has to be contrasted with a 50 per cent decline in the interest rate, and, therefore, the income, our predicament, and the pressure under which we work, can be imagined. From an annual income of Rs. 2.2 crore, our current annual income is less than Rs 1.20 crore, keeping small savings apart. Serving 37,000 knowledge holders with these meagre resources is obviously impossible. But we live in hope.

On another front, more than 65 per cent of our entries so far are based on the herbal knowledge system, and we have not been able to award any of them because of the direction of our Governing Council, which rightly felt that the claims of herbal healers needed to be validated. How do we get these validated? Unless all pharmacy, biotechnology, botanical, and other laboratories in the country gear themselves to take up this task in a mission mode as a national priority, we will not be able to build upon tremendous knowledge richness at the grassroots level. If we have to hire public and private sector research labs on behalf of these innovators, we will need enormous financial resources. It is a different matter that in most of the labs, we do not have high throughput facilities to screen a large number of samples in the shortest possible period of time.

Likewise, educational systems need to be encouraged to give priority to value addition in traditional knowledge.

Unless the corpus of NIF is increased by at least 10 times and an additional Rs 100 crore fund for incubation, technology acquisition and dissemination is created, the dream of making India innovative will be delayed, if not denied altogether.

However, the enormity of the task that faces us has not made us loose heart; and as we take stock of our efforts so far, we pledge to re-dedicate ourselves to the service of this nation's traditional knowledge holders and innovators. Creation of a consciousness which links seven Es (Ethics, Efficiency and Entrepreneurship, Excellence, Environment, Equity, Education, and Empathy) is a task that NIF is committed to pursue regardless of all the limitation in close collaboration with Honey Bee collaborators and other civil society volunteers.
Annexure I

Honey Bee – Newsletter and other activities

The Honey Bee Newsletter and its local language versions are published to share information with providers and other stakeholders. Local language versions essentially provide the platform for sharing value added information among farmers and other innovators, while the English version helps in sharing information across the language and regional boundaries. This newsletter started with a discourse on knowledge, rights of knowledge providers, ethics of conservation, logistics of innovations etc, and it became an important voice on the issue of IPR. When nobody was debating about GATT in the developing countries (and CBD was still to be signed), the Honey Bee network was raising the question, “Will you stand by IPRs of peasants?” In some sense, it was a drive to make us more accountable towards people whose knowledge we wanted to learn from. What we realized after a while was that the contribution that we are getting from all sections of the society was far more from individuals than from NGOs.

Other activities of Honey Bee

However, in addition to the publication of the newsletter, the Network tried to do many other things. To enumerate a few initiatives, way back in 1991, the first biodiversity contest was organized by our oldest partner, SEVA, among children as well as adults in a village in a drought prone region of Madurai. SEVA is a collaborating NGO for the Tamil version of Honey Bee. Similar contests were organized in Kerala, Uttar Pradesh, Himachal Pradesh and Gujarat in India, and in Vietnam and Bhutan. What was most remarkable about these contests was the fact that young children from very disadvantaged backgrounds showed an extraordinary ability to inventorise biodiversity and its local uses. Many of those who had dropped out from the formal education system had not dropped out from, so to say, the informal education systems. In fact, many of them had excelled in this system of survival knowledge.

When the movement started expanding more, a need for setting up SRISTI, a development voluntary organization, was felt in 1993 to provide backup support to the Honey Bee network. Indian Institute of Management, Ahmedabad, has provided extremely valuable support to the Honey Bee network right from its inception.

Main functions of Honey Bee Network

Five functions were identified as crucial to the core activities of Honey Bee network:

a. Documentation and dissemination (through application of information technology and otherwise) of innovations and traditional knowledge
b. Validation and value addition in the knowledge, innovation and practices
c. Protection of intellectual property rights
d. Provision of monetary and non-monetary incentives for individual and collective creativity, conservation contribution, and innovations, and
e. Policy advocacy for expanding institutional space for grassroots innovators and traditional knowledge holders.

It is around these five functions that the activities of Honey Bee network, SRISTI and its partners were organised. It is these functions which became the basis for evolution of the National Innovation Foundation (NIF).

At the end of the day, the Honey Bee Network has, in some way, proved that the modern institutions can blend with the best of local knowledge systems, traditional knowledge and contemporary creativity. We have realised how critical the issue of traditional knowledge is. But equally important is the issue of contemporary creativity. There are a number of people who have come up with innovations in the past few years. While the focus on traditional knowledge is justified, given its important role in the survival of millions of people, contemporary sources of creativity are also important to reinforce the experimental ethic.

The validation and value addition of documented knowledge helped in recognising what was needed to be shared, how, when, in what form and with whom. It is obvious that not all experiences of knowledge holders might have the same validity. The on-farm research was attempted as one approach to validate. Linkages with formal institutions of science and technology was another. It was also realised that knowledge experts among themselves could debate and ascertain the potential some of the practices might have by drawing upon their own understanding and experience about the concerned knowledge systems. The meetings of Shodh Sankal, that is, the chain of experimenters, became an important means of such a dialogue among the innovators and others interested in these knowledge systems.

**Incentive Models for Rewarding Innovators**

The Honey Bee Network took up the enormously challenging task of experimenting with various models of recognising and rewarding innovative individuals, groups and communities. SRISTI has conceived four different incentive models for rewarding innovators:

**Material-individual:** This includes awards, fellowships, patent rights, license fees and other forms of remuneration and monetary incentives for individuals.

**Material-collective:** This includes trust funds, risk funds, mutual insurance funds, venture capital support and revolving funds under the direct control of the stakeholders. The reward would flow to a group through different funds to encourage inventive communities to experiment more and more on the path of entrepreneurship.
Non-material-individual: This includes honoring the innovators for their unique contributions to society by conferring titles, public felicitation, invitation to give lectures at formal centres of learning, conferences, meetings etc.

Non-material-collective: This includes changes in educational curriculum, favourable policy environment for conservation practices, eco-friendly products, capacity building through transfer of technology, etc. The policy change influencing the livelihood options of communities and individuals without necessarily providing immediate monetary input would also constitute non-monetary or material collective incentive. The respect, recognition and reward for community actions, besides creation of a consciousness which links seven Es (Ethics, Efficiency and Entrepreneurship, Excellence, Environment, Equity, Education, and Empathy), thus became a very important non-material collective incentive for creativity, conservation and caring culture in society.

The synergy among the seven Es will emerge essentially in an institutional context. The technology can only change the ratio of inputs and outputs, but how are outputs shared, whether inputs are used within sustainable limits and to what extent the environmental, ethical, and equity considerations are kept in balance will depend upon the institutions. These institutions can be formal as well as informal. Traditional knowledge is often conserved by the communities and individual experts through norms and values that influence the way resources are used, benefits shared and interest of future generations, as well as non-human sentient beings (birds, animals, insects etc) looked after.
Annexure II

Explanatory Note on Scouting and Documentation of Grassroots Innovations

Scouting and Documentation being the most important goal of NIF, we provide an explanatory note on the working and methodology:

To scout grassroots green innovators and traditional knowledge holders who had solved a local problem entirely through their own effort without any outside help requires a massive campaign around the country. The knowledge so documented requires Prior Informed Consent (PIC) of the innovators and Traditional Knowledge holders, besides verifications in the case of those chosen for commendation, awards and support for value addition and commercialisation. NIF has drawn upon a variety of approaches for scouting and documentation evolved by the Honey Bee network for its national campaign for over last decade and a half.

The documentation and dissemination are, to some extent, simultaneous processes. Hence, the dissemination of documented innovations and traditional knowledge became an integral part of the most of the methods used for documentation of grassroots innovations. The Honey Bee network has been able to mobilise a large number of students from rural (and some urban) colleges, rural youths, grassroots functionaries of rural development and other departments of the state government, teachers and development workers and individual volunteers, or what we may call NGIs (Non-Governmental Individuals), for documentation and dissemination.

Various methodologies and approaches used for documentation and dissemination are:

i) Survey of Odd Balls in the Villages through Students.

Initially about 100-120 student volunteers from various Gandhian institutions in Gujarat are selected every year by the Honey Bee Network for about two months during the summer vacation. They are given simple orientation training in small groups for scouting and documenting innovations and traditional knowledge. They are encouraged to appreciate the grassroots innovations created by their family members and neighbours in the village to begin with. The students are asked to narrate some of their own experiences, which were interesting, intriguing or inspiring. By underlining the ones that we find counter intuitive or less obvious, we convey what we are looking for. The process of training gets demystified and the purpose of scouting becomes clear because the examples of what we are looking for are drawn from the scout’s own experience. The students then survey different villages. They also collect addresses of a few farmers who either know about the innovator concerned and/or have fields adjoining the fields of the innovative farmer. We write letters to these contacts later to have a first round of confirmation. Later, another student/field investigator revisits each site to avoid any error in the process. The best scouts are given prizes in the annual Honey Bee network meeting.
ii) Organising Competitions for Scouting Innovations

Competitions have been organised in various parts of India among students and grassroots functionaries of the state government. Survey forms have been developed to seek brief information about the innovations scouted by the participants. Application forms, procedure and other details are explained through meetings in schools/colleges. Voluntary teachers coordinate such contests in their schools and ensure that students work in the spirit of fulfilling their curiosity to learn from informal knowledge experts in our society rather than to earn a small honorarium. For launching competitions among the grassroots functionaries, workshops are organised to explain the purpose of scouting campaigns, as well as to expose the participants about the earlier experiences in scouting. A committee of three persons evaluates the entries sent in by the participants and the winners are awarded prizes and certificates in the network meeting. Some of the outstanding innovators identified through competitions are also honoured at such meetings. Many students and functionaries can participate in this activity. Revolving trophies are given to the best district official/development agency which scouts the most interesting innovations and traditional knowledge. We have not succeeded, so far, in institutionalising such a process in many states, but efforts are on.

Though one finds that the same, or similar, traditional knowledge, and in some cases, even innovations, are recorded from more than one place, we do not discourage this. This helps us to learn about the capability of local communities and individuals to evolve similar solutions to same problems independently, autonomously and simultaneously. In some cases, such a knowledge or innovation may indeed have diffused from place to another. Our experience so far has been that several innovations and traditional knowledge are discovered from unexpected quarters within a very short span of time through such competitions.

iii) Scanning of Old Literature

There are many visionaries and experts at the regional level who do not get their due credit and recognition just because they did not publish their ideas in English. As a result, many times it so happens that we end up giving credit for ‘reinventing the wheel’. One of the purposes of scanning the old, vernacular literature is to bring these unaccredited knowledge systems to light. We have collected old books from civil society, old institutions and stalls, NGOs and vendors of old books. We are trying to reprint some of these books. Particular mention may be made of a book by Gangaben, who became a widow at an early age and published a compendium of 2080 formulae for self employment based on local knowledge, way back in 1898 in the Gujarati language.

iv) Agricultural and Cultural Fairs

Agricultural fairs are vibrant traditional institutions in rural India, where people assemble in large numbers, either for religious or cultural celebrations. Honey Bee network members
participate in such fairs by putting up stalls. Many innovative volunteers sometimes set-up and run these stalls. In addition, a computer for accessing Honey Bee database, posters, leaflets and other publications in local languages are kept at the stall. Many farmers, artisans, community leaders and professionals visit the stalls and get information about the innovations developed by other farmers. While accessing this knowledge base, they also share their own innovations with Honey Bee network members.

v) **Shodh Sankal - a local network of grassroots innovators**

To generate a lateral learning environment among the grassroots innovators, SRISTI has initiated the concept of *Shodh Sankal* - chain of experimenting farmers. The idea is to bring together experimenting farmers and discuss the results of trials that farmers have taken up on their own to solve various local problems. This discussion also enhances the esteem for local knowledge system. It is possible to generate ‘lateral learning’ among farmers by sharing innovative practices found suitable in one region with the farmers in another similar region after on farm testing/trials if necessary. This could help to speed up the process of technological change in regions where formal technology generation system has not been very successful, such as dry regions, mountainous regions and other disadvantaged areas. Even in less risk prone regions, it cannot be assumed that an innovative technology will diffuse on its own just because some farmers in a village have evolved it.

vi) **Shodh Yatra (journey for exploration)**

Based on the experiences of several years, the network launched the concept of *Shodh Yatra* in 1998. The journey of exploration is organised on foot from one village to another for 8-10 days, covering a maximum of 250 kms during extreme summer as well as winter. Innovative farmers, artisans, students and scientists join the *Shodh Yatra* and walk with the objective of participatory learning and dissemination of information, as well as spreading experimental and inventive ethics among communities. Local experts, whether in traditional knowledge or contemporary innovations, are honoured at their door step in these villages. The Honey Bee database is shared with farmers in the local language through laptop computers and print publications. A mobile exhibition on medicinal plants, posters, artefacts, working models of innovations etc, are used for making the presentation more relevant to the local context. Biodiversity contests are organised among children while recipe contests are organised among women in some of the villages (particularly with focus on such food recipes in which at least one uncultivated plant has been used).

vii) **Scouting through Innovators**

Unlike the agricultural practices, the search for artisanal and farm machinery innovations is far more complex. One village may have several hundred farmers but only one or two artisans. To meet 100 artisans, one may have to survey 50-100 villages. However, over a period of time we discovered that social network of artisans is reasonably strong. Once we identified an innovative artisan or mechanic, we asked him to look for others of his kind. This process has helped in discovering many innovators.
viii) Scouting through Media

Many newspapers and magazines have written about the innovations and traditional knowledge recognised by Honey Bee network. Some of the innovators have approached us after reading about other innovators. This process is further strengthened through circulation of posters of competition among various institutions and stake-holders. A very small number of innovations are also scouted through internet where existing websites (www.sristi.org, www.nifindia.org, www.gian.org, www.honeybee.org, www.indiainnovates.com) of the network have popularised the missions of NIF and other collaborating institutions.

Practices collected from various sources reflect a variety of knowledge systems, problem solving approaches, sectoral areas of technology, and above all, a variety of ethical approaches to evolution and dissemination of local solutions. The technological solutions have been recorded from various fields such as agronomy, plant varieties, plant protection, crop production, soil and water conservation, farm implements, veterinary and animal husbandry, poultry keeping, vegetative dye, forest and other natural resource management, leather tanning, energy generation, transport, general utilities, farm and small scale machineries, household utilities, etc. The methods described above are complementary to each other and are some times followed together. The practices scouted or documented, irrespective of the methods used, are verified by writing letters to the innovators, followed by a personal visit from the team. Innovators are encouraged to correct the practices and interpretation made of the information provided by them. Verified practices are stored in the computerised database with the names and addresses of the innovators, as well as communicators. If the same practice is reported from other sources without variation, the names of the other providers are also added in the same record. However, the success rate of a particular scouting method may not be the same at every place; it varies over time and space and, of course, the social group attempting to use these methods.

ix) Scouting through the Network

The network collaborators and coordinators of GIAN play a very important role in helping to attain a record of respectable number of innovations and traditional knowledge through their active involvement with the network.

Lateral learning in the network: Experiences shared by the collaborators in their endeavour of Scouting and Documentation

In a recent meeting attended by personnel of NIF, the Honey Bee Network and allied organisations, various collaborators shared their experiences about different methodologies tried by them to scout innovations and traditional knowledge. It was stressed that our focus need not be only on the number of entries, but also on the quality of entries. Similarly, mere documentation is not enough, conversion of innovations and traditional knowledge into
products and enterprises is also necessary. There was a general consensus that the mobilisation of entries through advertisements was much lesser whereas the results through network contact were much better. NIF’s experience at the national level corroborated this. Out of about 13000 innovations/traditional knowledge examples, hardly 1600 practices/innovations were mobilised through advertisements in the papers. It was also felt that before detailed documentation, the originality and social importance of the innovation should be ascertained. Those practices, which are well known in a given region, could be kept as open source technology available for wider use.

SEVA, (Madurai), organized workshops in different regions of Tamil Nadu and tried to scout other innovators and traditional knowledge holders through innovators themselves. He gave examples of several innovators who had only developed a concept or an incomplete product but after the documentation process, felt inspired to complete the development of the product. In some cases, the innovation was postponed in deference to the request from the affected people. For example, the innovator who developed coconut harvester did not develop it immediately when neighbours were affected. Later on, to meet his own needs, he completed the innovation by borrowing money at a very high rate of interest. The trigger was the documentation process initiated by SEVA. The workshops of animal healers helped in uncovering even more traditional knowledge of animal husbandry and healing from those who came to learn.

Many people enquire as to what would be done after their knowledge is documented. A note clarifying NIF’s commitment, capacity and concern in this regard is being developed and shared in local languages.

