Knowledge Network for Augmenting Innovation Ecosystems:

Lessons from Honey Bee Network[1]

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Institutional policies for supporting creative and innovative individuals in formal and informal sectors shape the vigour and richness of the innovation ecosystem in any country. There are several indicators by which one can measure the hunger a society has for innovative solutions to various problems in different sectors and at different levels. I have argued that 'a change not monitored is a change not desired' [Gupta, 1984]. Thus, a society, which does not track the emergence, evolution, incubation and diffusion of different innovations, perhaps does not want them, and may I say, even deserve them.

In this paper, I first describe the indicators for monitoring the health and vigour of the innovation ecosystem. I identify the processes through which such a system can be galvanized to spur more innovations. The knowledge network among innovators and various stakeholders thus becomes stronger. Finally, I suggest some institutional innovations, which might help in strengthening the links between formal and informal sectors of innovations.

Part I
Indicators of innovation ecosystem health:

Senior policy makers such as ministers of science, technology and innovations or the office of the prime minister must monitor policy reforms [their speed, scale and scope] to spur the innovations in each sector. It is natural that the questions to be asked at different levels of the government and / or civil society or even corporations will not be same. However, the frequency or the interval at which different questions should be asked will depend upon how much patience a society wants to keep with a particular speed of reforms, or how much time it takes for a change to be effected to make results apparent in a given context. Certain problems require day-to-day monitoring while for others quarterly or yearly will be all right. Different indicators reveal health of different subsystems of an ecosystem. Let us look at some examples of indicators at macro-, meso- and micro-levels.

Macro-indicators:

> Has the unit cost come down in various sectors and spaces over last five years? Unfortunately, in most countries inflation is assumed as an inevitable feature of the economy and unit cost of various operations keep on increasing progressively. The top level of government should track the opposite.
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> How many ideas from the grassroots were learnt, analyzed, abstracted and scaled up in different ministries?

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How many programmes were stopped, modified or started on the basis of the feedback from the grassroots?

Meso-indicators:

Were various barriers to innovations identified for institutionalizing cost saving and effect enhancing innovations?

Whether appropriate institutional changes were brought about to support technological innovations at different levels in public and private sector?

How many patentees were approached to either in-license their innovations for improving public systems or to support their entrepreneurial ventures or to acquire their rights to make those technologies open source for MSME?

How many student teams were mobilized in different parts of the country to benchmark the energy, material, waste generation and recycling by MSME and what steps were taken to ameliorate the conditions?

Micro-indicators

How many grassroots innovators have received support from formal R&D, design and fabrication institutions?

How many products and services based on innovative efforts at grassroots level received product development and incubation support?

How many industries came forward to sign benefit-sharing agreements with the grassroots innovators and communities to scale up their ideas innovations?

How many children and technology students received support or were linked with prototyping centres for converting their ideas into products?

How many traditional knowledge-holders signed up contracts with formal R&D institutions to develop extremely affordable and safe solutions for agricultural, livestock and human problems?

How many communities were supported for *in situ* conservation of biodiversity so as to keep the local supplies of knowledge based products intact?

What steps were taken to develop protocols for sustainable extraction, processing and distribution of biodiversity based final or intermediate products?

How many trust funds were created to empower local communities to manage their knowledge systems dynamically and in a socially desirable manner?

How many women innovators got support to take their ideas forward in different sectors of the economy?

These indicators are only illustrative and obviously can be modified to suit socio-cultural needs of a society. The point to be underlined is that if these questions are not asked, then certain kinds of institutional and policy changes will not take place. The fact that number of conferences and meetings on inclusive development have increased in the recent past proves that even in OECD countries the business as usual is being questioned. Many developing countries are trying to pursue inclusive and/or harmonious development. But, the synchrony among technological, institutional and cultural factors is not being systematically pursued even in India. I have always insisted that if, *'technology is like words, institutions are like grammar, and culture is like a thesaurus'*. In most innovation ecosystems, the inter-relationship between technology, institutions and culture have not been forged synergistically. To illustrate, if innovations have to be supported and there is no voluntary network of mentors and chroniclers, then most innovators may remain unattended and unconnected with each other. Under such circumstances, institutional development is vital and Honey Bee Network provided a platform for empathetic institutions to evolve. But, availability of institutions is not enough if the culture of the people manning these institutions is not conducive to the local needs. Recently, in one of the states, this tension was brought out very vividly. We have a Grassroots Innovation Augmentation Network [GIAN] cell, which has hired staff to help the innovators. An expert was to visit the cell and thus the staff called up a young student innovator telling him about the preciousness of the time of the expert. The student replied back saying that his time was also precious. The staff got annoyed and rebuked the boy. The boy called me back asking as to what mistake did he do. He was willing to meet the expert but he didn't want that only the expert's time be treated as precious. He was right and our staff was wrong. Many times, people in the innovation supporting institutions may not realize that their jobs are generated by the innovators. They are the servants and the innovators are the masters. The culture of service and subservience towards the knowledge holders takes time to evolve and many of the Honey Bee Network institutions have such a culture in abundance. But, in others, it takes time to take root. Every country has to pay attention to the cultural issues without which the ecosystem will not become nurturant. One of the indicators we developed in GIAN in 1997 was the number of times innovators were asked to come to office. The philosophy was that service should be provided at the doorstep of the innovator. And yet, time and again exceptions were made. Unless we track such practices, the attitude will change, the relationship will reverse and the masters may not be treated as masters.

