Policy gaps for promoting green grassroots innovations and traditional knowledge in developing countries: learning from Indian experience

SRISTI's effort to institutionalize Honey Bee Network experience in the form of NIF (National Innovation Foundation) ten years ago had generated lot of interest in different parts of the world. Several institutional innovations over last two decades have sown the seeds for future transformation to make society more creative, collaborative and compassionate. Inclusive or harmonious development cannot follow otherwise. In this paper, I draw upon the key building blocks of an innovation eco system and redefine the concept of national innovation system which for so long has ignored the innovations and traditional knowledge system in the informal sector. Most of the time, the study of Research and Development [R&D] in the formal organized sector was considered same as a study of innovation system. The network of institutions supporting R&D became part of the larger system and expenditure on R&D became determinant of innovation potential. The creativity of the informal sector was neither taken note of nor ever measured to quantify the contribution it could make to the process of development and the larger innovation eco system. The educational system did not include in past and still does not include reference to creativity at grassroots. The people were supposed to adopt the ideas and innovations developed by the formal system. Almost the entire literature on diffusion of innovations dealt with adoption of technologies developed by formal R&D system.

In such a context, the new trail triggered by Honey Bee Network more than two decades ago was like ploughing a lonely furrow. The genesis of Honey Bee Network is described elsewhere [Gupta, 2003, 2006, 2008]. The contribution of the Network in creating awareness about how common people solve their own problems is beginning to be understood. However, various building blocks of a nurturant system are yet to be put in place. While in India the progress has been slow but steady, in most countries, even the beginning has not been made.

Building blocks of an innovation eco-system:

The motivations for people to solve problems creatively can vary from extreme altruistic to extreme selfish and that is quite understandable. Creation of community and public goods has motivated people from time immemorial. And yet, most public and private institutions are premised on the understanding that individuals or groups will often innovate in their own self-interest. The design of portfolio of incentives, while in general, receives much less attention, but to the extent it does, it considers success of an innovation only or mainly in terms of commercial outcomes. Non-monetary exchanges in society are not considered worthy enough for promotion and support in the innovation eco-system. Even for the innovations which may have commercial future, the institutional arrangements for product development, design, testing, calibration, user trials, investment of risk capital, etc., seem very poorly designed and supported. The eco-system is weak for individual innovators from the professional background as well. Thus, if innovations still take place in public and private sector, formal and informal economy, the credit for much of it should go to the fortitudinous ability of the people. The design of the future eco-system should be guided by the assumption of a highly variegated landscape. Any other assumption could mean that only some who are well-endowed, well-connected and quite resourceful are able to get the support in preference to the small, scattered, segmented and socially disconnected innovators.

1. *Reaching the innovators:* No eco-system would ever serve any purpose if the clients are missing. I have seen many incubators set up by the academic institutions waiting for the innovators. When they don't receive the innovators, they change their policy to work with those who they receive. The means and the ends get mixed up. There are some who do not know how to search but there are others who know but do not want to try. Nothing can be done about the latter. But those who want to know, the experience of Honey Bee Network and the www.techpedia.in can be useful. Honey Bee Network pooled more than 100,000 ideas, innovations and traditional knowledge practices from over 540 districts at NIF (National Innovation Foundation) through an on site search process. Techpedia.in pooled more than 100,000 projects pursued by 350,000 students in 500 colleges around the country. Search is a labourious process and cannot be restricted to mere advertisements in the newspapers or on visual media. Various

methods for searching creative people in rural or urban areas include involvement of students during summer vacation, walk through the rural areas [shodh yatra], meeting of the innovators and experimenters and encouraging them to become scouts, having scouting stalls in the cultural and agricultural fairs, organizing biodiversity contests among children, recipe competition among women and others, competition among grassroots functionaries of state development departments, etc.

Several years ago, Ministry of Science, Technology and Innovation [MOSTI], Malaysia invited me to discuss above framework. They had set up a 200 million Ringat Innovation Fund. But they had not received many entries from rural areas or from young people. After discussing various ideas, which we have tried in Honey Bee Network, I suggested that we should go to a school nearby. Accordingly, a visit was arranged at an hour's notice to a school at Shah Alam. On the spot, we organized idea competition first at individual level on any issue that they wanted and second at group level to find creative solutions for the disadvantaged social groups. Amazing range of ideas came out, some of which were published in Honey Bee [Vol…….]. Thus, creating mental, institutional and policy space for innovations to be articulated is the real crux of the matter.