PRITVI, gave information about the collaboration with the Director of Agriculture, Karnataka, through whom about 20,000 pamphlets were circulated all over the state, apart from thousands of posters. This approach led to generation of a wide variety of ideas, innovations and traditional knowledge entries. While reviewing the campaign strategy, he said that only 10 per cent entries came in response to the poster based campaign, about 30 per cent came through NGO and readers of magazines like Adike Patrike, and 15 per cent through personal visits, after getting some leads from network members. An issue was raised that there should be a balance of resources spent on scouting vis-à-vis the follow up action on the scouted innovations and traditional knowledge. Several questions being raised in the media about the process of documentation were discussed, such as:

a. what is the relevance of digital documentation when most people do not have access to digital technology
b. if there are no IPR laws in the country which can safeguard Traditional Knowledge, should documentation be done at all
c. if benefits cannot be ensured and IPRs cannot be protected, should documentation process be stopped for a while
d. can the Prior Informed Consent (PIC) note and its framework be really understood by the people, and if not, what steps are being taken to facilitate its easy comprehension and compliance by people and NIF.
On digital documentation, it was explained that the long ranging controversy on bio piracy required patent offices world wide to have access to digital information on public domain traditional knowledge so that no patents were issued on such knowledge. This has been a demand of global civil society for a long time. TKDL (Traditional Knowledge Digital Library) thus ensures complete protection of Indian documented knowledge heritage in terms of bio-piracy. So far as documentation processes are concerned, the purpose is not just the protection of IPR; the idea is to make India innovative and build bridges between excellences in informal and formal science. The public domain traditional knowledge can be disseminated among other communities to promote lateral learning and improve productivity and sustainability in the society.

Further, till IPR system evolves, confidentiality has to be maintained in NIF. The information is shared with third parties only as per the PIC. In some cases, where scope for value addition exists, sharing is done on the basis of non-disclosure agreement (NDA). Every contractual staff or associate of NIF is expected to sign NDA. It is on the same pattern as all the collaborators and RAC members have been asked to sign the NDA. Documentation also helps in preventing the erosion of knowledge, besides generating respect among the knowledge holders about this knowledge system. As mentioned earlier, some of the innovations got matured precisely because documentation process created pressure to perform. Such an ethic is extremely healthy and would help make India a more creative, productive and inter connected society. So far as the issue of PIC is concerned, the current complexity in the background has emerged because of the feedback received and the need to ensure fairness in the process. We have to share pros and cons of every option so that people can decide what they think is proper in the matter.

SRISTI GYAN Kendra, Uttaranchal pursued a ‘Shodh Yatra’ on cycle and scooter covering about 250 kms, including four states. The first round of the ‘Shodh Yatra’ was done to identify the places where documentation was to be attempted. Initially, he and his young colleagues began with booklets in Hindi but the response was not very good. Then they started with cassettes and the impression people got was that they had probably come to sell something. Slowly, they came to realise that they had to use a mobile exhibition. They developed a new vehicle called as “Saksham” with NIF’s support, which provided the facilities of dissemination, using multimedia technologies. This strategy worked very well because a number of people, young and old, came forward to see the odd balls in the exhibition and then volunteered to share their own experiences.

Their team also made a presentation to the young students who were attending the national integration camp, and through these young participants, got leads for new innovations. They also set up a telephone help line through which they answered questions of farmers using the Honey Bee database. Sometimes, the process of documentation was quite frustrating. After visiting 20 villages over two weeks, they got only three innovations. They also tried to show ‘Shodh Yatra’ films developed by EMRC, Ahmedabad, in collaboration with SRISTI on cable TV. Several technology offers were received through this channel.
PEDES in Kerala tried to use the NGO network to scout for innovations. He mentioned that among other channels, the leads in the newspapers were very helpful for documenting innovations. Given higher literacy in Kerala and wider readership of newspapers, journalists had started giving more attention to local innovations here than perhaps elsewhere. About 50 to 60 innovations were documented through these leads. He also felt that if some of the innovations were commercialised quickly and also replicated widely, then the documentation process would become faster. He also suggested that some of the older innovations, which might have been commercialised locally, should also be documented so that through the National Register, such knowledge would get disseminated in other areas.

Dr Balaram Sahu is a well known writer on scientific issues in Orissa and has recently started the Oriya version of Honey Bee. He, along with Mr Ranjan Mahapatra, are trying to coordinate the campaign in Orissa. He talked about several ideas which could be taken up for scouting and documenting innovations:

a. It would be useful to tap young minds at the school level to create awareness; in turn, it would also help to bring forward their creativity amidst masses
b. Formation of innovative and eco clubs involving students from school and colleges could help
c. Posters made to popularise the innovations could also help, and
d. Slogans should be developed, which capture the essence of NIF goals.

Mr Mahapatra (SRISHTI, Orissa) suggested that self help groups of women should be involved. The administrative agencies can also help in the process of scouting. The connection between the scouting and livelihood support strategies of poor people was necessary.

Mr Sunda Ram, an innovator cum scout, has been pursuing the scouting process in Rajasthan. He tried several interesting innovations in scouting. He organised a contest on biodiversity-based knowledge among forest department officials, in which the district forest officer, forest guards and community forest protectors participated.

*Dr V Vittala said that GIAN NE (Grassroots Innovations Augmentation Network – North East) has conducted several community meetings in Assam at Kamrup, Morigaon, Nagaon, Nalbari, Tezpur and Jorhat district, in Arunachal at Ziro, NERIST. Students from all over the northeastern region have been mobilised as volunteers for scouting.*

Government officials are also supporting the scouting process by their official network. Recently GIAN-NE has scouted one innovator with the help of Mr I. K. Baruah, ADC, Morigaon. Ms Vineeta Sharma, SP, Morigaon, has taken keen interest and circulated our Assameese version leaflets among all the police stations of the district.
Mrs. G. B. Marak, Social Welfare Officer, RI-Bhoi district, Meghalaya, is coordinating with GIAN-NE in organising meetings in the district. Further, GIAN-NE has conducted scouting competitions at Jorhat, Tezpur, North Guwahati and Nirjuli, Itanagar. GIAN-NE has scouted about 250 innovations during the last 10 months.

Several other ideas emerged in the meetings. Some of these are:

a) Certain practices could be kept in open source if they were not unique, depending upon the conditions imposed by the innovator concerned in the consent form.

b) Innovations, even if they are old, may be accepted and included in the national register but should not be considered for awards.

c) Sometimes, grassroots innovators are unable to articulate the essence of their innovation. Therefore, it is necessary for the scout to try to explore and decipher the meaning of the practice through iterative discussions and perseverance. To achieve better results, scouts should be given proper orientation training for documentation.

d) For intensifying documentation process, it would be helpful to recruit local correspondents (khabarpatri) based in villages (as tried by SRISTI recently) who may have an inclination towards documentation of innovations and TK.

e) Innovators could also act as a scout. Whenever an innovator scouts another similar person, it becomes easier for him to identify the problem because of his familiarity with the subject matter. His assistance in the documentation process, improves the quality of documentation at times.

f) Innovators could be broadly classified into two categories: grassroots people, having low academic background but vast experience and professionals/trained personnel, having access to state-of-art knowledge network system.

g) It was agreed that explaining the intricacies of the PIC form and note to innovators and traditional knowledge holders would require considerable effort by the scouts. It was felt that regional workshops be organised for the purpose.

h) Local language versions of Honey Bee are providing a very useful and productive way of disseminating the campaign goals and Honey Bee network philosophy. NIF should support spawning of new versions in different regions.

i) Many of the Nodal Officers are playing a very important role in popularising the NIF’s campaign and they need to be supported to strengthen links with various institutions to strengthen the goals of NIF.
Annexure III

Grassroots Innovation Augmentation Network (GIAN)

The Government of Gujarat came forward to join hands with IIM-A, SRISTI and Honey Bee network to help set up the GIAN Gujarat. It made an initial corpus grant for the establishment of Gujarat Grassroots Innovations Augmentation Network to link up innovations, investment and enterprise. The existing scope of Gujarat GIAN has been expanded to include two more states, Maharashtra and Goa, so as to become GIAN, West. It has been making steady progress in commercialising technologies, filing patents in India and abroad and building of a portfolio of new projects. It has received excellent support from TePP (Technopreneurial Promotion Programme) of the Department of Science and Technology and Department Scientific and Industrial Research. Several models of successful incubation have emerged which would be helpful for guiding the activities of other GIANs. Very substantial offers for licensing technologies are under negotiation and seven licensing deals have been concluded already. The details of the projects incubated are given in Annexure IV.

WAIGIANIC - Western-region Association of Indian Grassroots Innovators for Augmenting, Nurturing Innovations and Creativity has been setup with the objective of managing a fund, which could be used for mobilizing financial support for development of ideas and small innovations. We are pleased to announce the setting-up and operationalisation of the fund. A five-member committee, comprising two innovators, CIO-National Innovation Foundation, CIM-GIAN and Secretary –SRISTI shall manage the fund. In the last six months four disbursals, amounting to Rs. 10,500/-, have been made from the fund.

GIAN West -- most proactive among GIAN network

GIAN West being one of the most proactive regional bodies among the GIAN network, its achievements and working are being described in considerable detail.

GIAN (W) has achieved one successful technology transfer during February, 2004. The non-exclusive manufacturing and marketing rights for the Natural Water Cooler for the states of Gujarat and Rajasthan were transferred to a young entrepreneur from Mehsana for a down payment of Rs. One lakh and a royalty of 2.5% of sales for a period of five years.

The GIAN has also been adjudged the joint winner of the National Award for Technology Business Incubation for the year 2003. The other joint awardee is the Telecommunications and Computer Networks (TeNet) Group based out of the Indian Institute of Technology, Chennai. The award has been instituted by the National Science & Technology Entrepreneurship Development Board (NSTEDB), Department of Science & Technology, Govt. of India to recognize the good work done by various organizations in the area of techno-entrepreneurship development and business incubation. The award carries a cash
The prize of Rupees One Lakh along with a trophy. The award was formally presented by the Hon’ble President of India, Dr. A.P.J. Abdul Kalam, on June 30th, 2004, as a part of the Technology Day function in New Delhi.

One of the technologies incubated by GIAN, the Cotton Stripper machine developed and commercialized by Shri Mansukhbhai Patel has been awarded by the National Research Development Corporation under the category of Successful Commercialization of Indigenous Technology at the Technology Day function held on June 30, 2004 in New Delhi.

**Milestones of GIAN-West**

- Networked with premier technical and design institutes such as IIM, IITs, NID, MIT, etc., for technical and managerial assistance
- Established a design studio GRIDS (Grassroots Innovations Design Studio) at the National Institute of Design, Ahmedabad, to provide world class design inputs to the grassroots innovations, supported by the Gujarat government
- GIAN recognised as an R&D institution by the Department of Scientific and Industrial Research, Government of India
- Achieved six technology transfers for four innovations at a district, state, national and global level
- Linked various schemes of DST and DSIR, such as Technopreneur Promotion Programme (Tepp), TIFAC and leading nationalised banks to help innovators in the form of product prototype, workshop establishment, conference and seminar, etc
- Facilitated filing of nine patents and two design registrations in India and five patents in USA
- Facilitated filing of five trademarks protection applications
- Facilitated outside recognition and reward to grassroots innovators. Dr Vikram Sarabhai Young Scientist Award has been awarded to young innovator Mr Kalpesh Gajjar, who invented an oil expeller machine. Eight innovators, supported by GIAN-West, have been awarded by NIF
- Established the patent facilitation cell with the help of the Industries Commissionerate, Government of Gujarat for small and medium innovators
- Incubation support extended for 17 innovations
- Supported 30 innovative projects, including five projects of social relevance
- Venture finance arranged for seven innovations
- Five patents filed in USA with pro-bono support from THT, a Boston-based law firm

**Structure of GIAN West**

The Board of Directors of GIAN Gujarat (registered as a charitable society and a Trust) includes the Additional Chief Secretaries of agriculture and industry, three managing
directors of state corporations (GMDC, GNFC and GIIC), three professors from IIM-A, a representative of SRISTI, SEWA, and GOPAL Dham, three NGOs, and the CEO of Gujarat Venture Finance Ltd. The SRISTI president has been appointed as the Managing Trustee. The Directors of IIM-A and NID, and the state Chief Secretary are permanent invitees. The state government has encouraged state corporations to contribute to the corpus to the extent of Rs 45 lakh as against the original target of Rs 1 crore.

**Incubation and prototype financing**

Incubation assistance continued for 10 hp tractor, oil expeller, 5.5 hp tractor, motorcycle ploughing machine, double acting pump with balancing mechanism, solar cooker, innovative wind mill application, auto air kick pump and auto weigh sprayer. Incubation and prototype finance was arranged for all of the above from TePP, GEDA and Science and Society program of DST.

The innovation of ‘Groundnut Pod Separator’ of Mr Marutrao Sarode has been studied and a student of IDC, IIT Mumbai, has developed two prototypes for the groundnut pod separator.

Through NIF, 12 projects have been supported by GIAN West (8 awardees, 4 non-awardees). Out of these, three awardees have been provided support through NIF. Among the remaining nine, five innovators have been provided support through TePP (three awardees and two non-awardees), two innovators through GEDA (one awardee and one non-awardee), one innovator through DST (non-awardees) and one through SRISTI (awardee). From among the second competition award winners, the “Check Dam” of Mr Bhanjibhai has been supported technically and financially. Students from IIT-Kanpur are working on this. Another innovation of the same innovator, “10 HP Tractor”, has also been supported for testing and certification.

**Incubation Activities At Grassroots Innovation Design Studio (GRIDS)**

Under an agreement, signed on April 17, 2001, with the National Institute of Design, GIAN established a Grassroots Innovation Design Studio (GRIDS) for facilitating formal design inputs to the grassroots innovations. As per the agreement, NID will take up at least four projects from GIAN each year to integrate formal design inputs with grassroots innovations.

In the first phase, two crucial products, viz the Motorcycle Ploughing Machine and small tractor were taken for design integration. Also, a mobile exhibition of innovations is being designed by NID students. Students selected both the products from a range of choice given to work on aesthetics, space re-orientation, form and feature standardisation, ergonomics, etc. Both the products have received design inputs from students. However, a great deal of work remains to be done before moving on to the next stage in the product cycle.
The outcome thus generated is protected in the name of the innovator with due recognition to the contribution by the faculty and students.

Both the products were displayed in the Auto-Expo at New Delhi, where they were greatly appreciated by visitors. The second phase of the projects is on for selection. This studio has mobilised interest of design students in grassroots innovations and a large number of students are coming forward to work on these challenging innovative products. A project of automatic weight sprayer has already been taken up in this session.

The real challenge before the students is to blend mechanical interventions with design integration so as to optimise the functional efficiency of the equipment. Hence, sometimes external technical help may have to be mobilised so that designs become functional and alternative to end-user. It is obvious that grassroots innovations have to compete with other projects from industry, offering new attractions. But so far, GRIDS is getting a good response.

**GIAN-North**

Gian-North has been housed temporarily in the Children Science and Technology Park (CSTP) of the DST, Government of Rajasthan. Some projects proposed by GIAN North were taken up for technology maturation in a meeting organised at IIT Delhi. The list of projects valorized and incubated through GIAN North is given in Annexure V. GIAN North has taken up several projects dealing with farm machinery, organic farming, water conservation and herbal technologies. IT is also coordinating with local NGOs and S and T institutions to forge linkages among innovators and these institutions.

**GIAN-North East**

GIAN North East has been started for the time being in the premises provided by IIT, Guwahati, without waiting for the declaration of interest or support from any of the north eastern states. Some of the projects proposed by GIAN North East have received support from state governments. Filing of patents and product development is being pursued with the support of IIT Guwahati students and faculty members and NERIST, Arunachal Pradesh. The current set up has been geared up to take the incubation activities for some projects of North-East region out of the award winning innovations. The list of projects valorized and incubated is given in Annexure VI.

**Setting up new GIANs in other regions**

NIF has decided to set up GIANs in different regions of the country in close collaboration with respective state governments and other institutions of excellence, as well as NGOs. Ideally, each GIAN should have a corpus of Rs 5 crore at least, with recurring support of Rs 20-30 lakh per annum for incubation. However, so far, only Rajasthan Government has come forward to support GIAN North with a corpus contribution of Rs 50 lakh. NIF is setting up GIANs in different regions of the country, primarily to provide a helping hand to
grassroots innovators to convert their innovations into enterprises. So far, GIAN-North, GIAN-North East (in collaboration with IIT Guwahati) and two GAIN cells have been established. GIAN-W is expanding the scope to Maharashtra and Goa to convert it into GIAN West. Of late there has been some positive response from Jharkhand, Tamil Nadu, West Bengal and Karnataka also.

Coordination with other GIANs:

Three projects of GIAN North and two projects of GIAN West have been taken up by GIAN North East for further value addition. GIAN North East is helping GIAN West in the marketing of Kushal Sprayer. Likewise GIAN North has taken up diffusion of innovative check dams in Rajasthan, developed by Bhanji Bhai, and several other technologies evolved in Gujarat. GIAN West has taken up technologies developed in Kerala such as manual milking machine for replication in Gujarat and Maharashtra.
Annexure IV

GIAN-WEST

Project Status Summary

Completed Projects
The following projects have been successfully completed and are not being provided with any active incubation support by GIAN.

- Aaruni Bullock Cart
- Innovative Pulley
- Cotton Stripper Machine
- Motorcycle Sprayer
- Kittanal
- Natural Water Cooler
- Foot Sprayer
- Kushal Sprayer
- Erisilk
- Solar Cooker
- Auto Air Kick Pump
- Gum Scrapper

Current Projects

Vanraj Tractor
The prototype of the 10 HP tractor is currently under testing at CFMT&TI, Budni. There were delays in the testing procedures on account of certain modifications that were required to be done on the prototype while on the test bed. Parallely, we have initiated efforts to get interested entrepreneurs involved in the project at this stage itself. There are two parties from Hyderabad interested in buying the licensing rights and initial meetings with both have been held. In addition, GIAN has identified four high potential pockets in India from the point of view of the mass manufacturability and demand for the technology. It is planned to release advertisements in the regional media in these four pockets inviting potential licensees and partners.