Part II
Processes for strengthening the innovation ecosystem

The future of any society will not be safe if children do not acquire the value of compassion, collaboration and co-creation. Unless children become impatient with the problems, the inertia will be inevitable. The experience of IGNITE competitions organized by National Innovation Foundation [NIF] over the last few years demonstrates that children are far less patient with the social problems than has been the case with our generation. This is a very reassuring indicator for any society. The pity is that most countries have similarly creative children but recognition to them by the former or the present head of the state is not often institutionalized. Their creativity does not become the centrepiece of social consciousness. How do we make children's ideas the fundamental building block of the country's innovation ecosystem?

Igniting the minds of children: Most textbooks in school make no reference to any creative idea by common people or children in our country. Situation may not be very different in

other countries. Fortunately, India is seriously thinking about providing a scholarship to a thousand children based on their imagination and creativity. There are lifelong scholarships for outstanding scholastic performance in science and technology. But, similar support was not available for being creative. The youngest child awarded by NIF was class one viz., Chris Ananth [http://nif.org.in/awards/search-award-list_radio.php]. Six years ago, I was invited by Ministry of Science, Technology and Innovations, Malaysia [MOSTI] to help in structuring a National Innovation Fund. During the discussion, an issue came up about seeking ideas from different levels of society. I said why don't we do an experiment and go to a nearby school and test the idea whether children are truly creative or not. At a short notice, we went to a residential school in Shah E Alam. After presenting the challenge, students were asked to invent solutions to different problems, first alone and then in groups. Some of the ideas, which came out were so much ahead of time that nobody could doubt the innate creativity of the children. Question then is why don't we harness the creativity of children in every school and provide them recognition and rewards for their ideas. In China, a very strong counterpart of Honey Bee Network exists in the form of CHIN [China Innovation Network] at Tianjin University of Finance and Economics [TUFE]. A large number of students' ideas have been pooled together in a database having more than 3000 innovations by children and common people. Some among these children have suggested solutions to the problems that we all faced in our life. I wish the lessons based on some of the ideas will become part of the curriculum.

Five years ago, we had a summer Shodhyatra [every six months, we walk in different parts of the country to learn from within, each other, nature as well as common people] in Uttarpradesh starting from my village, Gangagargh in district Bulandshahr till Daula, the village of water harvesting champion Rajender Singh in Baghpat. A journalist from BBC who runs a very popular column, The Business Today, viz., Peter Dey was walking with us to understand the nuances of the way we discovered and recognized the innovation. His wife, Rommie Dey was a teacher in a primary school outside of London. She noticed that in every village, we asserted a possibility of everyone being a potential inventor or innovator. She challenged me to speak to her class of tiny tots through a video recording and then she would see whether my assertions are valid or not. I talked to her class for ten minutes. She played the video after going back. Few months later, when I was in London, five kids of different nationalities came to present me 'A book of inventions for Prof. Gupta'. I was overwhelmed by the power of their imagination and the diversity of their ideas. If a proof was needed, it was available now that it is not an individual or an institution, which had a magic of uncovering innovations. Anyone could do that, anywhere so long as the Honey Bee spirit of cross-pollination, giving creativity its due and if possible sharing benefits with the people was followed. A kind of inverted model of innovations has emerged. Children invent, engineers fabricate, and companies commercialize.