2. *Documenting the innovations:* In 1988-89, I developed a detailed check list for documenting innovations and traditional knowledge practices. Soon we realized that more disaggregated the categories of documentation, less useful is the data. One can disaggregate a narrative but it was not easy to get the story from disaggregated fields. People don't often think in segmented manner. It is better to have their narrative as it is articulated rather than filling up the form. We curtailed the details and the quality of information improved drastically. We decided that one should begin with only synoptic information and follow it up through a detailed documentation after short listing or screening the synoptic information of the larger pool. The creative tension between holistic and reductionist view of knowledge is very important to understand and appreciate the phenomenological cases of grassroots innovations and traditional knowledge.

3. *The ethics of the knowledge extraction:* In a paper, "Who has the right to knowledge" [1988], several issues concerning the knowledge rights of people, responsibility and accountability of outsiders [firms, scientists, public administrators, students, etc.] and the asymmetry in attribution and reciprocity were discussed. Recently, in another paper on "Is just also fair?" [2008], this issue has been revisited. Various editorials of Honey Bee [The eye of the bird, 2010] have also dealt with this issue. No eco-system will be sustainable if shared understanding of various ethical issues involved in knowledge exchange, utilization, benefit sharing, etc., does not evolve. Such an understanding requires formal as well as informal mechanism.

    i. The formal mechanisms can be: [a] requirement on the part of every student or scholar who documents people's knowledge to be obliged to share the findings in local language with the knowledge provider, [b] all degree granting institutions to make it mandatory for such scholars not only to share findings but also acknowledge the knowledge providers specifically as authors of knowledge and not just as participant [as is customary], [c] an obligation not to publish findings which are unique and thus may entitle the local communities or individuals to the protection of their intellectual property rights. Over the years, enormous amount of individual and community knowledge has been brought by outsiders in public domain without attribution, accountability, reciprocity and benefit sharing, [d] requirement on the part of funding agencies at national and international level to require every grantee to observe the principles of attribution, sharing the findings, benefit sharing, etc., without exception. The default condition should be that the knowledge providers will be acknowledged and their Prior Informed Consent is taken rather than keeping them anonymous as is the current practice in many social science research councils around the world.

ii. The informal mechanisms can be: [a] opportunity to knowledge providers to learn from each other, to do research on their own conditions and to share their knowledge with other communities in local language, [b] platforms for periodic debate and discussion on various practices among informal knowledge experts to refine and refute various ideas, [c] exchange of knowledge and possible mode of action with the institutional experts so as to learn about multiple heuristics for interpreting their current knowledge, [d] opportunity to pool the practices of different knowledge holders around a common theme for developing better value added practices for common good. A concept of *technology commons* has also been developed to enable such pooling of innovations [primary and derivative] to be licensed at no cost to self-employed people and at cost to commercial enterprises [Sinha, 2009], [e] creation of local language knowledge registers, databases for systematic collection of local knowledge for its transmission to the next generation through formal or informal educational processes and [f] distributed characterization, incubation and augmentation labs which help people to find out about the scientific knowledge about their biodiversity and other local resources *in-situ.*

iii. An eco-system that does not consciously and explicitly acknowledge the knowledge rights of people loses its legitimacy and also mutuality. My feeling is that one reason why lot of organizations have not yet started following Honey Bee philosophy is because of the *ethical load* inherent in it. We have to be appreciative of those mistakes which are unintentional and are borne out of ignorance as distinct from the intentional ones. To illustrate, I tried as a member of editorial board of Indian Journal of Traditional Knowledge to influence the ethical policy with regard to publication of papers in the journal dealing with peoples' knowledge. Several well-wishers of the Network took a critical note of my presence in the editorial board and its violation of the Honey Bee philosophy. Finally, I had to resign from the board because I could not influence the policy. This is going to be a long drawn process before any institution in formal

or informal sector anywhere in the world would insist on the compliance with these values. I must admit that some of my own doctoral students have not complied with the norm of sharing their work in local language with the knowledge holders. Therefore, in a very self-critical perspective, I realize that ethics cannot be legislated. It has to be internalized. Eco-system managers at national and international level [National Biodiversity Authority of which I am a member is as negligent towards these values as Convention on Biological Diversity or WIPO's inter-governmental panel on the subject] have not yet realized the crucial linkage between the interactional values and the institutional health and outcomes. A protocol needs to be developed for the purpose at national and international level.