Shakti - Motorcycle Ploughing Machine
Demonstrations were held of the motorcycle driven plough in farms in the Pune district. The response of the farmers was mixed primarily because of the continuous drought in the region since last two years, which had reduced the buying power of the farmers. However, one farmer-businessmen is interested in commercializing the technology in the Baramati-Purandar region. The entrepreneur was met in Pune and he is expected to visit Ahmedabad in the month of August for further discussions. Atul Auto Limited, Rajkot, has been
contacted to explore the possibility of disseminating the technology as a standard attachment with their vehicles.

Oil Expeller
Talks have been initiated with an interested entrepreneur from Akola willing to start commercial production of the machinery. Demonstrations were given to the entrepreneur in Kadi, Gujarat, where the oil expeller has been successfully installed. Certain minor modifications are required to be made in the design. Demonstrations would need to be given to the entrepreneur once the changes have been made.

Motor Protection Device
The device was tested in Electrical Research & Development Association (ERDA) Vadodra. The test was successful and all the performance parameters and claims were successfully verified. Subsequently, based on the positive results of the market research conducted, the technology was put up for investment under the newly formed Micro Venture Innovation Fund (MVIF). MVIF has made its first investment of Rs. 75,000/- in BSK Industries, a firm promoted by the innovator. The investment was made for manufacturing 20 units of various models of the device for test marketing purposes. There are two interested parties – one from Pune and the other from Hyderabad, interested in buying the licensing rights of the device for the states of Maharashtra and Andhra Pradesh. Field demonstrations for both these parties are expected to be held in the first or the second week of August in Pune. In addition, major players in the sector like Crompton Greaves and L&T have also been contacted and details passed on. Response from them is still awaited.

Diesel Engine
Shri Mansukhbhai Sachania of Atkot village of Rajkot district has developed the small low cost, lightweight and efficient diesel engine. The engine is unique as there is nothing comparable to it available in the market, in terms of size and weight. The engine was tested at ERDA, Vadodra. However, the engine could not be completely tested on account of certain limitations in the testing procedures and also because of limitations in the prototype, which was more than 3 years old. The next step is to develop a customized testing procedure to map out in detail the performance characteristics of the engine, before taking up active value addition and commercialization. The technology is proposed to be put up for MVIF funding, given its high potential.

Double Acting Reciprocating Pump
The double acting-reciprocating pump has been developed by Shri Budhuba Jadeja from Kutchh with the objective of increasing efficiency of water lifting in areas where the water table is very low and the power supply is not good. The prototype was tested at the Nirma Institute of Technology, Ahmedabad. Based on the test reports, certain design improvements were identified. A proposal has been received from the Electric Research & Development Association (ERDA), Vadodra for taking up further value addition and prototype development work. However, it was felt that a private partner with experience in the pumps industry should also be brought in at this stage to ensure a more market and
demand oriented prototype development process. Various pump manufacturers and entrepreneurs have been contacted for the purpose and discussions initiated. A seminar is planned, along with ERDA, in Vadodra, where the technology would be presented to various pump manufacturers for gauging their interest in value addition and further commercialization.

**Bicycle Sprayer**
Modifications have been made by the innovator in the prototype in such a way that the attachment can be fixed to the bicycle without disturbing the original drive mechanism of the bicycle. One can also operate the sprayer by riding the bicycle, which was not possible earlier. The final prototype, with all these features, is under development.

**Auto Air Kick Pump**
This innovation, developed by Shri Arvindbhai Patel of Ahmedabad, has been commercialized by an entrepreneur from Dahanu, Maharashtra. The entrepreneur has managed to sell about 5000 units in the last two years. However, the sales growth of the product has now slowed down. The entrepreneur has also tried to market the product directly to the OE suppliers like Bajaj Auto, TVS etc., but has not met with any success till date. Another entrepreneur from Pune is willing to take up the manufacturing and marketing rights with the plan of introducing the product in the market at 40% lower prices. GIAN has declared this project as completed and will only pursue the matter of technology transfer as and when required.

**Hand Driven Sprayer**
The innovator of the technology, Shri Gopalbhai Surtia, has received the Sardar Patel Krishi Sanshodhan Award from Gujarat Government. The technology, which has been licensed to an entrepreneur from Ahmedabad, was taken up for design improvements by NID under GRIDS. The final prototype, as per the design suggested by NID, has been developed. The entrepreneur shall take up the same for mass manufacturing. GIAN is actively considering investing in the venture through MVIF.

**Auto Compression Sprayer**
An innovative sprayer has been developed by Shri Arvindbhai Patel using dead weight to generate pressure inside the cylinder. Shri Nileshbhai Satasia of M/s Niligiri industries of Ahmedabad had purchased this technology on a non-exclusive basis for commercialization. After signing of the agreement, both the entrepreneur and the innovator have been working together on further technical improvements. The technology is ready functionally, though some design inputs are required to maximize efficiency and improve aesthetics. The same are proposed to be done by the entrepreneur.

**Herbal Formulations**
GIAN is providing market development support to formulations developed by SRISTI-SADBHAV laboratory. Talks have been initiated with an entrepreneur from Maharashtra
dealing with bio fertilizers. The visit of the entrepreneur, to know more about the various herbal formulations in the Honey Bee database, is expected in the month of August.

**Bicycle Hoe**
Shri Gopal Malhari Bhishe of Maharashtra has developed a simple but useful hoe by using the front panel of the bicycle. The crude prototype has been refined and an improved motorized version has been developed by the innovator with the financial support of GIAN. GIAN was able to generate demand from the state of Andhra Pradesh through one of its network partners. Field demonstrations were arranged in the Mehboobnagar district of AP in presence of the innovator and GIAN personnel. Based on the excellent response received in the demonstrations, GIAN had submitted a proposal for supporting the innovator under MVIF. The proposal has been accepted and an amount of Rs. 15,000 has been invested. Also, a TePP grant of Rs. 34,000/- has been sanctioned to improve the motorized version of prototype.

**Buttonhole Edging Machine**
Shri Anil Kambdar from Godhra of Punchmahal district has developed an indigenous, low cost and user-friendly buttonhole-edging machine. A market research study was conducted and based on the positive results of the same, various entrepreneurs in the sewing machine industry were contacted for partnering for the final prototype development process and further commercialization. A reputed sewing machine and buttonhole machine parts manufacturer from Pune has evinced interest in taking up the prototype development work and commercialization. The entrepreneur has been met and samples of the buttonhole made by the machine have been sent. The entrepreneur is expected to visit Godhra for assessment and evaluation of the current prototype, in the near future.

**Innovative Tongs**
The innovative tongs, which have been developed as part of the lateral learning activity of GIAN, have been taken up by NID, under GRIDS for design improvements. The final report and recommendations are expected in September 2004 from NID.

**Check Dam**
GIAN has bagged a project from the Commissionerate of Rural Development for implementing 100 check dams as per the innovative design of check dam developed by a grassroots innovator. The project is expected to commence in August 2004. The detailed structural analysis of the innovative check dam was given to a structural consultant for design validation. Actual data was collected from the sites where the check dam has been implemented. The recommendations of the structural consultant regarding the stability of the dams have been received and the same shall be implemented in future designs.

**Modified Bicycle**
The innovation was analyzed for novelty, value and potential market. However, the results were negative on all counts and therefore the innovation has been dropped from the portfolio of GIAN. However, the innovator has been given a small amount from WAIGIANIC to continue his experimentation and to add further value to the innovation.
Electricity Operated Kerosene Stove
The stove, which uses kerosene as a fuel but burns it as a gas using electric current, was tested at ERDA, Vadodra. A thermal efficiency of 53% was obtained. The innovator had previously sold some stoves to customers in Junagarh and Amreli. Some of these customers were met for user feedback. It was concluded that though the technology was promising, the product design needed to be improved. Talks have been initiated with reputed stove manufactures in Rajkot and Coimbatore for further product development and commercialization.

Matchsticks from Natural Fibre
The innovator from Nandurbar, Maharashtra has developed matchsticks from a natural and abundantly available fibre. The technology holds the promise of revolutionizing the entire matchstick industry. We have signed a development agreement with one of the largest players in the matchstick industry in India as per the terms of which, certain test would be carried out by the company in their in house labs. Based on the results of the tests, the matter would be taken forward. The terms of the agreement withhold us from disclosing anything more about the technology at this stage.

Innovative Non Return Valve
The innovative non-return valve developed by Shri Arvind Khandke of Maharashtra, which promises to reduce emissions and improve efficiency, was put through a number of in house and third party tests. Fuel consumption and emission tests were carried out in house as well as in the facility of M/s Scooters India Limited, Lucknow. Since the test results could not be interpreted conclusively, ARAI, Pune, was contacted for development of customized testing procedure. Their response on the same is awaited.

Innovative Application of Windmill
Shri Bharatbhai Agrawat has developed an innovative gearbox in the conventional windmill to increase its efficiency. A joint visit was made to the site by the GIAN team along with officials from GEDA and Prof. Girija Sharan, IIMA to check the development status and performance of the prototype. A performance testing methodology was developed based on which data collection has commenced.

Seed Varieties
A summer intern from Xavier’s Institute of Management, Bhubaneswar, was given the project of developing a commercialization model for the various innovative seed varieties in the Honey Bee database. The seed varieties of Pigeon Pea and Sesame were taken as case studies for the same. Various models for commercialization have been recommended, which need to be further discussed and brainstormed internally.

Innovative Sickles
An innovative sickles, with the concept borrowed from barber’s knife and with blades on both the sides of the sickle, have been developed by Shri Kishorbhai Bharawada of
Junagarh district. The future strategy is to develop around 25 units of the product and use them for test marketing and to generate user feedback.

**New Projects Taken Up for Incubation Support**

**Pulse Thresher**
Shri Gopalbhai Surtia, the innovator of hand driver sprayer, has developed a device for threshing Pigeon Pea and other pulse crops for which conventional thresher is not suitable. The device is very simple and easy to use. The innovator is making certain improvements in design and technology before the machine can be taken up for active commercialization.

**Automatic Thread Winder for Kite Flying**
Shri Parshbhai Panchal of Ahmedbad, has developed an automatic thread winder (Firki) used in kite flying. The major benefit of the device is the speedy winding of the thread automatically compared to manual winding in the conventional winders, which is extremely time consuming and tedious process and also leads to knot formation in the thread. Given the mass participation in kite flying during Makar Sakranti, the technology has high business potential. The technology is under consideration for support under MVIF for further product improvements and commercialization.

**Button Stitching Machine**
Shri Anil Kamdar, the innovator of the buttonhole machine, has taken a step forward and developed a concept model for the button-stitching machine. The innovators idea is to totally indigenise the buttonholing as well the button stitching operations, which are the two most complex operation in garment manufacturing and are both currently being done by imported machines.

**Wind Operated Power Generator**
The unique design and placement of magnets and armature coils as well as an innovative RPM governor mechanism has been developed Shri Dineshbhai Mistry of Rajkot. The objective of the design is optimal power generation at both low and high RPMs, which is ideally suited for a windmill driven power generator where the input power varies depending upon the wind velocity. GIAN is presently evaluating the claims of the innovator by undertaking formal testing either at PTDC, Rajkot or Nirma Institute of Technology, Ahmedabad, before taking it up for active incubation support.

**Modified Blower for Air Curtains**
The innovator, Shri Yagnesh Mehta has developed an innovative design for the blades of the blowers for air curtains and has also adopted the ABS plastic material in the new design. Air curtains, which are needed to throw air with very high velocity, need to operate at very high RPMs. The conventionally available blades are made of aluminum, which requires high maintenance and replacement if operated at high RPM. The innovator, after years of toil and effort was able to make an optimal design for the blades and was able to extrude the blades in ABS to ensure optimal performance with minimum maintenance and
replacement. GIAN is currently evaluating the technology with respect to similar technologies available in the market before taking it up actively.
Jabbar Gear for Rickshaws
The innovative 4-gear system developed by Shri. Sheikh Jabbar of Nagpur, has been developed with the objective of reducing drudgery for the rickshaw puller. Though, there have been efforts at developing gears systems for rickshaws in the past, most of them have failed because they have not addressed the key problems faced by the rickshaw pullers. Shri Sheikh Jabbar who himself is a rickshaw puller, has developed the gear system base on chain and sprocket mechanism, from the perspective of the rickshaw puller. GIAN is currently planning to invest, through MVIF, in the development of ten prototypes, which would be used for field trials and test marketing.

Kero Gas Stove
This kerosene based stove, developed by an innovator from Jalgaon, Maharashtra, also burns kerosene in the gaseous form, thereby giving a higher thermal efficiency. However, this stove does not work on electricity and the conversion of liquid kerosene into gas is effected through a pre-heating mechanism initially and then through the heat generated by the burner. The stove has been recently sent to IIT Guwahati for testing.

Key Way Making Fixture
This innovative fixture, developed by an innovator from Maharashtra, makes it possible to undertake key way making operations on a lathe. Key ways are generally made on milling machines. Though various such fixtures are developed by machinists for their day-to-day use, this device is very simple and cheap and therefore has commercialization potential. There is potential to disseminate the technology in Gujarat and Maharashtra, which have large manufacturing base and number of small workshops having lathe machines.

Cross Regional Application of Innovations
Milking Machine
As a part of cross regional application of innovations initiated by GIAN, the Innovative Milking Machine developed by Shri Raghawa Gowada of Karnataka is being considered for applications in Gujarat and Maharashtra. Dialogues have been initiated with two entrepreneurs from Gujarat to replicate the technology locally.

Exercise cum Washing Machine
The exercise cum washing machine is a device that provides an easy and enjoyable way for washing cloths while exercising. The innovator Ms. Remya Jose is a school student. GIAN has taken up this project because of its wide appeal and mass applications. Ms. Angelina, an exchange student from Russia, has worked on the project. A new improved prototype has been developed based on the recommendations given by her. GIAN now intends to carry out certain operational tests for assessing the washing efficiency of the machine before taking it up for further value addition and commercialization.

Tile Making Machine
This is a very useful and appropriate technology from Uttar Pradesh for rural and low-income areas of Gujarat. The technology also has tremendous employment generating
potential.

**Post Harvest Groundnut Separator**
The innovator from Rajasthan has developed the machine to collect groundnut pods left over in the soil after harvesting. Looking to the tremendous of the potential of this technology in the Saurashtra region of Gujarat, we have taken it for commercialization in the state. We are planning to identify interested entrepreneurs through advertisements in newspapers.

**Tea Making Machine**
The innovative tea-making machine developed by an innovator from Rajasthan has high potential in Gujarat and Maharashtra. The tea made in the machine is by using the traditional Indian style of boiling the tea leaves with water in contrast to the conventional tea vending machines that use brewing of tea leaves in warm water. An initial presentation has been made to Wagh Bakri Group, which has to be followed up with demonstrations once the latest microprocessor controlled model is ready.

**Shaver for Sheep**
This innovation, which has been made by an innovator from Delhi, for horses, has applications for sheep shearing in the Kutchh and some parts of North Gujarat. GIAN is pursuing the matter with the Gujarat Sheep and Wool Development Corporation Ltd. to promote this technology in the state.

**Patent Assistance Cell**
The request that GIAN had made to the Industries Department of Gujarat Government to make modifications in the current PAC scheme to allow for reimbursement of 50% of charges at the time of filing instead of at the time of grant of the patent, has been accepted and will be implemented as part of the next Industrial Policy. With this, we hope that we should be able to mobilize the interest of many more innovators from Gujarat.

GIAN has filed four patents and one design registration under the Cell since November 2003. To promote the awareness in the society, GIAN has participated in two workshops on Patent Education and Awareness, organized at the BK School of Management, Ahmedabad and at Rajkot Engineering Association, Rajkot.

We are planning to organize an awareness workshop at IIM Ahmedabad in association with the Industries Department, Government of Gujarat.

**Presentations/Clearing House Sessions**
GIAN organized various presentations / Clearing House sessions to show case its technologies to potential entrepreneurs / licensees. A technology clearing house was organized with the Rajkot Engineering Association in Rajkot. A presentation was made to the Small Business Group of the Mahatta Chambers of Commerce, Industries and Agriculture in Pune. A number of student interns also delivered presentations on behalf of GIAN at various locations.
Network Development
Building strong networks with institutions, industry associations, mentors, entrepreneurs etc. is critical from the point of view capacity building. It is by building and optimally utilizing the network that our dream of incubating hundreds of innovations would truly come true. Contacts were developed with the following institutions / associations:

Industry Associations:
- Federation of Small and Medium Enterprises, New Delhi
- Maharatta Chambers of Commerce, Industries and Agriculture, Pune
- Pimpri Chinchwad Small Manufacturers Association, Pune
- Federation of Andhra Pradesh Chambers of Commerce and Industries, Hyderabad
- Confederation of Indian Industries, Ahmedabad
- Indian Society of Agri Business Professionals, New Delhi
- Vadodra Chambers of Commerce, Vadodra
- Rajkot Engineering Association, Rajkot
- Karnataka Chambers of Commerce and Industries, Hubli
- Coimbatore District Small Industries Association, Coimbatore
- Modinagar Industries Association, Modinagar

Educational Institutes:
- Department of Business Management, Haryana Agriculture University, Hissar
- Department of Business Management, Punjab Agriculture University, Ludhiana
- Centre for Transfer of Technology, NIRD, Hyderabad

Incubators / Entrepreneurship Development:
- Nirma Labs, Nirma University, Ahmedabad
- Science and Technology Entrepreneurship Park, Pune
- Science and Technology Entrepreneurship Park, Coimbatore
- ICFAI Centre for Entrepreneurship Development, Hyderabad.