When former President of India, Dr.A.P.J.Abdul Kalam honours the children on November 10 at IIMA, he would be reinforcing the importance our nation attaches to the creativity of school children. Ideally, we should be able to spot such children even when they are out of school. Eventually, we might reach such kids too.

Engaging technology youth for solving social problems and augmenting grassroots innovations: The next level of creativity that needs to be harnessed is that of college students. Society for Research and Initiatives for Technologies and Institutions [SRISTI], a voluntary organization set up to support Honey Bee Network in 1993 has organized a platform viz., techpedia.in. It already has summaries of 100,000 projects pursued by 350,000

students from over 500 colleges and institutions. This year, Dr.R.A.Mashelkar, Chairperson, NIF and a mentor of techpedia.in gave Gandhian Young Technological Innovation awards in the month of May 2012. These awards can be seen at http://www.techpedia.in/award/. Many of these ideas have the potential to change the industries standards and help in conserving energy, reduce drudgery and improve efficiency. There are more than a million students in our country and theoretically every student is capable of being an innovator. During the last year, many of the student teams from Gujarat Technical University mapped the problems of MSME during summer. The University gave them credit not only for identifying the problem but also for trying to solve the same. Hundreds of solutions were developed by the student teams in close cooperation with their faculty and MSME entrepreneurs. Many of the entrepreneurs gave them recognition for their contribution. Every country has this huge untapped potential of young technology students, which unfortunately has remained unexplored for such a long time. The educationists around the world must question this inertia urgently. A technology platform of this kind can address several other challenges: [a] encourage collaborative learning among the students from different colleges and cities, [b] an idea developed to some extent at one place or institution can be taken up for further value addition elsewhere in the form of what we call as *kho-kho model* or *relay approach* to problem solving, [c] the current levels of energy, material and waste management in different MSME units can be benchmarked and eventually improved, [d] the unsolved social problems can be put on the agenda of the students for their resolution as final year project and [e] the grassroots innovation and outstanding traditional knowledge practices can be taken up for validation and value addition and possible entrepreneurial development.

Involving individual inventors for strengthening inclusive development: During 1998-2008, I went through about 6000 patents by individuals in Indian Patent database and identified 250 meaningful inventions. These inventors were invited at IIMA in four Inventors of India conference and possibilities of linking formal and informal sectors of innovations were explored. The Centre for Innovation, Incubation and Entrepreneurship [CIIE] at IIMA in fact was set up as a follow up of the first Inventors of India workshop with the help of Gujarat Government and a small support from NIF. The idea was that mass impact and high tech innovations will be targeted. However, over a period of time this focus has been lost though general entrepreneurial activities have been taken up to a large extent. There is a need for developing more focused incubators but not aimed at only *ex-situ* incubation but also *in-situ* incubation. The *ex-situ* implies the innovator has to reside in the incubator whereas *in-situ* refers to the situations in which mentoring support is provided in a distributed manner to the innovators wherever they live. NIF has followed an *in-situ* incubation model. It is costlier, distributed and involves much more coordination and monitoring costs. But, in emerging economies where many professionals and other individuals cannot delink from their family responsibilities, there is no escape from *in-situ* incubation. This is the reason why all incubators put together in India may not have more than 500 incubatees. Whereas if *in-situ* incubation model was followed, the inclusion of thousands of more innovators could have been achieved. The individual inventors even from professional background can indeed contribute to mentoring the grassroots innovators. A creative person from organized sector can perhaps empathise better with another creative person from informal sector. One of the key disappointing findings of the survey of individual inventors was that none of them had ever been approached by any angel fund or pre angel fund managers. The plight of individual inventors in the organized sector was only a shade lesser than the plight of individuals in the informal sector. Because of NIF, the informal sector innovators are entitled to receive all support but the scale is still constrained by resources.

Golden triangle for rewarding creativity: Linking innovation, investment and enterprise: It is well known that it is generally not possible that an innovator may also have sufficient investment funds and relevant entrepreneurial skills and orientation. Thus, one has to reduce *ex-ante* and *ex-post* transaction costs of linking innovators, entrepreneurs and investors. The three actors need not be at one place and could be across the world. Thus, an entrepreneur from say, Canada or Denmark could pick up an innovation from India and set up an enterprise in China or South Africa. This potential of distributed knowledge management globally can be harnessed for supporting innovators.