4. *Characterising knowledge:* Making sense of one's ideas and imagination in a contested domain of private, community and public ownership of knowledge and resources [Gupta and Sinha, 2001 requires negotiations within family, community and larger social network. It is inevitable that secular and sacred get intertwined like a double helical structure of DNA in the knowledge systems[1] [Gupta, 1993, ICCIG, 1997, 1999]. While modern mind can ignore the rituals associated with secular technological practices, for a person deeply steeped in the local culture such separation is not always possible. Perhaps it is also not necessary. Even the modern science has to come to believe the effectiveness of faith and positive expectations. The characterization of knowledge in terms of technical, institutional, socio-cultural and behavioural terms requires longer-term engagement with knowledge providers. While dealing with large numbers, such an engagement may not be possible in all the cases at all the time. Therefore, a precise, easy to understand communication system has to be developed so that exchange of

[1] Rajani Bakshi, Traditional Sciences Congress, Economic and Political Weekly, 28 [52] 2872-2874 quotes my statement at the Congress, "Perhaps the most emphatic attempt to make a departure from this discourse [relying on notion of cultural pride] was made by Anil K Gupta of the Centre for Management in Agriculture at Indian Institute of Management, Ahmedabad…. referring to several examples of cooperation and reciprocity, Gupta said: "Those who are searching for symbols of restoring our pride will not relate to these cases, because their preoccupation is with symbols of conquest, which dissipate and [have] no concern with this link between secular and sacred". The continuing tradition of creativity had to become the building block of future.

information among knowledge providers, knowledge catalogers and knowledge mediators can take place at mutually acceptable pace and terms. There are several useful practices that can be followed to make this process useful to all actors involved.

i. When prior art search is done to find uniqueness in the innovation or distinctiveness claims, a summary of the prior art in local language can be sent to the knowledge provider so that her knowledge gets augmented. For many uneducated or less educated knowledge holders, the concept of prior art itself may be new. Therefore, it will have to be explained as to why we have to see what kind of knowledge already exists in published or unpublished sources before accepting a claim worthy of further investigation.
ii. Once validation has begun, it is imperative that knowledge holders are kept informed of the progress and the findings from time to time. In the memorandum of understanding [MOU] NIF signed with CSIR [Council of Scientific and Industrial Research] and ICMR [Indian Council of Medical Research], there is a provision for the innovators and traditional knowledge holders to visit the labs and understand the process of validation, characterization and value addition. This kind of interaction involving visit of scientists to the field and vice versa, of innovators to the lab helps both sides in understanding the way formal and informal systems of science and technology characterize knowledge[2]. The characterization of knowledge is also circumscribed by the constraints imposed by what I call as '4S'

[2] More than a decade and half ago, I was invited to serve on the evaluation panel of National Institute of Health, USDA and other institutions to look at the programme on Biodiversity Conservation through Drug Discovery. A Nigerian scientist working with Walter Reed Malaria Research Institute was asked during the discussion to narrate an example where a traditional healer claim that the medicine worked but in the validation process, it was found to ineffective. Maurice Iwu, Founder of Biodiversity Conservation and Development Programme in Nigeria recalled one such case in which when the scientists repeatedly went to the healer to tell him that his claim did not work, despite all the care they took, the healer got exasperated. He asked as to how did the scientists give the medicine to the patient. The scientists replied through injection. Healer said, he never gave it as an injection. He always asked the patient to take it orally. He insisted that scientists follow his method and then test. As expected, this the medicine worked. This shows that scientists sometimes might consider their methods to be superior to the ones used by traditional healers. Actually, their methods are only different and unless proved otherwise, these differences should be respected.

model [Gupta, 1995], i.e., Space, Season or Time, Sector and Social segmentation. The characterization varies a great deal across time and space and among social communities as well. Same plant is used for one purpose in one place and another purpose elsewhere. Not only this, the taboos on the use of various plants also vary. These variations in the way communities characterize resource are understandable. But, the formal taxonomies do not distinguish variability arising out of local taxonomies.