NGOs:
- Bhartiya Yuva Shakti Trust, New Delhi
- WASSAN – Watershed Support Service and Action Network, Hyderabad
- Pravah – (Platform for Mobilizing Action on Drinking Water), Ahmedabad
- ARPAN – Advancement of Rural People and Nature, Himmatnagar.

Others:
- MITCON Consultancy Services Limited Pune
- Bicycle and Sewing Machine R&D Centre, Ludhiana.
Exhibitions
GIAN participated in many workshops and exhibitions in order to exhibit the innovations and for dissemination of the innovations. These exhibitions and workshops provided a good platform to showcase different innovations and GIAN’s activities. These are as follows:

1. March 2004 - Workshop on Value Addition and Validation of Herbal Practices
2. July 2004 - WASSAN Network Meeting and Exhibition, Hyderabad
### Annexure V

**GIAN-NORTH**

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<tr>
<th>Project</th>
<th>Status</th>
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| **Tea Maker, Haryana**          | • Second Prototype developed and is under testing. This prototype is in tune with the innovator’s design and has following modifications. 
  • Improved built-in heating mechanism is added to ensure the tea making in time 
  • Sensor based electronic control 
  • Provision of Sugar-less tea 
  • Provision for Milk-less tea 
  • This machine also has the provision for altering the taste 
  • Third Prototype is under development. This is a microprocessor controlled machine with digital display and software control. |
| **Remote Fire Cracker, Haryana**| • Innovator has developed six units and two are procured at GIAN-North 
  • Details sent to explosive department, Nagpur for their comments. Reply awaited. 
  • Innovator was requested to inform the local police about this development in writing. |
| **Pump less Stove, Uttar Pradesh**| • Two similar prototypes of the stove are procured and got evaluated at IIP, Dehradun. 
  • Further evaluation being carried out by GIAN-NE |
| **Kerosene Gas Stove, Uttar Pradesh**| • One prototype of Kerosene Gas Stove developed and procured. 
  • The prototype has been evaluated at IIP, Dehradun 
  • Report submitted to NIF and the innovator 
  • Further evaluation being carried out by GIAN-NE |
| **Hydrogen Gas Stove, Madya Pradesh**| • One prototype procured from the innovator and is evaluated by IIP, Dehradun 
  • Report submitted to NIF and the innovator 
  • Further evaluation being carried out by GIAN-NE |
| **Village Film Projector, Uttar Pradesh**| • Prototype developed/ repaired by the innovator. Material management and development supported by GIAN-N 
  • Can be demonstrated to NIF by the innovator and his |
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<tr>
<th>Project</th>
<th>Status</th>
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| Groundnut Digger, Rajasthan            | • Product developed and commercialized  
• MVIF proposal submitted for Rs. 1,35,000/- and approved by NC- VARD & BD for Rs. 1,05,000/- for two machines  
• Innovator is not interested to take the support for two machines and interested only if support is for minimum five machine |
| Trench Cutter, Rajasthan               | • Product developed and commercialized  
• Innovator seeks business development and financial support                                                                                                          |
| Bicycle Operated Horse Shaver, Uttar Pradesh | • Product developed and commercialized  
• Innovator seeks support for further product development and commercialization                                                                                      |
| Automatic Coil Winding Machine, Madya Pradesh | • One Prototype developed  
• Innovator seeks support for pilot production and commercialization. Innovator is also interested to transfer the technology. |
| Tile Making Machine, Uttranchal        | • Prototypes developed  
• Innovator seeks support for pilot production and commercialization.                                                                                         |
| Natural Dyes, Uttranchal               | • Dyed samples collected  
• Discussed the testing with Textile Committee, Jaipur and Pant Nagar University  
• Innovator will get the colors tested by Pantnagar University and will get back to us.                                                                            |
| Pine needle power as fuel, Uttranchal  | • GIAN-N offered the material and processing cost support to the innovator for the development of stove. Innovator refused to take the material and is interested in direct cash for this development. He will develop the stove of his own and will get back to us. |

Activities
**DSIR Registration**: Application is prepared for recognition of GIAN-North as Scientific and Industrial Research Organisation (SIROS) under Department of Scientific and Industrial Research.

**NSTEDB proposal**: Proposal ready and submitted to NIF.

**Media Award for best Reporting**: Bhoruka Charitable Trust, Jaipur have announced this National Award. This award will be announced and organized by NIF.

**State Grassroots Innovation award**: DST, Rajasthan had announced state awards in consultation with NIF’s annual award. For second award competition which comprises three state innovators and one scout would be recommended by NIF. This award will be given every year. The first award function is likely to be held in September, 2004.

**Land and Building for GIAN-North**: Land has been allocated to GIAN-N by DST, Jaipur. A site plan is to be made and building layout is to be worked out.

**Interest on the corpus**: A request for releasing the interest for first year is made through DST, Jaipur.

**NRI’s association with GIAN-North**: About 171 E-mail’s were sent for getting collaborations for GIAN-North. These addresses were given by Mr. Inderjeet Khanna.
Annexure VI

GIAN-NORTH EAST

In continuation with the Objective of GIAN-NE/NIF, creating employment opportunities based on the Grassroots innovations was given thrust, in addition to the ongoing regular activities of GIAN-NE during March 2004 to July 2004. In this endeavor it is encouraging to note that GIAN-NE has achieved moderate success.

During this period two technologies from the Grassroots have been successfully transferred to local entrepreneurs and the proceedings out of this transfer has been disbursed to innovators. Rs 40,000.00 (Rupees forty thousand) has been received by GIAN-NE towards innovation promotion fund.

Few enterprises based on Grassroots Innovations have also been set up with the assistance of MVIF.

The success of the GIAN-NE has made the local financial institutions like Rashtriya Gramin Vikas Nidhi, Gramin Bank etc. to come forward for financing projects based on innovations. Ventures will be setup with the assistance from these institutions in next few months.

In the following paragraphs activities carried out by GIAN-NE is highlighted:

Creating livelihood opportunities among rural women:

NGO/Federation of SHGs

Assisted in setting up women’s NGO (Swayampurna) of N. Guwahati to generate livelihood activities based on Innovation PHOTOLAM for marginal sections of the society..

The aim is to get products especially from the grassroots for the NGO and its associated federation of SHGs.

Assisted ladies club in setting up NGO and its associated federation of SHGs.

Identified Photo lamination innovation from Chennai for NGO.

Negotiated with innovator for licensing the production and marketing rights of the innovating in NE India.

Assisted NGO in identifying and procuring market, getting grants and loans from financial institutions.
Manufacturing will be done in individual hoses by supplying raw materials to each member of SHG through NGO.

Nearly 50 women will earn Rs 800 to Rs. 1000 per month by producing 100 lamination sheets each day.

Rashtriya Gramin Vikas Nidhi and Canara Bank will be providing financial assistance to the NGO and SHGs.
Identifying and augmenting dormant potentials of former staff of GIAN-NE

VIRASA Enterprise

Assistance was given to Virasa in extending its outreach and sales of Products originating as innovations from the grassroots.

Helped VIRASA to build sales network through scouts and innovators by selling products of innovators.

Guided VIRASA in conducting workshops for Auto air kick pump. Phenomenal growth in sales of the pump has been achieved due to this effort

Help was also extended to Virasa in streamlining its operations and in bookkeeping

Assisted Virasa enterprise in procuring temporary distribution rights for Photo lamination from Tamil Nadu.

Technology transfer

Power disc

- Technology know how of the Power disc innovated by Mr. R.K. Debgupta, has been transferred to a local entrepreneur, Mr. Deepak Das of Guwahati. Under this transfer the innovator and GIAN-NE have got to gain around Rs. 10 lakhs within a span of 2 years, discounting the royalty on the revenue and equity participation when the company for production and marketing of the power disc is set up.

Preliminary testing in the presence of entrepreneur, innovator and GIAN-NE staff done under various conditions in different venues.

PCRA unwilling to give test report

Preliminary testing of the two newly fabricated power discs have been completed in IIT-G.

Zero head water turbine

- Technology was transferred to Mr. kailash Agarwal of Steel and Industrial Stores, Tinsukia. The total payment amounted to Rs. 100,000 along with shares on the profits for every unit sold. The project has been declared closed successfully.

A few Prospective customers who have shown interest have been given the contact of steel and Industrial stores, Tinsukia.
Patent has been filed

Tepp proposal has been sent.

Engineering drawing completed and given to Steel and Industrial Stores.

**Business Development /Market support**

Facilitated the transfer of Distribution rights from Prabhat Machinery, Nalbari, to Virasa Enterprise, Guwahati, due to the inability of Prabhat machinery to carry on with the business.

With the help of GIAN-NE, local innovator from N. lakhimpur, Mr Bharali, has been able to sell more than 500 units of his rice-pounding machine within 3 months.

Initiated dialogue with CDRI, Lucknow, to explore opportunities for augmenting the herbal innovations.

Market survey for Innovations available with GIAN-NE was carried out in various places of the North East.

Innovators have been provided with opportunities to meet the experts where ever necessary to evaluate the innovation or for updating them selves with scientific background.

Educating the innovators about their product and the market dynamics.

Linked the innovators with different interested entrepreneurs to come out with better product together.

**Product development**

**Testing:** Some of the products that are currently in the testing phase are:

**Power disc:** transfer of technology has been achieved for the power disc innovated by Mr. R.K. Debgupta, after successful trials at IIT Guwahati and Kirlosker Small Engines Division, Pune. Currently, testing on its various applications on different models is soon to be completed.

**Herbal termite control:** This innovation by a school girl has been sent to Forest Research Institute, Dehradun, for scientific trials on the request from some scientist form the Institute.

**Herbal Mosquito repellent:** This innovation by another schoolgirl is currently being tested in house at GIAN-NE to determine its various applications, forms, and concentration.
**Low discharge zero energy water pump:** this innovation by Mr. Imli Toshi from Nagaland has already been tested for its effectiveness and efficiency by GIAN-NE.

**Herbal treatment of Alopecia araeata:** CDRI, Lucknow was approached.

**Kerosene/water stove:** testing of kerosene stoves of various configurations is in process.

**Prototyping:** The list of prototypes that have been developed for various innovations:

- Manual wood cutting machine: three prototypes have been developed and one of them has already been sold. Final manufacturing drawings are under preparation.
- L drop auto door protector by Mr. Govinda Gogoi: manufacturing drawings and process is under evaluation.
- Bo filter by Mr. Imli Toshi (Nagaland): manufacturing drawings and process is under evaluation.
- Detachable Bicycle attachment by Mr. Kanak Das: Four new prototypes were developed for market survey.
- Innovative arrangement of fan blades by Nipul and Bipul bezbora under evaluation for suitable applications.
- Working prototype of the Wind / wave turbine is under progress.
- Testing of the hypothesis of building pump based on implosion principle as suggested by Shri Gaur has been completed.

**Presentation/outreach/Miscellaneous**

On the invitation of BIRD (NGO) a presentation was given by GIAN-NE at Assam Agricultural University, Guwahati. Competition pamphlets and Honey Bee Newsletters were distributed among the various participants from the North Eastern states.

Participated in Indian Science Congress 2004 in Chandigarh.

A presentation on protection of traditional knowledge of NE India in Vivekananda centre at Guwahati.

Three presentations/lectures has been given at NIRD (Guwahati) during the concerned period. Competition pamphlets and Honey Bee Newsletters were distributed among the various participants from the North Eastern states.

Competition posters/pamphlets have been sent to over 2000 institutions.
Innovators have been visited in various parts of Assam and updated about the developments on their innovations.

Technical benchmarking, prior art search, translation done for various entries.

Meeting with faculty and students of design department with GIAN-NE to initiate taking up of design improvements needed for grassroots innovation.

Meeting of prospective entrepreneurs and creating awareness on business opportunities based on Innovations.
Dear Traditional Knowledge holder(s),

The National Innovation Foundation (NIF) was established by the Department of Science and Technology, Government of India, in March 2000, as an autonomous society to recognize and promote grassroots innovations and traditional knowledge of individuals/communities. This initiative shall help in reducing the erosion of knowledge, increase the social esteem of the grassroots innovators and knowledge providers and help India become an innovative society. NIF strives to obtain the written consent and authorization from all the innovators/knowledge providers to disclose and/or add value to the innovation/traditional knowledge submitted for inclusion in the National Register of Green Grassroots Technological and Traditional Knowledge. An explanatory note, describing the implications of various options given in the form, is enclosed along with this form to assist you to fill up the form. NIF assures full compliance with the conditions specified by you and any modification in these conditions will be taken up only after obtaining your written consent.

Reference No.:

(Signature)

Stamp of NIF

Title of Traditional Knowledge/herbal practice:

We will appreciate if you could tick ‘YES’ or ‘NO’ in the appropriate boxes (for items A to E).

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<th>Yes</th>
<th>No</th>
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<td>A. Can NIF share your address with those interested in your traditional knowledge?</td>
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<td>B. Can NIF display/publish your traditional knowledge on the Internet/in Honey Bee magazine or any other media?</td>
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<td>C. Can NIF share your traditional knowledge under the following condition/situation(s)?</td>
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<td>(a) (i) Partial disclosure/summary</td>
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<td>(c) At no cost for individual use, but on commercial basis for larger use</td>
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<td>(d) After further research on it</td>
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<td>(e) Any other option? Please specify:</td>
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D. Can NIF mediate on your behalf to pursue the following?
   (i) Developing business plan by third party/students [ ] [ ]
   (ii) Product development [ ] [ ]
   (iii) Intellectual Property Right protection [ ] [ ]
   (iv) Technology transfer to a third party [ ] [ ]

E. Would you like to share the benefits obtained through NIF, with a third party? [ ] [ ]

   If yes, in what proportion out of 100, would you like to share the benefits with the following?

   Innovator/TK holder [ ] Community/Village [ ] Innovation promotion fund [ ]
   Researchers or those who add value [ ] Institutional overheads [ ]
   Conservation of natural resources [ ]

   If you want to propose an alternative benefit sharing system, please advise:
F. Which non-monetary benefit will you prefer, if applicable, such as (YOU CAN TICK MORE THAN ONE)

- Honour in a public function at local, state or national level,
- Recognition in media,
- Recognition in text books in case of really unique distinction,
- Support for contacting other innovators/traditional knowledge holders,
- Linkage with R and D institutions for valorization of knowledge,
- Opportunity to share one’s knowledge with others in shodh yatra and shodh sankals,
- Support to the community to share the knowledge with other communities,
- Guidance form formal or informal sources to conserve the natural resources used in traditional knowledge,
- Supply of scientific information in local language about the herbal or other traditional knowledge,
- Any other such support, specify ____________________________________________________.

G. Whether the consent of local community has been taken while submitting the community traditional knowledge to NIF?

Yes [ ] No [ ] Does not arise [ ]

H. Whether the concerned community has been informed of the improvements made in the traditional knowledge belonging to them

Yes [ ] No [ ] Does not arise [ ]

I. To what extent the specific traditional knowledge/community knowledge is known and/or practiced within or among the concerned communities?

Known to few. Known widely. Practiced by few. Practiced widely.

J. In the case of any improvement/modifications done by you in the existing knowledge, with whom would you like the benefit to be shared?

Only community [ ] Only communicator [ ] Both [ ] Specify share [ ]

However, if the specific traditional knowledge/community knowledge is not public domain, the rights shall belong to the community represented by its leaders.
Declaration: I/We have read this Prior Informed Consent Form and have understood the implications of various choices described in the explanatory note. I/We have voluntarily decided to select the option/options which I/we have ticked above for questions from A to F. I/We further assure NIF that all the information given above is true to the best of my/our knowledge and belief. I/We acknowledge that if the knowledge innovation/practice contributed by me/us are already in public domain, then the restrictions in the form will not apply.

Name and Address of the Community/Traditional Knowledge Holder.

Signature

______________________________

Name of the Nominee/Authorised Representative:

Signature

______________________________

Name and Address of witness/Collaborator/Scout/NIF Representative.

__________________________________________

______________________________

Signature of witness

Date: ____________________________

National Innovation Foundation
PRIOR INFORMED CONSENT FORM

National Innovation Foundation
Honey Bee Network

Technological Innovations and Ideas

Dear Innovator(s),

The National Innovation Foundation (NIF) was established by the Department of Science and Technology, Government of India, in March 2000, as an autonomous society to recognize and promote grassroots innovations and traditional knowledge of individuals/communities. This initiative shall help in reducing the erosion of knowledge, increase the social esteem of the grassroots innovators and knowledge providers and help India become an innovative society. NIF strives to obtain the written consent and authorization from all the innovators/knowledge providers to disclose and/or add value to the innovation/traditional knowledge submitted for inclusion in the National Register of Green Grassroots Technological and Traditional Knowledge. An explanatory note, describing the implications of various options given in the form, is enclosed along with this form to assist you to fill up the form. NIF assures full compliance with the conditions specified by you and any modification in these conditions will be taken up only after obtaining your written consent.

Reference No.: ________________________________________

(Signature)

Stamp of NIF

Title of Innovation/Idea: ________________________________________________

We will appreciate if you could tick ‘YES’ or ‘NO’ in the appropriate boxes (for items A to E).