Linking formal and informal science and technology: One of the basic objectives of Honey Bee Network and SRISTI was to forge this linkage to improve the productivity and sustainability of grassroots innovations. NIF has succeeded in forging such linkages on a very extensive scale. Apart from the MOU it has with Indian Council of Medical Research [ICMR] and Council of Scientific and Industrial Research [CSIR], NIF has worked with more than 180 public, private and civil society sectors R&D labs. Several hundred research projects have been pursued to add value to people's knowledge. More than ten years ago, SRISTI set up a natural product lab viz. Sadbhav SRISTI Sanshodhan dedicated completely to operationalize the linkage between formal and informal science and technology. It is strange but paradoxically true that it is the only lab dedicated completely to add value to people's knowledge when there should actually be thousands of such labs around the world if not more. Every country should have dedicated labs preferably in partnership with civil society organisations and actors to bring grounded passion and most sophisticated scientific knowledge together. One needs at least six steps to build this linkage: [a] public and private sector R&D labs must have at least ten per cent dedicated resources for adding value to people's knowledge from the informal sector and include the research findings in their annual report, [b] every public sector educational and research institutions should offer at least 50 postgraduate scholarships each to young scholars to work on this linkage in different farm and non-farm sectors, [c] distributed and decentralized R&D facilities must be created in 50 most impoverished regions in every country to ensure *in-situ* value addition and thus improvement in livelihood conditions,[3] [d] every lab should report number of experiments started, stopped or modified due to the feedback from local communities, [e] IPRs of the local communities and creative individuals must be protected. While scientists may become co-authors or co-inventors in the patent application, the benefits ideally must flow entirely to the innovators with some overhead charges deducted for the lab. Where co-authorship is not possible, the genesis of the idea and provision of the lead should be mentioned by name in the text of the paper acknowledging and attributing the credit for the lead appropriately. If any benefits emerge on account of commercialization, a reasonable share must go back to the people and [f] the reciprocity of formal sector towards informal sector should be well defined such that findings of the research are shared with the people from time to time in local language and proper references are given in the subsequent citations. The capability of the local communities to understand and assimilate the results should be increased. Validation must involve the local protocol evolved by the community as one of the necessary treatments. The community should be invited to visit the lab and explore the possibilities of using the formal R&D system for pursuing their imagination and ideas.

[3]The gravity of the matter can be imagined from the fact that almost no value addition takes place *in-situ* in forest and tribal regions and some of the desert area where majority of the poor people live. Almost entire raw material is sent out for value addition outside. Local communities just work as labourers and are not assured of even minimum wages as a labourer. Unless local value addition takes place, the larger part of the value gain will not stay in the region and people will remain perpetually poor. It is not surprising at all that most insurgent and violent social movements take place in these regions treated often as internal colonies.

There could be many other ways in which these linkages could be strengthened but the six points mentioned here provide the minimal frame of reference.

Making formal open innovation platforms reciprocal and respectful of informal sector: Large number of private sector companies around the world have initiated so-called open innovation platform to source ideas from the crowd/masses. In most of the cases, neither acknowledgement is made in any follow up R&D or product development activities; the question of attribution in publications or patents almost never arises. In some cases, the idea providers are paid some money but in almost in no case, they are given access to internally generated knowledge and/or institutional facilities to pursue their own ideas. The openness, therefore, unlike the Honey Bee Network is only limited by the willingness of the corporate sector to absorb but not actually share. So, corporations are open to receive but not open to collaborate or reciprocate. It is desirable to bring greater mutuality between corporations and unorganized sector for mutual benefit. The corporations will learn the frugal, flexible and friendly ways of fabrication and design while the local communities will benefit by achieving access larger markets and therefore get benefits for improving their environment and economic conditions.

Distributed product development and incubation funds: Thanks to the responsiveness of the 13th Finance Commission, every district of the country has Rs. One crore [USD 200,000] for supporting innovations in public systems and by common people. The fund was created based on a paper contributed by Honey Bee Network. There is a need in every country to have decentralized funds having seven key purposes: the fund should support product development, testing, calibration, value addition, design, fabrication and commercialization. Unfortunately, most countries do not recognize the community level absence of access to such risk funds. It is strange but true that the world has thousands of conferences and windows of opportunity on micro finance. But it does not have any major initiative on micro venture finance. As a follow up of the International Conference on Creativity and Innovation At Grassroots, at IIMA, 1997, the first risk fund in the form of Grassroots Innovation Augmentation Network [GIAN] was created with the help of Gujarat government. Subsequently, NIF created a Micro Venture Innovation Fund with the help of SIDBI [Small scale Industries Development Bank of India] in 2003 to provide financial support to innovators under single signature and without any collateral security or co-applicant. Most people paid back the loan. The question is how long can society ignore the need for such important link in the innovation eco system. If risk capital is critical for information and biotechnology, why wouldn't it be relevant for grassroots technological and institutional innovations?