iii. Some of the dimensions, which need to be looked into for making, the eco-system more robust are: [a] the language, some linguists believe, shapes the habit of thought. Therefore, one should be careful in describing the knowledge system in the way one does[3], [b] the parameters of characterization such as the colour, slope, depth, acidity and other dimensions of soil taken into account by the local communities while classifying soil. US Department of Agriculture uses a seven fold classification which is much poorer compared to the classification used by several local communities. Scientists could pay attention to the local parameters with benefits.

iv. The tools developed by modern science can be provided to local communities to strengthen their ability to characterize their own knowledge system. A mobile phone based water quality testing device can easily help in ranking various local solutions for treatment of water. Some of these tools may actually spur more

[3] One of the most contested phrases was coined by late C.K.Prahalad as "fortune at the bottom of pyramid". He assumed that large corporations should tap into the purchasing power that poor people have and therefore these people should be treated as potential consumers. He never realized that poor people are not only consumers, they could also be providers of ideas, innovations and traditional knowledge. Thus, the term BOP distracts attention from the resources and skills in which poor people are rich. The experience of Honey Bee Network over last 20 years has demonstrated that poor people are not at the bottom of all pyramids such as the ones dealing with knowledge, values, or institutional networks. Once we characterize poor as consumers, we miss their potential as providers. This is the power language has. Amartya Sen in his paper on Description as a Choice [1981] asked as to why poor people became 'weaker section' after the sixth five year plan in India. He asked rhetorically as to how could those who had to bear the heaviest burden be called 'weaker section'. Another example is the term 'unskilled labourer'. Anybody who has slightest understanding of the variety of skills common people have would consider it a strange term. But, NREGA [National Rural Employment Guarantee Act] classifies 250 million people as almost unskilled. Doesn't this characterization symbolize something fundamentally flawed in the way we treat human potential. To me, the use of the term involves a crime against humanity.

innovations because one would know the relative efficacy of the current solutions more accurately.

v. Databases of functional, structural and cultural explanations of biodiversity-based knowledge in local language are essential to expand the interpretative capabilities of local communities. Despite billions of dollars having been spent on conferences and research and policy interventions for conservation of biodiversity, development of such databases accessible to people in textual, oral or visual media has not been a priority at national and international level.

vi. Cross-fertilization of knowledge through enabling people from one region doing research in another region is one of the ways in which the ability to characterize environment can be enhanced at community level. Such a mechanism has not been formally evolved but SRISTI is trying to pursue this as a part of Shodh Yatras. Nominees from different remote areas are invited to walk with us and are assisted by knowledgeable students or assistants to enable them to learn about local knowledge in a comparative perspective. This process may trigger and strengthen the polycentric innovation and knowledge network. Unless communities can learn from each other on their own without external mediation and enrich their ability to characterize their own as well as external resources, their capacity to imagine new possibilities for value addition or entrepreneurial exploration may not expand significantly.

5. *Adding value for building horizontal and vertical supply chains:* The reason languages evolve is to articulate multiple meanings [some intersecting partially or completely and others non-overlapping], which help in expanding the scope for imagination. It is such an imagination or even speculation, which triggers experimentation in some cases. If meanings could not be expanded, then new possibilities would be difficult to conceive. If a language has a word for flying object, *viman,* thousands of years ago, it has created a possibility to conceive a flying object. But, if such an object does not get developed, then it was not because language lacked the capability to conceive or speculate but because of