Yes  No

A. Can NIF share your address with those interested in your innovation/idea?  [ ] [ ]

B. Can NIF display/publish your innovation/idea on the Internet/in Honey Bee magazine or any other media? [ ] [ ]

C. Can NIF share your idea/innovation under the following condition/situation(s)?

   (a) (i) Partial disclosure/summary [ ] [ ]

   (ii) Full disclosure [ ] [ ]

   (b) Only on commercial terms (if the interested party is willing to pay for it) [ ] [ ]

   (c) At no cost for individual use, but on commercial basis for larger use [ ] [ ]

   (d) After further research on it [ ] [ ]

   (e) Any other option? Please specify:

____________________________________________________________________________________

D. Can NIF mediate on your behalf to pursue the following?

   (i) Developing business plan by third party/students [ ] [ ]

   (ii) Product development [ ] [ ]
(iii) Intellectual Property Right protection [ ] [ ]
(iv) Technology transfer to a third party [ ] [ ]

E. Would you like to share the benefits obtained through NIF, with a third party? [ ] [ ]

If yes, in what proportion out of 100, would you like to share the benefits with the following?

Innovator/TK holder [ ] Community/Village [ ] Innovation promotion fund [ ]

Researchers or those who add value [ ] Institutional overheads [ ]

Conservation of natural resources [ ]

If you want to propose an alternative benefit sharing system, please advise:

F. Which non-monetary benefit will you prefer, if applicable, such as (YOU CAN TICK MORE THAN ONE)

- Honour in a public function at local, state or national level,
- Recognition in media,
- Recognition in text books in case of really unique distinction,
- Support for contacting other innovators/traditional knowledge holders,
- Linkage with R and D institutions for valorization of knowledge,
- Opportunity to share one’s knowledge with others in shodh yatra and shodh sankals,
- Support to the community to share the knowledge with other communities,
- Guidance form formal or informal sources to conserve the natural resources used in traditional knowledge,
- Supply of scientific information in local language about the herbal or other traditional knowledge,
- Any other such support, specify

____________________________________________________.

Declaration: I/We have read this Prior Informed Consent Form and have understood the implications of various choices described in the explanatory note. I/We have voluntarily decided to select the option/options which I/we have ticked above for questions from A to F. I/We further assure NIF that all the information given above is true to the best of my/our knowledge and belief.
Name and Address of the Innovator(s)
________________________
Signature

________________________
________________________
________________________
________________________

Name and Address of witness/Collaborator/Scout/NIF Representative.

________________________
________________________
________________________
________________________

Signature of witness

Date: ____________________

National Innovation Foundation
Bungalow No. 1, Satellite Complex, Jodhpur Tekra, Premchand Nagar Road, Ahmedabad - 380 015, Gujarat India
email: campaign@nifindia.org www.nifindia.org Fax: +91-79-673 1903
EXPLANATORY NOTE ON PRIOR INFORMED CONSENT

NIF is extremely happy that you have shared Innovation/Traditional Knowledge developed/communicated by you, based on your own and independent effort or drawn from community knowledge. It has been included in the National Register of Grassroots Innovations and Traditional Knowledge. We need your informed consent before we decide to share this with any third party, or on the Web or in any publication, or with any prospective entrepreneur or potential investor, or other individuals or communities requiring that knowledge for their own livelihood needs, with or without any restriction as per your instructions.

The objective is to balance the twin goals, partly in conflict, of dissemination and protection of your innovation/traditional knowledge. Dissemination will benefit communities and individuals directly without any cost whereas the protection and potential commercialisation of the same through contractual arrangements may also help them, but at some cost. If we had an intellectual property rights system in our country that granted the rights quickly, we could have got you the protection for new and non-obvious innovations/localised traditional knowledge with industrial applications. We could have then shared the innovation/traditional knowledge with others without causing any trade off. It is because of the absence of such a system that we need your PIC so that we do what you think proper under the circumstances. PIC is also needed to fulfill ethical responsibility that NIF has towards knowledge providers (individuals or communities) and grassroots innovators.

NIF is duty bound to follow your instruction and keep complete confidentiality, if that is advised. The purpose is to make you aware of your rights as a knowledge provider and as a contestant in the National Competition for scouting green grassroots innovations and traditional knowledge. It is not required as yet by law, but NIF has decided to take your PIC so as to follow an ethical practice. This will help generate an environment of trust among various stakeholders who may provide innovation or add value to it or may have interest in commercial or non-commercial diffusion of the same. However, if the knowledge, innovation or practice provided by you is already well-known and is in the public domain, then the restrictions on its diffusion or application will not apply.

* Consent of community for sharing traditional knowledge with NIF

Community knowledge, innovation and practices may, sometimes, be communicated by individuals who may or may not have improved it significantly. In general, we will appreciate it if any communicator of community innovation or traditional knowledge would ensure the following conditions:

A) Knowledge of a community, as it exists, is shared with NIF, preferably after obtaining the informed consent of the concerned community leaders, with the understanding that individual improvements in the same can indeed be communicated after informing the community.
B) The degree to which a given traditional knowledge is known and/or practiced within or among communities may be disclosed in the submission.

C) In the case of community traditional knowledge, any individual may share the same with NIF, as stated above, but the right, if any (that is if the traditional knowledge is not in the public domain already), would belong to the community represented by its leaders or customary institutions except in the cases where (i) improvements are brought about by individuals or (ii) only an individual practices or specialises in that knowledge. In the latter two cases, the benefits, if any, would be shared between the individual and the community.

It is obvious that each individual communicator or community representative submitting an entry to NIF will have to ensure compliance with these conditions. NIF will act in good faith and without negligence and hope that this will eventually become a general practice in the country. NIF will have no machinery of its own to ensure that this has, indeed, been the case in each entry. What we hope is that as the awareness increases in society about ethical ways of accessing people’s knowledge, more and more people will comply with these conditions.

The process of seeking consent by NIF provides the Innovator/Traditional Knowledge Holder/s with complete information on the basis of which to make an informed decision. In case of incomplete information provided by you, we will be bound only by the columns ticked or instructions provided. Wherever possible, if your innovation or traditional knowledge has been scouted by some third party, he/she will also try to explain to you the implications of PIC.

**Definitions**

Unaided technological Innovation refers to any technological improvement in an existing machine/method, use or material involved in solving a problem or producing a product or service; or a new invention or application of existing technologies without taking the help from any outside agency or institution in the formal or informal sector. Innovations or inventions/traditional knowledge, which may cause any adverse consequence to the environment or cause any moral hazard, will be excluded from the purview of (NIF) National Register. However, all other entries not included in the National Register will be kept in a separate database of People’s Knowledge (PKD) comprising public domain and confidential knowledge provided by the knowledge holder/s. In addition to this, a separate database of innovations by professionals for applications at grassroots will be developed.

Traditional Knowledge is any knowledge, innovation or practice produced by individual knowledge experts, healers, crafts persons etc., alone or in groups or community a long time ago or several generations ago. Community in this context will essentially mean the members of the Panchayat, sub-panchayat, ward or mohalla.

There are three implications of “Informed Consent”,

(1) That the innovators/ knowledge providers have been fully informed of all information relevant to the activity for which the consent is sought, in the native language or other mode of communication;

(2) The innovators/ traditional knowledge holders understand and agree in writing to the carrying out of the activity for which the consent is sought, and the consent describes that activity and lists the records/innovations or traditional knowledge that will be released to third party; and

(3) The innovators/ traditional knowledge holders understand that the consent is voluntary and may be revoked by them.

It is true however, that even after you sign the form, you are free to change your mind and decide not to participate in the value chain or technology transfer process. But such a change may not be binding on the agreements already entered into by then by NIF or anybody assigned with the responsibility. NIF is duty bound to keep you informed of the progress in the development, if any, of your idea or innovation. You can change your views at that stage also.

Implications for each of the conditions:

   **A. Sharing of address with a third party**

Quite often people interested in an idea or innovation or traditional knowledge are keen to find out more about the same, just for curiosity’s sake, or for adding value or doing further research or for exploring commercial opportunities of using the same.

**Advantages of providing your address:**

- The third party may directly contact you and thus his/ her transaction cost of seeking information will be reduced
- You may be able to assess the terms of possible agreement directly without any influence or suggestion by NIF
- Dissemination of your ideas may take place directly though you without any chance of distortion or loss of information

**Disadvantages of giving your address:**

- While dealing with a third party, you may or may not be able to a) ascertain the genuineness of the information seeker, (b) negotiate a favorable deal, (c) or draw up a proper agreement safeguarding your interests

In case you do not provide your full address, we offer to mediate and help in the process of negotiation and try to protect you from unscrupulous parties. However,
even if you wish to deal directly with the third party and at some stage seek our help in negotiation, you are always welcome to contact NIF.

B. Sharing of the Innovation/ Idea on the web site or through publication in *Honey Bee* or other media like film: with or without full disclosure

Nature of disclosure:

(i) We can show only the summary (partial discloser),
(ii) We can show the entry in detail (full discloser),

(i) Partial Disclosure

Advantages:

Potential entrepreneurs, investors, or other collaborators including researchers in private or public sector may show interest in joining hands in improving the technology or TK or disseminating it on commercial or non-commercial basis in society. The summary statement for a herbal technology may mean, for instance, “a herbal solution to treat diabetes developed based on local available raw materials”. Likewise, in the case of a machine it may be, “a motorcycle based plowing machine”.

Appreciation may follow from others with in and outside one's community when others with similar problems read or hear about your innovation. This recognition may prove to be more valuable for some people than any monetary reward.

The media (press, radio, television etc,) may approach you for wider sharing of your innovation/ traditional knowledge if they find the summary of your information interesting

Disadvantages:

Potential investors, entrepreneurs, or scientists may not contact you for development/ commercialization of product if they can make it with the help of disclosed information on their own

(ii) Full disclosure:

Advantages
Any third party can contact you directly regarding your innovation/traditional knowledge with their queries
Your innovation/traditional knowledge may gain recognition, publicity and respect among the readers/viewers/listeners
Horizontal dissemination among peers or other members of local or wider community may encourage experimentation and possible utilization of the disclosed knowledge, thus increasing opportunities for self employment, poverty alleviation, environmental conservation and improvement in productivity.
Copyright in the knowledge/innovation/practice is protected
Disclosure may, by itself, generate demand for the products among consumers or potential partners in value chain. In some cases, the method of practicing the traditional knowledge or the process of using the innovation is complicated or all the materials are not available locally, such that users can not practice it or develop it on their own. In such a case they may like to buy it from the innovators and thus demand may get generated.
Potential investors, entrepreneurs, scientists may contact you for further development/commercialization of the product

Disadvantages:

The information will be in the public domain, anybody will be able to use the disclosed information
Once the information is disclosed, a patent cannot be granted on the disclosed information. Any specific part of the technology not disclosed can still be protected
Potential investors, entrepreneurs, or scientists may not contact you for the development/commercialization of the product if they can make it with the help of disclosed information on their own
Other people may benefit from it without giving you any credit for the same

C. Sharing of information

(a) with restriction imposed
(b) on commercial basis
(c) on no-cost basis for personal application or household use only
(d) with further research or value addition in it
(e) any other

a) With restriction imposed

The knowledge provider may like to be consulted before taking up any value addition or licensing discussions with third party. Some innovators/traditional knowledge holders would like non-monetary benefits such as attachment (appellation) of their name to any product that is developed and diffused, or credit to them in the product package or on label. Likewise, they could put any other restriction, which NIF is expected to follow.
b) On Commercial Basis

The right to use the technology is granted to a third party only on the basis of benefit sharing. The terms may vary from one commercial deal to another. In some cases, the entrepreneur may agree to offer a small amount as up-front license fee but may share a given proportion of gross sales (generally 2-3 per cent) as royalty for a given period of time. However, the ability of a technology to generate commercial demand may depend upon its uniqueness, its commercial viability, whether the technology is in usable form or requires further research and development to convert innovation or idea into a product. Thus, even if somebody ticks this option, it may be appreciated that NIF may not be able to immediately generate commercial options for everybody submitting entries to the National Register. We will share synoptic information on the web and in our databases, and then potential entrepreneurs may show interest in a specific technology or product.

The disadvantage in marking this option is that only those users may get the advantage of your innovation or traditional knowledge who have capacity to pay for the right to license the technology. Further, in the absence of sharing full detail with others, those interested in developing this technology further may not be able to do so.

c) No-cost for individual use, but permission necessary for commercial use

The implication is that if some individual small farmer or artisan wants to use your innovation or traditional knowledge for personal application at his/her own small farm or in small workshop only, he/she can do so without any obligation to share benefits.

The disadvantage is that somebody may claim that it is for personal use but may later end up generating a commercial advantage. This will require a carefully drafted licensing agreement.

d) With further research and value addition

The innovation or traditional knowledge can be shared only after it is made more effective or efficient by pursuing further research by the innovator herself/himself or by another research organization. The innovation/traditional knowledge will not be shared with any third party without further research on it, if this condition is ticked.

The disadvantage is that if NIF or the innovator is unable for some time to take it up for value addition, because of lack of priority or lack of resources, the innovation will remain undisclosed with the rest of the society. Further, in the absence of disclosure, some independent researchers may also not be able to come forward to join hands for value addition.

e) Any other
If you want to specify any other condition to NIF for enabling sharing of your information, you can do so under this choice.

**D. Mediation by NIF for technology transfer**

The assignment of technology or right to NIF to mediate implies that NIF can intervene on the behalf of the innovator/traditional knowledge holder/s, communicator/community for various purposes such as development of business plan, products, protection of intellectual property rights (IPR) in the cases where applicable.

(i) Consent for Business Plan preparation implies that NIF might engage students, GIAN team, or others to explore the business prospects of an idea or innovation or traditional technology.

(ii) The consent for the product development may require NIF to engage institutions like IITs, NID or other technological collages or private entrepreneurs, or research and development centers for value addition.

(iii) The consent for IPR would enable NIF to pursue possible protection of the intellectual property rights through its own team or engaging private attorneys.

The cost of these activities may be recovered from the possible licensing fee or royalty income that might be generated from the commercialization of the technology or shared by the innovators/traditional knowledge holders wherever applicable and possible. NIF reserves the right to include only some of the award winning or priority technologies accepted in the national register for pursuing above. Criteria may include potential social impact, uniqueness, possible positive impact on environment or poverty alleviation or on jobs, or just the wider consumer applicability in reducing drudgery or women, or increasing efficiency or development of dry land regions etc.

(iv) Technology Transfer

Assignment to NIF or authorization to mediate

By assigning rights to NIF or authorizing it to mediate, innovator/traditional knowledge holder enables NIF to negotiate on its behalf with the potential entrepreneurs and investors. In the case of any dispute regarding transfer of technology to third party, NIF will provide legal support in deserving cases to innovators/traditional knowledge holders to enforce the agreements with the concerned party.

Advantages:

You will receive guidance about when, at what terms and to whom the technology should be transferred
NIF will contact the concerned persons/ institutions for further development
This will avoid the possibility of some third party taking advantage of the ignorance or lack of familiarity with the negotiation process on the part of the innovator/knowledge provider. The know-how or tacit knowledge may remain undisclosed and thus provide opportunity to negotiate separate agreements for the same.

**Disadvantages:**

The assumed benefits in the licensing agreement may not actually fructify.

Given social expectations, the licensing terms may try to balance the interests of small entrepreneurs and thereby prevent the innovator/traditional knowledge holder from maximizing his/her gains.

In the absence of the disclosure of tacit knowledge, the technology users may have difficulty in exploiting the full potential of the technology.

**Technology transfer on one’s own**

**Advantages:**

Complete control over the process of negotiation
No obligation to share benefits or economic gains with other innovators, or innovation fund or community (though the innovator may decide to do so voluntarily)
The know-how or tacit knowledge may remain undisclosed and thus provide opportunity to negotiate separate agreements for the same.

**Disadvantages:**

You may not be able to negotiate with the entrepreneur to get the maximum benefit for your innovation
You may lose your innovation in the hands of the entrepreneur, being an individual
Potential entrepreneur may not contact you.

**E. Benefit Sharing Arrangements**

Benefits can be of four kinds, 1- monetary – individual (MI), 2- monetary collective (MC), 3- Non monetary – individual (NMI) and 4- non monetary collective (NMC). The first category includes monetary awards, license fees or royalty from commercial exploitation of technology or traditional knowledge, or any other monetary gain by entrepreneurial process. The incentives in this case go to individuals. However, as per the benefit-sharing clause given in the Consent Form, one can share part of the individual monetary gain with the community, innovation promotion fund and institutions helping the value chain. The second kind of incentive is for communities or groups but in monetary form. It could
include trust funds, micro-venture fund, common property infrastructure for use by individuals as well as communities (for instance, a workshop to fabricate tools, machines or process herbs, make medicines etc.). In this category also, individuals can be supported by the collective fund. The third kind of benefits deals with non-monetary reward to individuals such as recognition, a citation in a public function, dissemination of one’s creativity through media or in workshops or other public functions. Naming of streets or some other infrastructure or any other landmark after the innovator etc. The fourth kind of benefit is for collectives/communities and is non monetary in nature. For instance, the changes in policies and pedagogies for education at different levels so that, respect for informal innovators/traditional knowledge holders increases in society.