other institutional or cultural reasons. Value addition in local or external resources is important for improving efficiency of resource use, conservation, augmentation and dissemination of service or products to others. Formal R&D institutions perform this function within their mandates and try to expand the potential for value addition in different sectors to meet various social and industrial needs. This R&D process is not restricted to public or private sector only but can also be extended to cooperatives, labour and workers unions and informal associations of farmers, pastoralists, artisans, etc. In many cases, individuals on their own through their own resources also do research or experimentation and sometimes innovations. While support system for formal sector is well developed though even that can be improved a great deal, the one for informal sector is weak and non-existent in majority of the countries. It is ironic because most societies facing one form or other of rural protest, insurgency, social unrest or violence realize that some of it can be traced to persistent poverty, unemployment and lack of public support for meeting basic needs. And yet, the indifference continues. The paradox is that this indifference, conceptually, leaves lot of space for local experimentation even if sub-optimally and devoid of opportunities for validation through blending with formal science and technology. It is this space that we have explored in the Honey Bee Network and wish to trigger new institutional designs, which can augment ability to experiment and innovate at individual and community level. The horizontal supply chains have existed from time immemorial through weekly markets in the most interior regions whether relying on barter, cash or gift economies. But, with inroads made by modern markets and other institutions, these chains have become weaker. The perception of utility of products and services provided by local experts or entrepreneurs has also changed over time due to media exposure or deliberate public policy. A bone setter who might be a better expert than an institutional medical facility might not get as much attention of the local communities in some areas as she might deserve. This may have nothing to do with her expertise. Local products in various functional domains can be developed by pooling inputs from local villages. The value added products can be packaged for *short distance and short period* consumption. Such a strategy will strengthen local *small loop economies* and reduce carbon footprints, economise on energy consumption and reduce entropy. Some of the raw materials for vertical supply chains also are provided by the similar regions. But, devoid of any stake in the

supply chain, the people mainly perform the task of collection of raw materials as labourers. Since no *in-situ* value addition takes place, due to inflationary and other pressures, their real wage rates often go down instead of increasing. While the growth takes place in the value added sector, these regions and people therein remain at the lowest end of the value chain. Their knowledge rights are not protected and their ability to get royalty from the exploitation of these potential rights remains unexplored. Policy gaps both in horizontal and vertical supply chains are many and require systematic attention if the capabilities of local communities for sustainable resource use and improve livelihood have to be significantly augmented. The social unrest will be otherwise an inevitable consequence. The gaps in the policy for value addition in formal and informal sector are:

Formal Sector:

i. Dedicated fund for product development: Every public R&D lab should have dedicated funds for adding value to innovations and outstanding traditional knowledge practices in the informal sector. However, mere allocation of funds may not be enough. Unless the use of these funds is monitored at the highest level and becomes part of strategy reviews of the institutions, the motivation may not be strong for using these funds. The other sources of fund are always more attractive because of lesser constraint of accountability to society. The peer review and publications can easily sustain the existing R&D system.

ii. Centrally allocated funds from a national council may sometimes be more useful for adding value to orphan projects. The sanctions from such councils may assume a contractual obligation and thus may have higher accountability. The user organizations of local innovators can also be enabled to contract such research to the formal sector.

iii. The agenda setting process for the formal R&D institutions may include selection of specific unsolved problems of economically depressed regions and social segments in the relevant sector. Once such an engagement becomes a part of on going agenda and

priorities setting process, the inclusion of the problems of disadvantaged social groups or their innovation may become easier.

iv. The testing facilities in public institutions are often priced at the same rate for formal sector or informal sector[4].

v. The setting of standards for various technologies is known to influence the evolution and diffusion of innovations. However, the ability of grassroots innovators to influence the existing standards is not very high. There has to be a consultancy panel in the Institute of Standards or Bureau of Indian Standard to periodically review the standard in different sectors taking into account the innovations from informal sectors as well.[5]

vi. Distributed testing and calibrating facilities have to be created to bring in higher degree of precision and consciousness about quality in the informal sector. In the case of herbal product, facilities for testing microbial load would help in drawing attention to the need for sanitation and quarantine mechanisms. Similarly, the surface quality affected by welding process and its role in affecting the efficiency of throughput will bring about greater awareness about different kinds of welding and plasma technologies. A similar effort

[4] When GIAN (Grassroots Innovation Augmentation Network) had to get a tractor developed by a grassroots innovator, Bhanjibhai tested at a central facility recognized by Ministry of Agriculture for the purpose, the fees asked and paid was same that would have been required from a multi national company. Similarly, when Protection of Plant Variety and Farmers' Rights Authority accepts applications for registration of variety developed by farmers, it insists on similar treatment except when such varieties are accepted as extant varieties. There are no funds earmarked for paying the fees for such purposes from unorganized sector. This is a major lacuna in the current public policy perhaps around the world.

[5] An innovation developed by Birendra Kumar Sinha for pollution control [sound as well as carbon emission] will not succeed unless the standards for emission levels for diesel engines and generators are changed. Only then, manufactures may have incentive to license the technology and incorporate it in their manufacturing system. The regulatory authorities will have to then develop appropriate norms and monitoring processes to enforce these standards. Market for such an innovation would thus emerge and expand. It may be useful to recall that when American car industry was losing out to Japanese, one of the steps that automobile engineering institute is supposed to have done was to find out in which technology American car manufactures had an advantage. Once it was realized that emission control was one such area, the standards were apparently modified and a comparative advantage for the domestic industry was achieved. Since these standards were non-discriminatory and the Japanese industry had not till then developed breakthrough in this regard, some time was gained. The standards can therefore play a very strategic role in gaining competitive and collaborative advantage.

should be made to spread awareness about new materials, particularly composites for grassroots fabrication.

vii. The modular design of products requires availability of various components in blendable formats. If some of the old people wish to have cell phones with only two or three buttons to call immediate kins, they ought to have the facility for such fabrication around the corner. The companies manufacturing cell phones may consider providing different modules for application at grassroots level such that more and more operations become smart. For instance, several innovators have developed the mobile phone based switches for irrigation pump sets or other amenities at home. At the receiving end, one does not need a full-fledged cell phone. Having a module with just a sim card and a signaling system is enough, which might cost only five or ten dollars instead of 50 dollars for a cheap phone. This will expand the market for smart remote switches for various appliances and equipments.

viii. Sensors and other embedded systems for grassroots applications: Most engineering technologies developed in the informal sector are mechanical in nature and seldom involve use of embedded systems. A farmer, for instance, while ploughing the land and sowing seeds cannot get online feedback about the depth being maintained except by experience that too at approximate level. The performance of some the seeds and therefore the productivity may depend upon constant depth in an uneven or heterogeneous soil condition. Having a depth sensor which would give immediate indication to the farmer would be very helpful to increase pressure in case of manual or hydraulic driven systems. There are large number of other applications in hydro turbines or juice or gel extractors in which feedback from the throughput can help in modifying the conditions of the input energy and torque thus affecting energy efficiency and productivity. The Industrial Training Institutes [ITIs] or polytechnics need to be restructured so as to modify the curriculum, pedagogy and the framework of cooperation

between these institutions and local fabricators, artisans and mechanics. Such an interface is more or less absent today.

ix. The packaging industry often considers consumption patterns to be guided by a distance of 1000 miles and consumption after a year. Even if much of the consumption takes place within 100 miles and before three months, the energy is consumed for much longer time and farther distance. This is avoidable wastage. Biological decomposable materials have to be developed for shorter-term consumption and shorter distance transportation. Supply chains both horizontal and vertical will start getting reorganized and also become more energy efficient [Gupta, 2009].

Informal Sector:

x. The value addition process in the informal sector is influenced considerably by access to tools, technologies, materials, testing facilities and the scale of fabrication. While there is a great need for creating facilities in the formal sector, simultaneously one has to improve peer learning potential among the grassroots innovators and traditional knowledge holders. Creation of knowledge networks through mobile phones in local language can be very helpful. Likewise, column in local newspapers and radio can facilitate such learning. Radio has not been used much for triggering dialogue among local innovators at any significant level.

xi. The sharing of facilities requires individual innovator based incubators at grassroots level. This concept was developed in the last few years and several innovators were supported by NIF for the purpose. It must be acknowledged that every innovator would wish to have independent workshop including all the machines necessary for fabrication. The concept of outsourcing, shared facilities and pooled resources is not very popular with them and yet there is no other way one can increase the capacity of maximum people in minimum time and resources.

xii. Building horizontal supply chains will require giving a new direction to the movement of self-help groups of women. Generally, most

groups do not spend even one per cent of their savings on buying products made by other groups. The real market pull from their savings is taken advantage of by large corporations. If the micro finance movement has to become entrepreneurial in nature, then value addition by groups in local knowledge and resources would become inevitable. It is important to note that despite millions meetings, papers and discussions on micro finance, there are not even dozens of papers or initiatives or policy dialogues on micro venture finance. That itself shows the depth of the problem.