**Monetary benefits**

The campaign for making India innovative will succeed in the long run only if the innovators and traditional knowledge holders and other stakeholders take the responsibility of running it in a self-reliant manner. The self-reliance of the entire value chain will require that some part of the benefits that innovators may get from possible commercialization is shared with various actors and institutions. Those involved in the conservation of resources, process of adding value, sharing information, generating commercial opportunity, need to have incentives to join the value chain. The community of which an innovator is a member is an important stakeholder because it helps in conserving resources, provides the general knowledge pool by drawing on which many innovations or traditional knowledge evolve and are improvised. Thus the share of the community is generally essential to maintain knowledge systems in a vibrant form.

Likewise, the shares of the various stakeholders have been suggested in the proposed ratio of benefit sharing. But you are free to decide what proportions you feel proper. That may have a bearing on the motivation of the various stakeholders. For instance, suppose you say that 90 per cent of benefits should come to you, the innovator, and the remaining ten per cent may go to those who add value, or the community or innovation fund. In that case, it is possible that many scientists or private entrepreneurs may not agree to commercialize the innovation or traditional knowledge. The Innovation Fund will make it possible to help those innovators or traditional knowledge holders whose ideas or innovations may not attract private parties for value addition or dissemination. NIF has limited funds and the ability of NIF to help a larger number of innovators will depend upon the resources we can raise for the Innovation Promotion Fund.

**Non Monetary benefits**

NIF has shared several non-monetary benefits so far such as recognition in national award function (it includes monetary benefit also for some), dissemination of innovations/traditional knowledge through exhibitions, Shodh Yatra (walk through the villages every summer and winter in different parts of the country), multi-media and multi-language data base, workshop of the innovators to promote lateral learning, workshops with
experts for product development, or other feedback, and visit to each others’ place. The diffusion of non-commercializable innovations / traditional knowledge and consequent recognition is one of the major non-monetary benefits. There are cases when these benefits count for much more in motivating one to innovate or share one’s knowledge with others compared to monetary benefits.

F. Consent of the community while submitting the traditional knowledge to NIF

The communicator of the community practice or traditional knowledge must ensure that they have obtained the informed consent of the concerned community leaders and members as the case may be, while submitting the entry to NIF, as it exists.

Advantages:

- The community will get the due share at the time of the commercialization of the tk/practice
- It will encourage other communities to share their knowledge.
- The natural biodiverse resources may be conserved to a large extent.
- Mutual trust is reinforced between the communities and the communicator.

Disadvantages:

- There may be difference of opinion among the members of the community and thus there may be opposition against the disclosure to NIF
- The community members may inhibit their sharing of knowledge with outside institutions given the historical exploitation that they have often suffered and past practice. Outsiders have almost neither acknowledged the community knowledge properly nor have generally shared any benefit with them.
- Lack of sharing may also impede people to people sharing of knowledge because other communities may also emulate similar restriction.

G. Whether the concerned community has been informed of the improvements made in the traditional knowledge belonging to them

Community knowledge, innovation and practices may some times be communicated by individuals who may or may not have improved it significantly. In case of any improvement/modifications made by the individual, it is desired that the same is communicated to the concerned community/individual concerned before or at least after, communicating it with NIF.

Advantages:

- The community will be aware of the improvements brought about by the communicator/knowledge holder. Many times till outsiders show interest, local
communities do not take interest in local innovations or improvements in T K and other knowledge.
The communities may also get the due share in case of any benefit provided in the PIC form includes this provision by the knowledge holder.
The community may also benefit; if the contributed knowledge is improved/modified substantially through linkage with formal science and technology institution and shared back with them.
Mutual trust will be developed between the community and the individual/communicator.
Disadvantages:

- The community may not like to share the knowledge with others and they may object to it.
- The community may not encourage the knowledge holder or innovator to take credit for improvement because of socio-cultural differences that might exist.
- The community might insist that the entire benefit if any, need to come to the community instead of the one who brought about the improvement inhibiting the entrepreneurial processes.

**H. To what extent the specific traditional knowledge/community knowledge is known and/or practiced within or among the concerned communities?**

The degree to which a given traditional knowledge is known and/or practiced with in or among communities may also be disclosed in the PIC.

Advantages:

- The validity of the knowledge may be assessed to some extent from the degree of diffusion of the practice among community members.
- One can distinguish between the entitlements of those who only know vis a vis those who also practice.
- In the case knowledge has high future prospect but not practiced at all, or is practiced by only one or two persons, then it may deserve priority for value addition because if urgent attention is not given, it might be lost.

Disadvantages:

- The lack of diffusion may be incorrectly seen as lack of desirability or worth of knowledge. Many times very many good ideas do not diffuse due to institutional barriers.
- Many more people may actually practice but this might not be known widely.

**I. In case of any improvement/modifications done by you in the existing knowledge, with whom would you like the benefit to be shared?**

In the case of community traditional knowledge, any individual may share the same with NIF as stated above, but the right if any (that is, if the traditional knowledge is not in public domain already) would belong to the community represented by its leaders or customary institutions except in the cases where (i) improvements are brought about by individuals or (ii) only an individual practices or specializes in that knowledge.

In the latter two cases, the knowledge holder has to advise as to whether the benefits if any would be shared between the 1) individual and the community, 2) only community 3) only communicator and 4) any other third party which may have added value.
Advantages:

Due share goes to the community which has conserved the traditional knowledge and merely because some body has communicated it to NIF, he/she does not get the right to receive compensation or benefits if any in due course.

Only for the improvements in T K, can individual exercise their rights. But even here, by specifying the claimants, the responsibility in the matter is taken by the knowledge providers.

The innovator/knowledge holder has to keep the community informed and thus help in the growth of the T K system itself in future.

It will encourage other people to conserve the traditional knowledge and to disclose the same to the person(s) who wants to work upon it for the further improvement thereon.

A fund could be raised to conserve the Traditional Knowledge and natural resources associated with it.

Disadvantages:

The knowledge holder/community will not share the traditional knowledge with others and thus the knowledge will remain undisclosed if their rights are not differentiated.

If individual knowledge holder/s has/have not agreed to share the benefits with the community at all, it may affect the relationship among knowledge holder, community and NIF.

If the share of those who have added value are not specified, then it is possible that not many institutional R and D professionals may come forward to add value. Once the value is not added, no benefits might arise except through mutual learning.

The knowledge holder/community will not share the traditional knowledge with others and thus the knowledge will remain undisclosed.

It is obvious that each individual communicator or community representative submitting entry to NIF will have to ensure compliance with these conditions. NIF will act in good faith and without negligence and hope that this will eventually become a general practice in the country. NIF will have no machinery of its own to ensure that this has indeed been the case in each entry. What we hope is that as the awareness increases in society about ethical ways of accessing, using and sharing people’s knowledge, and more and more people will comply with these conditions.

Please send comments to info@nifindia.org

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Phone: +91-79-673 2095/2456  Fax:+91-79-673 -1903
Annexure VIII

Projects supported directly by NIF and through collaborators

Directly by NIF

Mr Sakun Das has developed a multi-cylinder reciprocating pump. A prototype has been developed after the analysis of the concept by IIT Delhi.

Mr Bharat Kamble is developing, disseminating and testing a device which will prevent burning down the electric pump.

Mr Jayaseelan has developed a coconut de-husker. NIF supported this innovation through linkages with Industrial Design Centre, IIT Bombay.

Tamarind Cultivation and processing techniques of Mr A. I. Nadakattin have been supported through Prof. Saha of IIT Delhi. Dr T. N. Prakash of Hittalagida, Bangalore, will plan further work.

Mr C V Pathak’s pedal bore and other innovations have been supported for prototype development. A prototype has been developed and tested by Innovator.

A windmill developed by Mr N V Satyanarayana has been given product development support. Innovator will be provided further support after NIF receives a report of detailed work done by him.

PDS, Kerala

Mr. S. J. Joe has developed a portable steam jacket cum water heater multi utility stove. NIF gave support for product development.

Cardamom drying chamber developed by Mr P J Abraham has been supported for product development.

A low cost hand pump developed by Mr Ouseppachan Anchukandathil and Mr Reji Joseph has been supported by NIF. Innovator has already sold few pieces.

Ms Remya Jose of Kerala has developed a pedal operated washing machine. Support has been given to develop two prototypes.

SEVA, Madurai

Testing of Mastitis Formula

Mr. Ayyathurai Konar has been awarded by NIF during the second round of the competition for his community knowledge in animal healing. This is herbal medicine of Mastitis Formula for animal healing. SEVA has given samples of herbal medicine to 10 veterinary doctors for testing in the field. It is in the process of testing it in the laboratory of Tamil Nadu Veterinary and Animal Sciences University, Chennai.

Herbal Pesticide Formulation

Sri. Chellamuthu has been awarded by NIF during the second round of the competition with third prize for herbal pesticide formula developed by him. SEVA has given samples of
herbal pesticide to Pesticide Testing Laboratory, Tamil Nadu Agricultural University, Coimbatore during October 2003. Initial results are encouraging.

**Sugarcane Off bearer cum Trash mulcher**
Mr. Jeyakrishanan has been awarded consolation prize by NIF during the second round of the competition for developing Sugarcane Off bearer cum Trash mulcher. SEVA has contacted CAD consultant in Coimbatore and obtained improved. This improved model is being tested using Sakthi - Mitsubishi Mini tractor.

**Innovations in Power Tiller**
Sri. Thirumaran has been awarded Sristi Samman Award by Sristi during the year 2001. He has been given NIF research award for developing improved prototype of power tiller innovations. NIF has sanctioned Rs. 16,000 for developing improved prototypes. Following arrangements have been made in the prototype:
1. Seating Arrangements in Power Tiller
2. Steel Cage wheel for Power Tiller

These prototypes have been completed and ready for testing at TNAU (Tamil Nadu Agriculture University).

**Tilting Bullock Cart**
This is an attempt of cross regional application of an innovation of Sri. Amrithbhai Patel, one of the awardees of NIF. SEVA in collaboration with SRISTI is trying to overcome the weakness of the present model:
1. Tyres are weak and not suited for rough road.
2. The steel materials used are less gauge or thickness farmers in Tamil Nadu prefer wooden plank model.
3. Tilting mechanism is difficult to operate.

Improved prototype will be completed in next 3 months.

**Palmyrah Tree Climber**
This is an instance of lateral learning from one innovator to another. One of the awardee of NIF, Mr Pasupathy Marthandam, has developed a tree climber. This innovation was evaluated by another innovator, Mr. A N Manoharan and attempt was made to improve palmyrah tree climber by weight reduction, improved contact area, stable locking mechanism and high climbing torque.

**Improved mechanical coconut husker**
This is another instance where, SEVA has facilitated lateral learning among innovators. Mr. Jeyaseelan was awarded by NIF for his innovative coconut husker. Mr. A N Manoharan helped Mr. Jayaseelan in developing another prototype with financial assistance from TIFAC. This model has several advantages over the previous one in terms of its efficiency, robustness and multiple work station. The new device could be used as a means to earn
livelihood for group of individuals. Eight people can work on this multipoint composite machine operating eight husking blades with a single 2 hp motor. The earning potential using this device goes up several folds. There is a business enquiry from Sri Lanka for this device. It has been advised by NIF to submit a MVIF proposal for commercialisation.

**Coconut Harvesting Machine**
Tractor-based coconut harvesting machine developed by Sri Karuppiah which performs multiple operations such as harvesting four trees, digging three feet deep pits, soil excavation and handling fifty feet height operations. The project was supported by TePP.

**Improved Air-Energised Stove**
A project of design improvement of air energized stove of Sri Duraisamy was undertaken with the support from TePP. SEVA has approached K S Rangasamy College of Technology, Tiruchengode for technical support.
Annexure IX

Value Chain

Innovative Idea  
Innovative Prototype

Prototype refinement

User testing and iterative improvements based on the feedback

Final product

Final IPR

Developing the business plan

Benefit sharing agreement

Implementing various steps of the business plan (Self or licensee)

Sharing the profits amongst the stakeholders on the basis of PIC form & further negotiations

Role of Individuals and Institutions as stakeholders

A competent agency like NIF or experts in that field verify the concept as an innovation

Prior Informed Consent form sent to NIF from innovator for Value Addition
Market research by experts to assess the product potential (preliminary need analysis)
Intellectual Property Protection (provisional filing)

Role of technical professionals and technological institutions like IITs (engineering)
Role of design professionals and Institutes like NID (design and ergonomics)
Raising incubation fund for product development from individual investors and venture capital firms

Innovator getting mentorship to become an entrepreneur
Micro Venture Innovation Fund

Expert lawyers to define the terms of agreements with the technology licensee
Skillful negotiators to get the due compensation for the innovator and other stakeholders
Annexure X (a)

List of the Projects supported under MVIF

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Title of the innovation</th>
<th>Innovator</th>
<th>Coordinating agency</th>
<th>Total amount sanctioned from MVIF (in Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Motor Protection Device</td>
<td>Bharat Kamble, Dist- Solapur, Maharashtra</td>
<td>GIAN West</td>
<td>93,750</td>
</tr>
<tr>
<td>2</td>
<td>Pedal Operarated Generator 'Roshni'</td>
<td>Abid Hussain, New Delhi.</td>
<td>GIAN-North</td>
<td>45,625</td>
</tr>
<tr>
<td>3</td>
<td>Solar Cooker</td>
<td>Nazim Shaikh, Ahmedabad</td>
<td>GIAN-North</td>
<td>3,375</td>
</tr>
<tr>
<td>4</td>
<td>Bicycle Hoe</td>
<td>Gopal M. Bhise, Jalgaon, Maharashtra</td>
<td>GIAN West</td>
<td>18,750</td>
</tr>
<tr>
<td>5</td>
<td>Manual Wood Cutting Machine</td>
<td>Mr. Karuna Kanth Nath, Dist Darrang, Assam</td>
<td>GIAN North</td>
<td>72,500</td>
</tr>
<tr>
<td>6</td>
<td>Interlocking Bricks</td>
<td>Umesh Chandra Sharma, North Lakhimpur, Assam</td>
<td>GIAN NE</td>
<td>30,929</td>
</tr>
<tr>
<td>7</td>
<td>Safety Device for Fire Cracker</td>
<td>Balaram Singh Saini, Dist Ambala, Haryana</td>
<td>GIAN North</td>
<td>8,750</td>
</tr>
<tr>
<td>8</td>
<td>Tea Making Machine</td>
<td>Sh. Ashok Kumar Dhiman, District :Panchkula, Panchkula</td>
<td>GIAN North</td>
<td>37,500</td>
</tr>
<tr>
<td>9</td>
<td>Lemon Cutting Machine</td>
<td>Mr. M. Nagarajan, Usilampatti, Tamil Nadu</td>
<td>NIF</td>
<td>1,87,500</td>
</tr>
<tr>
<td>10</td>
<td>Rotary Huller</td>
<td>Mr. A. N. Manoharan, Madurai, Tamil Nadu</td>
<td>GIAN-Cell (Tamil Nadu)</td>
<td>26,875</td>
</tr>
<tr>
<td>11</td>
<td>Stove cum Water Heater</td>
<td>Smt. Jyothi Ravishankar, South Canara Karnataka</td>
<td>GIAN-Cell (Karnataka), SSIT, Tumkur.</td>
<td>5,625</td>
</tr>
<tr>
<td>12</td>
<td>Automatic Engine Stopper</td>
<td>Tukaram Verma, Raipur, Chattisgarh</td>
<td>NIF</td>
<td>57,500</td>
</tr>
<tr>
<td>13</td>
<td>An Effluent Filtering device (Septic Tank Baffle System)</td>
<td>Rajesh T. R, Thrissur, Kerala.</td>
<td>NIF</td>
<td>62,500</td>
</tr>
<tr>
<td></td>
<td>Product Description</td>
<td>Name</td>
<td>Location</td>
<td>GIAN (Lab)</td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------------------------------</td>
<td>-------------------------------------------</td>
<td>-----------------------------------</td>
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</tr>
<tr>
<td>14</td>
<td>Amphibious Bicycle</td>
<td>Mohd. Saidullah, Maharashtra</td>
<td>NIF</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Spring Loaded (Shock Absorber) bicycle</td>
<td>Mohd. Saidullah, Maharashtra</td>
<td>NIF</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Forage/Fodder cutter/harvester</td>
<td>Mr. Chandrapal Singh, Basti, Uttar Pradesh</td>
<td>NIF</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Automatic Motor Coil Winding Machine</td>
<td>Kailash Srivastava, Narsinghpur, Madhya Pradesh</td>
<td>GIAN-North</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Motorized kite string winder</td>
<td>Mr. Paresh Panchal Ahmedabad</td>
<td>GIAN West</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Multipurpose bicycle</td>
<td>Kamaruddin, Alwar, Rajasthan</td>
<td>GIAN-North</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Low Cost Film Projector</td>
<td>Hori Lal Vishwakarma, Dist.: Pilibhit, Uttaranchal</td>
<td>GIAN-North</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Jyothi’s Herbal Hair Oil</td>
<td>Smt. Valsamma Thomas, District-Idukki, Kerala</td>
<td>SRISTI-SADBHAV Sanshodhan Lab &amp; NIF</td>
<td></td>
</tr>
<tr>
<td>24,25</td>
<td>Kerosene Gas Stove, Hydrogen Powered Stove</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Modified Silkworm raring tray and An effective uzi Fly trap</td>
<td>Mr. S M Mangali, Dist.: Gadag, Karnataka and Mr. H A Mohammad Wakil Ahmed, Dist Bangalore, Karnataka</td>
<td>GIAN North</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Bamboo stick maker</td>
<td>Mr. Usman Shekhani, Dist. Kanker, Chattisgarh</td>
<td>GIAN NE</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Innovative Sickle</td>
<td>Kishor bhai Bhardwa,Junagarh, Gujarat</td>
<td>GIAN West</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Trench digging</td>
<td>Radhey Shyamji Tailor, &amp; Nathulal Jangid,</td>
<td>GIAN North</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Inventor</td>
<td>Location</td>
<td>GIAN Region</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>30</td>
<td>Cycle operated horse shaver</td>
<td>Md. Idris, Meerut</td>
<td>Rajasthan</td>
<td>GIAN North</td>
</tr>
<tr>
<td>31</td>
<td>Tile making machine</td>
<td>Sukhranjan Mistry, Udhamsingh Nagar</td>
<td>Uttar Pradesh</td>
<td>GIAN North</td>
</tr>
<tr>
<td>32</td>
<td>Pine Needle as fuel</td>
<td>Nand Kishor, Ranikhet</td>
<td>Uttaranchal</td>
<td>GIAN North</td>
</tr>
<tr>
<td>33</td>
<td>Bicycle driven Multipurpose agriculture device</td>
<td>Dhirajlal Thummer, Amreli</td>
<td>Gujarat</td>
<td>GIAN West</td>
</tr>
<tr>
<td>34</td>
<td>Innovative Tongs</td>
<td>Arvindbhai R Patel, Maninagar Ahmedabad</td>
<td>Gujarat</td>
<td>GIAN West</td>
</tr>
<tr>
<td>35</td>
<td>Jabbar (variable) Gear System for Rickshaw</td>
<td>Sheikh Jabbar, Maharshatra</td>
<td>Maharashtra</td>
<td>GIAN West</td>
</tr>
<tr>
<td></td>
<td><strong>SUM TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Annexure X (b)