6. *Financing of innovations and traditional knowledge:* Various models of financing have to be evolved for product development, market testing, demonstration, trial, user adaptation and large-scale diffusion through commercial and non-commercial channels. In the age of market dominance, it has almost become a mantra to suggest that users must pay for all the services. The paradox is that poorer one is, higher is the expectation of one's ability to bear. The concept of public good has been almost given a go-by in the rush for market driven solutions. Surely, there are technologies for which various kinds of market based solutions can indeed be generated. But, for non-monetary technologies, which may have higher sustainability impact, mobilizing financial resources has become most difficult today. The classical extension of ideas and innovations from lab to land still gets support but from land to lab to land is not something for which a lot of support exists. The system for financing innovations and outstanding traditional knowledge has to fulfill several expectations such as [a] minimal transaction costs for all involved i.e., investor, entrepreneur, mediator or interface managers and innovators or knowledge holders, [b] genuine risk taking ability so that high risk subjects or ideas do not get avoided or eliminated[6], [c] the terms and conditions at

[6] In a study during 1979-1984 involving more than 43,000 bank accounts, 644 villages of a drought prone district Mahendraghad and 43 different branches of commercial and cooperative banks, I mapped the resources or the endowments of each village and the portfolio of credit extended by the banks. It came out very clearly that without any communication any sharing of information among the branches, a clear consensus seemed to have emerged about which region to avoid for financing. It was obvious that risk averse institutions and risk averse farmers or pastoralists may not ever meet. Depending upon the respective ability to negotiate risks or having risk hedging possibility, they may meet to varying extent given the heterogeneity of endowments and asymmetry of information. The challenge is to redesign the resource delivery system for different socio-ecological contexts [Gupta, 1998].

which finance is extended should be easy to understand by the lay people, [d] there should be sufficient flexibility in designing financial support system keeping in mind the variability in socio-ecological contexts, [e] the transactions should be premised on trust rather than doubt. Just as innovators and traditional knowledge holders trust the mediators and reveal their ideas, designs, experiences, without seeking any security or guarantee, the financing system should also work on similar trust based principles[7], [f] the transparency should be maintained about all the costs incurred on behalf of the innovator,[8] [g] a healthy portfolio should also have a healthy proportion of default caused by unforeseen circumstances or market failure. Claims of 100 or 90 per cent payment have to be seen with suspicion because the background conditions of really poor people would not warrant such a high degree of repayment, [h] the cost at which investments are recovered cannot be uniform for all kinds of investment. Variability on account of sectoral, social and spatial heterogeneity must be factored in phasing the repayment and charging the cost, [I] the indirect benefits of every investment whether in terms of local capacity building or technological or social externalities should also be factored in while calculating return on investment, [j] the linkage between credit and technology may make both more viable in high risk environments, [k] public risk absorption mechanisms are necessary to unleash the entrepreneurial potential in regions which have not had much experience in dealing with external markets, financing systems and other intermediations, [l] pooling of risks may be advised by linking factor and product markets and other kinds of aggregations so that the investee feels comfortable in repaying in kind if cash

[7] When the concept of SRISTI Venture Fund was first mooted at the International Conference on Creativity and Innovation at Grassroots [ICCIG] in 1997 at IIMA, such was the expectation. The setting up of GIAN (Gujarat Grassroots Innovation Augmentation Network) in collaboration with Gujarat Government institutionalized the golden triangle for linking innovation, investment and enterprises. Subsequently, after setting up of NIF, a Micro Venture Innovation Fund [MVIF] of about a million dollar was set up in collaboration with Small Scale Industries Development Bank of India [SIDBI] in October 1993. All the investments under MVIF are made without any collateral and under single signature [see details at www.nifindia.org].

[8] There are funds, which sometime make it obligatory for the investee to buy consultancy services of a chosen consultant who is paid exorbitantly from the loan amount without any responsibility for the outcome. Similarly, enterprises are funded based on the knowledge of innovators who are denied any royalty because their knowledge is supposed to have been significantly improved upon. Such practices do not constitute a good ethical judgment and must be avoided. The lack of knowledge of innovators should not be held against them for not having been able to say no to unfair terms and conditions. The prior informed consent followed by the Honey Bee Network is obligatory in every such transaction.

transactions appear to be difficult, and [m] a concept of Technology Acquisition Fund may have to be developed to acquire the rights to improve, blend, sub-license the technology so that the attachment of the innovator to the technology does not come in the way of its improvement or diffusion. Such a fund has been set up at NIF and likely to be operationalised in the coming year.