### List of Proposals under process at NIF

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the innovation</th>
<th>Name of the innovator</th>
<th>Coordinating Agency</th>
<th>Fin support sought (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.7</td>
<td>Small efficient diesel engine</td>
<td>Mansukhbhai Sanchaniya, Rajkot, Gujarat</td>
<td>GIAN West</td>
<td>185549</td>
</tr>
<tr>
<td>2.8</td>
<td>Novel Screw</td>
<td>Mahabir Chowbey, Puruliya West Bengal</td>
<td>GIAN West</td>
<td>17913</td>
</tr>
<tr>
<td>3.9</td>
<td>Jute Matchstick</td>
<td>U S Patil, Nandurbar Maharashtra</td>
<td>GIAN West</td>
<td>10000</td>
</tr>
<tr>
<td>4.1</td>
<td>Cycle sprayer</td>
<td>Mansukh Bhai Jagani, Amreli, Gujarat</td>
<td>GIAN West</td>
<td>10000</td>
</tr>
<tr>
<td>5.1</td>
<td>10 HP Tractor</td>
<td>Bhanji Bhai Mathukia, Junagadh Gujarat</td>
<td>GIAN West</td>
<td>175000</td>
</tr>
<tr>
<td>6.2</td>
<td>Washing cum exercise machine</td>
<td>Remya Jose P, Dist- Malappram, Kerala</td>
<td>GIAN West</td>
<td>26,000</td>
</tr>
<tr>
<td>7.1</td>
<td>Multipurpose agricultural device</td>
<td>Kaspate Gorkhnath Khelva, Maharashtra</td>
<td>GIAN West</td>
<td>15,000</td>
</tr>
</tbody>
</table>

**Proposed Amount from MVIF**: 4,39,462
### List of Proposals under process at GIANs

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the innovation</th>
<th>Name of the innovator</th>
<th>Coordinating Agency</th>
<th>Financial support sought (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hand Driven Sprayer</td>
<td>Gopalbhai Suratia, Baroda Gujarat</td>
<td>GIAN West</td>
<td>3,00,000</td>
</tr>
<tr>
<td>2</td>
<td>Automatic Thread Winder for Kite Flying - Phase 2</td>
<td>Pareshbhai Panchal, Ahmedabad</td>
<td>GIAN West</td>
<td>10,00,000</td>
</tr>
<tr>
<td>3</td>
<td>Sprocket potter wheel</td>
<td>Poonabhai Jadav, Dahod Gujarat</td>
<td>GIAN West</td>
<td>7,500</td>
</tr>
<tr>
<td>4</td>
<td>Mobile bicycle sprayer</td>
<td>Subhas Jagtap, Maharashtra</td>
<td>GIAN West</td>
<td>15,000</td>
</tr>
<tr>
<td>5</td>
<td>Keyway making fixture</td>
<td>Vijay Shantaram Ghodke, Aurangabad, Maharashtra</td>
<td>GIAN West</td>
<td>5,000</td>
</tr>
<tr>
<td>6</td>
<td>Innovative blowers for air curtains</td>
<td>Yagnesh Mehta, Ahmedabad Gujarat</td>
<td>GIAN West</td>
<td>Amount to be finalized</td>
</tr>
<tr>
<td>7</td>
<td>Leaf Cup Making Machine</td>
<td>Laxmikant Chari, Goa</td>
<td>GIAN West</td>
<td>Amount to be finalized</td>
</tr>
<tr>
<td>8</td>
<td>Electromechanical Barge Unloader</td>
<td>Savala Kanekas, Goa</td>
<td>GIAN West</td>
<td>Amount to be finalized</td>
</tr>
<tr>
<td>9</td>
<td>Water Soluble Polybag</td>
<td>Upendra Uplenkar, Nalanda, Bihar</td>
<td>GIAN West</td>
<td>Amount to be finalized</td>
</tr>
<tr>
<td>10</td>
<td>Low Cost 35 mm Film Projector</td>
<td>Magan Pardeshi, Chalisgaon, Maharashtra</td>
<td>GIAN West</td>
<td>Amount to be finalized</td>
</tr>
</tbody>
</table>

**Estimated Amount from MVIF** 13,27,500
## List of Proposals for consideration in the next Six Months

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Innovation</th>
<th>Name of the Innovator</th>
<th>Coordinating Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mosquito Repellent</td>
<td>Leena Talukdar and Sushanta Mahanta, Pune, Maharashtra</td>
<td>GIAN-NE</td>
</tr>
<tr>
<td>2.</td>
<td>Raisin grading machine</td>
<td>Ramdas Madavrao Jagtap, Nashik Maharashtra</td>
<td>GIAN-West</td>
</tr>
<tr>
<td>3.</td>
<td>Double Action Signal System to avoid Railway accident</td>
<td>Nagendra Pandit, Maharashtra</td>
<td>GIAN-West</td>
</tr>
<tr>
<td>4.</td>
<td>Ground Nut Separator (to Wait for Six months as innovator is shifting his workshop)</td>
<td>Yusuf Khan, Sekar, Rajsthan</td>
<td>GIAN North</td>
</tr>
<tr>
<td>5.</td>
<td>Rice in Clay Balls</td>
<td>Ram Abhilash, Jasarailahabad, Uttar Pradesh</td>
<td>GIAN North</td>
</tr>
<tr>
<td>6.</td>
<td>Gas conversion kit</td>
<td>A N Manoharan Madurai, Tamil Nadu</td>
<td>GIAN Cell, Madurai</td>
</tr>
<tr>
<td>7,8</td>
<td>Bullock operated sprayer</td>
<td>Bhanjibhai Mathukia, Gujarat Revanasidappa, Dist.: Gulberga Karnataka</td>
<td>GIAN-West</td>
</tr>
<tr>
<td>9.</td>
<td>Cycle sprayer, syringe etc.</td>
<td>Rajan Kumar, Karnataka</td>
<td>GIAN Cell Tumkur</td>
</tr>
<tr>
<td>10.</td>
<td>Control of heliothis in paddy</td>
<td>Vijaybhai Rathod, Anand, Gujarat</td>
<td>GIAN-West</td>
</tr>
<tr>
<td>11.</td>
<td>Control of ‘talkidi’ in cotton crop</td>
<td>Mansukhbhai Mathokia, Bhavnager, Gujarat</td>
<td>GIAN-West</td>
</tr>
<tr>
<td>12.</td>
<td>Pedal Operated Cycle pump</td>
<td>Vikram Rathod, Adilabad Andhra Pradesh</td>
<td>GIAN Cell Tumkur</td>
</tr>
<tr>
<td>13.</td>
<td>Auto compression sprayer</td>
<td>Arvindbhai Patel, Ahmedabad Gujarat</td>
<td>GIAN-West</td>
</tr>
<tr>
<td>14.</td>
<td>One way clutch</td>
<td>Amol Thakur, Mahrshtra</td>
<td>GIAN-West</td>
</tr>
<tr>
<td>15.</td>
<td>Arecanut peeler</td>
<td>Ananta Kishna Hegde, Yallapur, Karnataka</td>
<td>GIAN Cell Tumkur</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>An improved compact microphone with high sensitivity</td>
<td>Jaibhagwan Singh Saini, Kaithal, Haryana.</td>
<td>GIAN North</td>
</tr>
<tr>
<td>17.</td>
<td>Paddy Variety from Uttranchal</td>
<td>Indrasen Singh Dist.:UdhamSinghNagar Uttaranchal</td>
<td>GIAN North</td>
</tr>
<tr>
<td>18.</td>
<td>Automatic Starter with timer for Motor Pumps</td>
<td>Roshanlal Vishwakarma, Narshimapur, Madhya Pradesh</td>
<td>GIAN North</td>
</tr>
<tr>
<td>20.</td>
<td>Door L lock –or L drop auto protector</td>
<td>Govindo Chandra Gogoi, Assam</td>
<td>GIAN-NE</td>
</tr>
<tr>
<td>21.</td>
<td>Technique to transmit music through electric circuits</td>
<td>Champak Bora &amp; Trilokya Chandra Bora North Guwahati, Assam</td>
<td>GIAN-NE</td>
</tr>
<tr>
<td>22.</td>
<td>Low-cost egg Incubator</td>
<td>Milon Jyoti Das, Guwahati, Assam</td>
<td>GIAN-NE</td>
</tr>
<tr>
<td>23.</td>
<td>Producing electricity from water flow</td>
<td>K. Abdullah, Kerala</td>
<td>NIF</td>
</tr>
<tr>
<td>24.</td>
<td>Floss removing machine</td>
<td>Maalyaa, Karnataka</td>
<td>NIF</td>
</tr>
<tr>
<td>25.</td>
<td>Incubator</td>
<td>K Jaffrey, Kerala</td>
<td>GIAN Cell Tumkur</td>
</tr>
<tr>
<td>26.</td>
<td>Bicycle Pedal Operated portable pump</td>
<td>Nasiruddin Gayen, Kolkatta, West Bengal.</td>
<td>NIF</td>
</tr>
</tbody>
</table>
Annexure X (e)

List of Proposals for which letter were written to Innovators for NVIF Assistance

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name and Address of The Innovator</th>
<th>Title of the innovation</th>
<th>Response received</th>
<th>Action Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mohd Saidullah</td>
<td>Amphibious Bi-cycle</td>
<td></td>
<td>Disbursed</td>
</tr>
<tr>
<td>2.</td>
<td>Mohd Saidullah</td>
<td>Spring Loaded (Shock Absorber) Bicycle</td>
<td></td>
<td>Disbursed</td>
</tr>
<tr>
<td>4.</td>
<td>Somanatha Iyer</td>
<td>Arecanut Peeling Machine</td>
<td></td>
<td>Professional hence Closed</td>
</tr>
<tr>
<td>5.</td>
<td>Mahabir Chowbey</td>
<td>Novel Wooden Screw</td>
<td>Y</td>
<td>Under process</td>
</tr>
<tr>
<td>6.</td>
<td>Abraham Joseph</td>
<td>Simple water lifting device</td>
<td></td>
<td>Hold</td>
</tr>
<tr>
<td>7.</td>
<td>Smt. Jyothi Ravishankar</td>
<td>Stove cum Water Heater</td>
<td></td>
<td>Disbursed</td>
</tr>
<tr>
<td>8.</td>
<td>Rajesh T R</td>
<td>Septic Tank Baffle System</td>
<td>Y</td>
<td>Disbursed</td>
</tr>
<tr>
<td>9.</td>
<td>S. Narasimha Bhat</td>
<td>Arecanut husking machine</td>
<td></td>
<td>Hold</td>
</tr>
<tr>
<td>10.</td>
<td>Vyas ji Mishra</td>
<td>Hydrogen Powered Stove</td>
<td>Y</td>
<td>Disbursed</td>
</tr>
<tr>
<td>11.</td>
<td>Remya Jose</td>
<td>Washing cum Exercise Machine</td>
<td></td>
<td>Under Process</td>
</tr>
<tr>
<td>12.</td>
<td>Md Nasiruddin</td>
<td>Bicycle Pedal Operated Portable Water Pump</td>
<td>Y</td>
<td>Under Consideration in next 6 months</td>
</tr>
<tr>
<td>13.</td>
<td>Kallada Jeffrey</td>
<td>Incubator for hatching eggs</td>
<td></td>
<td>Under Consideration in next 6 months</td>
</tr>
<tr>
<td>14.</td>
<td>K. S. Sudheer</td>
<td>Improved steering mechanism for three wheeler</td>
<td></td>
<td>Hold</td>
</tr>
<tr>
<td>15.</td>
<td>Antony Aryapallil</td>
<td>Mobile Pepper Thresher</td>
<td>Y</td>
<td>Hold</td>
</tr>
<tr>
<td>16.</td>
<td>Ramesh Chandra Gurjar</td>
<td>Seed cum Fertilizer Drill Machine</td>
<td></td>
<td>Hold</td>
</tr>
<tr>
<td>No.</td>
<td>Name</td>
<td>Product</td>
<td>Status</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------</td>
<td>--------------------------------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Usman Shekhani</td>
<td>Bamboo stick maker</td>
<td>Disbursed</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Devendra Purohit</td>
<td>Colour Laser Projector</td>
<td>Professional</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hence closed</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Shyama Pd. Singh</td>
<td>Thal kamal / Thal Padma</td>
<td>Hold</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Nageshwar Pandit</td>
<td>Double action Signal System to avoid railway accidents</td>
<td>Under Consideration in next 6 months</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Rathode Vikram</td>
<td>Bicycle operated Pump</td>
<td>Under Consideration in next 6 months</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Roshan Lal Vishwakarma</td>
<td>Multifunctional Automatic Starter for Electrical Motors</td>
<td>Under Consideration in next 6 months</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Nathulal Jangid</td>
<td>Trench Digging Machine</td>
<td>Sanctioned</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Yusuf Khan</td>
<td>Groundnut Separator</td>
<td>Under Consideration in next 6 months</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Chinder Singh</td>
<td>Multi crop combine</td>
<td>Hold</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Horilal Vishwakarma</td>
<td>Low Cost Film Projector</td>
<td>Disbursed</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Md. Idris</td>
<td>Horse Shaver</td>
<td>Sanctioned</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Kamaruddin</td>
<td>Multipurpose Bicycle</td>
<td>Disbursed</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Niranjan Prasad Sharma</td>
<td>Improved Kerosene Stove</td>
<td>Disbursed</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Sukhranjan Mistry</td>
<td>Manual Tile Making Machine</td>
<td>Sanctioned</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Keval Krishna Jouhari</td>
<td>Wireless Collar Mike</td>
<td>Hold</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Balram Saini</td>
<td>Device for Remote Firing of Crackers</td>
<td>Disbursed</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Sameerul Hasan Liaquat (Lalla Mistry)</td>
<td>An improved pumpless stove</td>
<td>Disbursed</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Ram Abhilash</td>
<td>Saksham- A LPG driven 2-wheeler</td>
<td>Under Consideration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project Name</td>
<td>Description</td>
<td>Status</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------</td>
<td>-------------------------------------------</td>
<td>-------------------------------</td>
<td></td>
</tr>
<tr>
<td>35.</td>
<td>Ashok Kumar Dhiman</td>
<td>Tea Making Machine</td>
<td>Disbursed</td>
<td></td>
</tr>
<tr>
<td>36.</td>
<td>Meva Ram Jangid</td>
<td>Camel Driven Bus</td>
<td>Hold</td>
<td></td>
</tr>
<tr>
<td>37.</td>
<td>Indrasen Singh</td>
<td>Paddy Variety from Uttranchal</td>
<td>Under Consideration in next 6 months</td>
<td></td>
</tr>
<tr>
<td>38.</td>
<td>Beni Singh</td>
<td>In Plant germination of Sugarcane</td>
<td>Hold</td>
<td></td>
</tr>
<tr>
<td>39.</td>
<td>Nand Kishore Upadhyaya</td>
<td>Pine needle as fuel</td>
<td>Sanctioned</td>
<td></td>
</tr>
</tbody>
</table>

**Annexure XI (a)**

**Processes & Systems of Incubation**

With an objective to share common understanding of evaluation criterion for short-listing of projects and process flow of incubation, a workshop was organized at IIM, Ahmedabad on February 13, 2004. Several experts from incubation business and management education were invited to share insights with the participating members of NIF and GIANS.

An incubation advisory committee was also constituted with the following membership for NIF and GIANS;

1. Mr. Rahul Patwardhan (CEO, India Co), Chair
2. Prof. Pankaj Chandra (Professor, IIM Ahmedabad)
3. Prof. V R Gaekwad (Retired Professor, IIM Ahmedabad)
4. Prof. P.K. Sinha (Professor, IIM Ahmedabad)

The group discussed and developed time lines and ranges the incubation processes and performance tracking system. Based on the recommendations of the Incubation workshop organized on February 13, 2004 organized at IIM, Ahmedabad, a Performance Tracking System was developed at NIF.

**MVIF Incubation Process and Performance Tracking System at NIF**

http:\\www.nifindia.org/incubation
Description of Incubation Process

Entry selected with in-principle agreement

SD1 → EV1 → P1

Submit proposal for seeking assistance from MVIF for further steps

Provisional Patent to be filed

Final patent filing

Wait / try for licensing

MP 1 → Found Entrepreneur

Submit proposal for MVIF

License Document

Investment decision

Technology Valuation

GO / NO

MR /

P2

PAS

Abort

P2 / NO

GO / NO

Abort
**Acronyms Used in the Flowchart**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>Enterprise Plan</td>
</tr>
<tr>
<td>EV1</td>
<td>Evaluation Document</td>
</tr>
<tr>
<td>MP1</td>
<td>Manufacturing Plan</td>
</tr>
<tr>
<td>MR</td>
<td>Market Research</td>
</tr>
<tr>
<td>P1</td>
<td>Budgeting for Prototype</td>
</tr>
<tr>
<td>P2</td>
<td>Development of Prototype</td>
</tr>
<tr>
<td>PAS</td>
<td>Prior Art Search</td>
</tr>
<tr>
<td>PIC</td>
<td>Prior Informed Consent</td>
</tr>
<tr>
<td>SD1</td>
<td>Scouting Document</td>
</tr>
</tbody>
</table>
Annexure XI (b)

New Initiatives in Business Development

Mapping a Portfolio of Similar Innovations
Stoves:
A portfolio of domestic heating equipment, which comprises a total of 29 innovations i.e. Kerosene Pressure Stoves, Chulha, Geysers, Ovens (including non-conventional energy based product) was pooled. Out of these, 17 stoves were benchmarked within the portfolio and with existing products in market. A market research was also carried out. Based on the findings, presentations were made to several of stove manufacturers in Rajkot, Mumbai, Chennai and Coimbatore. One enterprise from Rajkot; Ashok Stoves, which is one of the largest manufactures and exporter of stoves in India has showed commercial interest in taking up some of the innovative stoves forward. Technical validation reports from IIT-G shall be sent to them for their evaluation. In another significant development, one stove of Mr Mathew V. Mathew, an awardee of the first competition, is being sent to one distributor based in USA for evaluation of technical and business potential in US markets.

The testing of these technologies at IIP, Dehradoon and IIT Guwahati has been supported from MVIF.

Agriculture Sprayer:
A portfolio of 29 entries, comprising different types of agricultural sprayers was mapped. This is being used in similar ways as mentioned above in case of stoves.

Commercialization of some of these sprayers is being processed for MVIF assistance.
### Annexure XI (c)

**MVIF support for Cross-Regional Application of Innovations**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Technology</th>
<th>Innovator and Domicile State</th>
<th>Areas for cross-Regional Application</th>
<th>Project Undertaken By</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Incense Stick Making Machine</td>
<td>Usman Shekhani, Chhattisgarh</td>
<td>North Eastern States, MP, Chhattisgarh</td>
<td>NIF, GIAN NE</td>
</tr>
<tr>
<td>2</td>
<td>Tea Making Machine</td>
<td>Mr. Ashok Dhiman, Haryana</td>
<td>National</td>
<td>NIF, GIAN-W and GIAN NE</td>
</tr>
<tr>
<td>3</td>
<td>Exercise cum Washing Machine</td>
<td>Ms. Remya Jose, Kerala</td>
<td>National Market and International Market</td>
<td>GIAN W</td>
</tr>
<tr>
<td>4</td>
<td>Milking Machine</td>
<td>Raghvendra Gowda, Karnataka</td>
<td>National</td>
<td>GIAN NE, GIAN W</td>
</tr>
<tr>
<td>5</td>
<td>Low cost Egg Incubator</td>
<td>Kerala</td>
<td>National</td>
<td>GIAN NE</td>
</tr>
<tr>
<td>6</td>
<td>Herbal fragrances (Room-freshener, after-shave lotion &amp; deodorant)</td>
<td>Narayana Karki, Assam</td>
<td>National</td>
<td>NIF</td>
</tr>
<tr>
<td>7</td>
<td>Groundnut Digger</td>
<td>Mr. Yusuf Khan, Rajasthan</td>
<td>Gujarat (other states like TN, AP etc)</td>
<td>GIAN W</td>
</tr>
<tr>
<td>8</td>
<td>Shaver for Sheep/Horse</td>
<td>Md. Idris, Meerut, Uttar Pradesh</td>
<td>North India</td>
<td>GIAN W</td>
</tr>
<tr>
<td>9</td>
<td>Tile Making Machine</td>
<td>Mr. Sukhranjan Mistri, Utt Rachal</td>
<td>National (particularly with low income segment)</td>
<td>GIAN W</td>
</tr>
</tbody>
</table>
# Annexure XII

**List of Patent, Trademark and Design Applications filed in India and US**

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Comp.</th>
<th>Title of the Innovation</th>
<th>Name of the innovator</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Sprinkling Apparatus with multiple nozzles.</td>
<td>Annasaheb Udgavi</td>
<td>India</td>
</tr>
<tr>
<td>2</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Improved Multicrop thresher.</td>
<td>Madanlal Kumawat</td>
<td>India</td>
</tr>
<tr>
<td>3</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>Portable Power Generating Device.</td>
<td>N.V.Satyanaryana</td>
<td>India</td>
</tr>
<tr>
<td>4</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>Single wheel weed remover.</td>
<td>Gopal Malhari Bhise</td>
<td>India</td>
</tr>
<tr>
<td>5</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>Pathfinding Android.</td>
<td>Prem Singh Saini</td>
<td>India</td>
</tr>
<tr>
<td>6</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Multicylinder Reciprocating Pump.</td>
<td>Shakun Das</td>
<td>India</td>
</tr>
<tr>
<td>7</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Coconut Harvesting Device.</td>
<td>P. Karuppiah</td>
<td>India</td>
</tr>
<tr>
<td>8</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Moped LPG kit.</td>
<td>Ram Kumar</td>
<td>India</td>
</tr>
<tr>
<td>9</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>Double Acting liquid discharger.</td>
<td>Manubha Jadeja</td>
<td>India</td>
</tr>
<tr>
<td>10</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>Dishwashing Apparatus</td>
<td>Anil K. Makkanwar</td>
<td>India</td>
</tr>
<tr>
<td>11</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>Self propelled weeder</td>
<td>Ramkumar Patel</td>
<td>India</td>
</tr>
<tr>
<td>12</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>Leaf Mat-making apparatus</td>
<td>P. Marthandan</td>
<td>India</td>
</tr>
<tr>
<td>13</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Cardamom Drier.</td>
<td>P.J. Abraham</td>
<td>India</td>
</tr>
<tr>
<td>14</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Water level Indicator.</td>
<td>Eldose Markose</td>
<td>India</td>
</tr>
<tr>
<td>15</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Power saving Pump</td>
<td>Ram Naresh Yadav</td>
<td>India</td>
</tr>
<tr>
<td>16</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>Mobile charger.</td>
<td>A N Manoharan</td>
<td>India</td>
</tr>
<tr>
<td>17</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>Manual Washing machine.</td>
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</tr>
<tr>
<td>18</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>Improved bicycle</td>
<td>Kanak Das</td>
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</tr>
<tr>
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<td>Power Disc</td>
<td>Deb Gupta</td>
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<tr>
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<tr>
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<td>Process for treating bone fractures</td>
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<td>India</td>
</tr>
<tr>
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<td>Dulal Chaudhary</td>
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<td>Combating termites with Ipomea Earnea Jacq</td>
<td>Upasana Talukdar</td>
<td>India</td>
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<td>India</td>
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<td>Cotton Stripper</td>
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*Patent Granted*
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<td>Auto Air-kick Pump</td>
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<td>Natural Water-cooler</td>
<td>Arvindbhai Patel</td>
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<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Fibre optic Cable</td>
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<td>Kalpesh Gajjar</td>
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</tr>
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<td>Bicycle Sprayer,</td>
<td>Mansukhbhai Jagani</td>
</tr>
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<td>Portable battery operated sprayer</td>
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<td>Zero head turbine</td>
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<td>Cycle based pump</td>
<td>Vikram Rathore</td>
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<td>Lemon Cutting Machine</td>
<td>M. Nagarajan</td>
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* The Patent Applications filed by GIAN West before the existence of NIF. The entries from the third competition have been taken up for IP protection on the basis of *prima facie* evaluation. The formal screening and evaluation for possible awards is yet to be completed.
Besides the above patent applications, Design & Trademark applications have also been filed:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Design / Trademark</th>
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<tr>
<td>1</td>
<td>GIAN (Trade Mark)</td>
<td>GIAN</td>
<td>INDIA</td>
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<tr>
<td>2</td>
<td>SHASHWAT(Trade Mark)</td>
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<td>3</td>
<td>Bullet Shanti (Design)</td>
<td>INNOVATOR</td>
<td>INDIA</td>
</tr>
<tr>
<td>4</td>
<td>Folding luggage Carrier (Design)</td>
<td>GYPHY INTERLINK INDUSTRIES</td>
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Annexure XIII

**Traditional Knowledge -- Blending the old with the new**

Nations and societies which carry a legacy of ancient cultures and knowledge systems have a unique advantage – they can harness ancient wisdom and complement it with modern scientific thought processes in their march towards prosperity and modernity. Very often, drawing upon the reserves of traditional knowledge banks obviates the need for re-inventing the wheel. Combining traditional knowledge with new discoveries calls for a polycentric approach to cope with the challenges presented by the environment. These coping strategies rely fundamentally on traditional knowledge systems, constantly interacting with the contemporary knowledge, institutions and cultures from around the world.

Traditional knowledge is not something static, evolved over a long period of time and passed on, as if, in a fossilised form, by or to the subsequent generations. There are three aspects of traditional knowledge which deserve attention in the context of making India a knowledge-intensive society, trying to become a global leader in sustainable technologies:

a) Traditional knowledge evolved by people to cope with various stresses and challenges around them. In many cases, institutional norms, ethical values and cultural codes also evolve along with traditional knowledge. While some of the knowledge bits perform very specific functions of solving health, conservation or production problems, others help in shaping the broader worldview. With the passage of time, some of this knowledge and some of these innovative practices survive in their functional forms and some as part of belief systems, in fact, even as superstitions. Not everything in the tradition need either be functional or even morally desirable. A healthy skeptic approach provides answers to the constant struggle, which takes place between traditional technologies and contemporary consumer needs. Not everything which is rejected by consumers need be wasteful and, likewise, not every part of tradition carried forward by community members need be synergistic with the demands of a modern rational and communitarian society.

b) Traditional ways of solving problems will always remain a powerful means of generating grassroots innovations and improvised traditional knowledge. Trial and error, keen observation, experiments and an eye for detail contribute to many innovations at an individual or community level. The tradition of invention is a continuing one. Though given the colonial history and defeatist mentality it might have spawned, many people may not recognise this tradition. The problem thus arises when many of these innovations developed recently or a long time ago at grassroots level are not recognised or rewarded. Diffusion of such innovations may not take place and people may struggle with the same problems that might have been solved in another part of the society. Farmers, men or women, might select an odd plant which eventually generates a new plant variety, or develop a new machine, or develop a new drug or use fat of fish for killing pests, etc. These solutions might even be seen as contemporary grassroots innovations.

c) Traditional technologies many times involve modern materials, scientific concepts and tools. In many ways, these innovations are quite similar to the innovations generated in the formal,
scientific and technological systems, except for the process by which these solutions are evolved. The fishing community develops a new use of dynamite for catching fish (a non-sustainable means), farmers use soap solution (soap made of new chemicals and different from old natural oil soaps) for controlling pests, or a potter uses concrete to make tiles for roofs, etc.
Annexure XIV

Examples of traditional ways of solving local problems

Presented below are select technologies from different parts of the country which NIF has identified for possible commercial use. It is our contention that NIF’s National Register is more extensive than any such database, not only in India, but anywhere in the world.

(1) Mr Zahoor Ahmed Shah, 26 years, is from Anantnag district of Jammu and Kashmir, and belongs to a cattle rearing family. He discontinued education midway but has elder sisters and a brother who are educated. Mr Shah discovered the treatment for asthma and a formulation for treating wounds. He discovered the wound healing treatment when his cattle were injured. He looked around and tried some plant extracts and his efforts were successful. When his entry was received about wound healing and asthma treatment, NIF sent him a more detailed proforma for additional information. He took the trouble of contacting a curator, Mr Z S Khan, at the Centre of Plant Taxonomy, University of Kashmir, and got this plant identified and attached to his certificate. This shows new emerging consciousness, not only about local traditional knowledge, but also the need to build bridges with modern science. Of course, this is one of the rarest cases where a person has gone so far to get all the information. In majority of the cases, we get only local names and getting scientific names poses a tremendous challenge (particularly with limited human and financial resources at our disposal).

When the formulations sent by Mr Shah were reviewed, it was found that Verbena officinale (hamuk) had been used for wound healing in Hawaii and a company, Pacific Holistic, had already developed a commercial cream containing extracts of five plants, including this one. Similar was the case with regard to the asthma drug. But this does not mean that the research conducted by Mr Shah has gone waste and has no importance. It provides a lead for a very viable drug that can be made and used for local health at a low cost. It might even generate a small or large enterprise, if the same is used for developing a human and cattle wound healing drug.

(2) Mr Ram Abhilas has organised an Adarsh Farmers’ Club in Budawas Jasra village of Allahabad and has sent some very interesting innovations and traditional knowledge. Given the uncertainty of the onset and quantum of rain in this region, farmers have developed a very interesting practice of embedding paddy seeds in moist balls of clay collected from the tank basin (very fertile) and drying it. There should not be too much moisture otherwise the seeds will germinate and get spoiled. If the rain is late or excessive, the crop grown through broadcast seeds or transplanted seedlings get affected adversely. In that case, the farmer sows the balls of paddy seeds and these give higher yield than broadcast and transplanted paddy. It is a relatively new practice developed with the help of traditional knowledge. It can be diffused mainly through non-commercial means. Mr Abhilas has developed many other practices, such as sowing coriander around chick pea (a practice also found in western Haryana to save crop from pod borer). The general belief that it is the smell of coriander which repels the pest has been found to be incorrect. The pest is controlled by the predators
which are attracted by the nectar rich crop coriander crop. In this case, the farmers did the right thing for the wrong reason. This happens sometimes.

(3) Mr Ausaf Khan from Bhopal has developed a formulation for asthma, which he picked up from his father. It involves a common plant and salt. Mr Khan bemoans that this treatment is used by people only when they are disappointed with the allopathic system (that is, when the case becomes chronic). TK has to look into another issue -- because he does not charge for this medicine, people do not trust it easily, an ethical dilemma about the way this knowledge system should be preserved and valorised.

(4) Mr Kanak Das, who lives in a village 70 km from Guwahati, has developed a mechanism for reducing the effect of bump on a rider and also use the force generated on a bumpy road for transmission purposes. The faculty of the Mechanical Department, IIT, Guwahati, has taken it up for further analysis. GIAN-NE has initiated a market survey of the product and four different models have been developed. The mechanism will be tested for its utility with different models of bicycle available in the market.

(5) Traditional knowledge of curing bone fracture and back ache, using herbal medicine, has been taken up for making a viable product. Consent from the Biotechnology Department, Guwahati University, has been obtained to investigate the side effects. NIF has supported this work through GIAN, as in other cases. Assam Science Technology and Environment Council has also provided help to the local innovator, Mrs Puspalata Saikia, to improve the efficiency of treatments and to upgrade her infrastructure.

(6) Countable Calculator: This innovation relates to converting a hand calculator to a mechanical counter for factories at a low cost, developed by two young brothers, Champak and Trilokya Bora. GIAN-NE is incubating this product with the help of Department of Electronics, IITG, and a Technical Assistant of Tezpur University.

(7) Remya Jose is a 12th class student in a village near Palkad, Kerala. She has to change three buses every day, and spend two hours, each way, for going to school. Last year, her mother was not well. Her father is a cancer patient, and household chores, particularly washing clothes, was a major burden. What would most people do, cope with it some how. Remya invented a washing machine which also doubled as an exercising machine and cost only about Rs 1500. She is a brilliant girl, with extraordinary talent in extra-curricular activities, as well as in studies.

(8) Another girl student of 8th standard, Shweta, from a small town in Andhra Pradesh, was awarded last year for an idea of a post box alarm so that one came to know whenever a letter was dropped in the letter box. Interestingly, a US patent was issued on this technology in 2001, around the time when this idea was submitted to us, oblivious of the patent in USA.

(9) Mansukh Bhai Jagani in Amreli has developed an attachment so that one can do ploughing, weeding, sowing, etc, with the help of an Enfield motorcycle; Bhanji Bhai Mathukia has developed a ten horsepower tractor. But he is being charged the same fees for testing that is
charged of a large company like Ford or Eicher. Obviously, there must be some method in the madness of this kind which we cannot fathom. The same rule applies to any other technology developed by a farmer, or an artisan. Mr Mathukia has also developed an innovative check dam for water conservation in dry regions but can it be diffused on public media. No. Prasar Bharati will not provide ten minutes on the national channel for a series on India Innovates, lest Indian society becomes creative and makes life of mediocre mandarins difficult.