Designing an innovation support system requires new instruments of finance, factoring and inter linkage of factor and product markets [some of these were used by informal lenders to exploit the poor people. However, a benevolent banker or risk fund manager or micro venture innovation fund can indeed use the inter linkage of market for the advantage of the innovators. The role of risk capital has been most crucial in transforming the information technology and biotechnology sectors. Absence of such funds complemented by product development fund has stifled the entrepreneurial potential of the people.

7. *Intellectual property rights and technology licensing:* Notwithstanding various ideological biases for or against IPR system, it is our suggestion that knowledge rich, economically poor people should not be denied their knowledge rights. The framework for assertion and articulation of these rights may vary from place to place and among various social communities and individuals. There should be sufficient flexibility in the formal system to recognize and respect the conventional mechanisms for protecting these rights. There is practically no community that we are aware of which does not have some norms of drawing boundary around the knowledge rights of the individuals or groups thereof. In several papers over the last two decades, various nuances of the tension between the traditional and the contemporary forms of knowledge rights have been discussed [Gupta…..]. The central argument here is that the interaction between public, private and community rights over knowledge vis-à-vis natural resources create a matrix of opportunities. One has to tailor the incentive system so that conservation and augmentation of knowledge and resources takes place in a sustainable manner. Key policy gaps are:

    i. A legally sanctified global registry of local knowledge and innovations to provide incentives to people for disclosure [Gupta,

……]. It was proposed to set up INSTAR [International Network for Sustainable Technology, Application and Registration] at WIPO level so that both the objectives of promoting people to people learning and protecting the knowledge rights could be simultaneously achieved.

ii. The right to life should obviously take precedence over right to property. The concept of Technology Commons has been developed [Sinha, 2009] so that people to people learning is not impeded and at the same time, people to firm is facilitated through licensing agreements. The idea is that a lead technology or a primary innovation becomes the anchor Technology Commons. All those who have imitated but also made improvements are encouraged to pool the specific improvements in a Technology Common around the lead technology. None of the members of the commons can license technology on their own, but as a group they can delegate the power to the lead innovator to license the entire bundle or the commons to a third party for a consideration. The rights of the lead innovator would be weighed more than that of those who made marginal improvements. Such a concept does not prevent imitative learning at community level so long as it is used for making one's livelihood possible through self-employment.

iii. A fast track system for protecting the incremental innovations based on Australian Innovation System with maximum five claims, eight to ten years protection and grant within three months at a very low cost without requiring an elaborate examination. Lesser the cost of protection, lesser is likely to be the licensing cost. This will provide opportunity to micro and small entrepreneurs to license such innovations.

iv. A community innovation system to register traditional knowledge in the name of communities so that they have incentives to disclose, learn from each other and license their knowledge to those who can add value and share the benefits from commercialization.

v. Incentives for creative public goods in the form of prioritized and subsidized access to knowledge, technologies and other institutional resources. The experience shows that majority of the people may like to share their knowledge freely without bothering about much reciprocity. The problem is that young people get dissuaded from practicing or improving such knowledge, which they have seen as kept their elders as poor. We have to find the right mix of incentives and institutional support system that nourishes the generosity of local communities without punishing them for the same.

There are several other elements required in the eco-system such as open source platforms for collaboration, low cost access to public databases from which knowledge can be retrieved in local language and in multiple formats, the specialized windows of opportunity for women and focused educational and skill building programmes to augment traditional knowledge and skills.

The public policies for education, health, infrastructure, economic development and conservation of resources have to synergise. In a segmented bureaucratic system, used to working in silos, such synergy is not easy to achieve. However, hopes cannot be pawned in the hands of prejudices. One has to keep an open mind and believe that every public system has mavericks who would turn around the opportunities for the socially disadvantaged sections of the society. Private enterprise can also be motivated to join hands with such mavericks and trigger initiatives, which expand civil society space for experimentation and innovation. One must not ignore the fact that sustainability is a double-edged sword. Every innovation makes certain practices non-sustainable. The trick is to select, screen and support such interventions and initiatives, which do not require a trade off between conservation and creativity, collaboration and compassion and consideration and constraint free dissemination of knowledge and innovations.