In some of the countries the inclusive innovation funds are being designed to invest in companies, disregarding six of the seven attributes mentioned above. It is natural that such funds will fail to address the needs of such individual inventors who have not yet achieved either the robust proof of concept or proof of the market and may have just made a preliminary prototype as a part of their under graduate or postgraduate course requirement or as an individual backyard R&D. Such are the majority of the individual inventors from the professional sector and of course, not to mention the unorganized sector who will remain excluded. Where then would be the inclusion? The models of funding that might work for IT start-ups will not often work for hard manufacturing or service technologies. The cost of testing, calibration, certification, etc., are also often not discriminated for an innovation based startup vis-à-vis a normal corporate client. In many cases, an MSME is not subsidized

compared to other big companies. A whole range of fiscal, taxation and other policies need to be reviewed to make policy and institutional environment more inclusive for innovation based enterprises.

Nurturing social innovations: Conventionally even the social enterprises have been expected to recover their costs from the clients disregarding their ability to bear it in the short or medium term. To suggest that clients unable to bear the costs should only be served by public services is to eliminate entrepreneurial inter-mediation. The consequences of such absence have been significant exclusion of the needy people. Therefore, entrepreneurial mediation is necessary provided specific financial instruments and mechanisms are developed to cross subsidize such social ventures in various fields including education, common property resource development, long term rehabilitation of degraded or damaged natural resources, etc. Similarly, many social change agents try to fill the gap in meeting demands of the needy people and suffer from financial support. Innovations in social sector also need to be supported through social venture funds. There are not many such funds at international, national and regional level.

Embedding inclusion in educational and cultural systems: There are hardly any lessons in the college or school textbooks, which deal with inclusive, self-triggered and self-inspired innovations. Unless younger generation is exposed to such innovations at an early stage, they may often not be inspired to take voluntary initiatives when they grow up. IGNITE programme by NIF as explained earlier, makes an effort to harness innovation by children as well and SRISTI's techpedia.in does the same with technology youth. In addition to harnessing their ideas, proposal here is to expose them to the innovative ideas of others from within and across the emerging economies. Too much western bias may weaken the self-reliant resolve of the younger generation. This is particularly so when so many examples of grassroots innovations are available to refer. The cultural institutions including popular media like film and music can be very effective in this regard. The producer, Mr. Chopra and the director, Mr.Raju Hirani who made one of the biggest blockbuster films viz., Three Idiots had discussed the plot of the story at great length to pick up grassroots innovations for effective depiction in the film. Two of the innovations, which were remembered by most viewers included a two wheeler scooter-mounted flour grinding mill and a cycle-based sheep shearing device by Sheikh Jahangir, Jalgaon, Maharashtra and Mohammed Idris, Meerut, Uttarpradesh. The first one served those who were extremely poor economically and therefore had to buy their daily requirement of grain every day. Since main flour mills would not grind small quantities, the consumers had to buy flour itself and thus lose margin. A service provider with such a mill could go from door to door and provide service to poor people. The innovator had a shack on the roadside when he made this innovation. Stories of this kind will inspire the viewers and might do a great good in creating awareness about inclusive innovation. There should be special efforts made in every country to persuade the leaders of popular media to include examples of grassroots innovations in their communication efforts. The public broadcasting corporations have not shown a systematic approach to pursue such a mission. The private media managers should also be motivated for the purpose. Special awards can be instituted for best incorporation of the theme of inclusive innovation and UNESCO can take lead in collaboration with Honey Bee Network. Multimedia-multi language databases are essential for overcoming three barriers to learning i.e., literacy, language and localism. While the first such database was presented by Honey Bee Network at first Global Knowledge Conference, Toronto in 1997, it remains the only one of its kind. We must ask ourselves as to why such basic tools for inclusion should not be used more widely. This is another area where UNESCO can play a very active role.

Summing up:

I have outlined the broad contours of an inclusive ecosystem for promoting innovations that serve the disadvantaged sections of society and often arise from among them. The changes required at technological, institutional, cultural and educational level will improve the access, assurance, ability, and attitudes of the managers as well as consumers of various services and products. There are always risks and uncertainties involve in any socio-economic transformation. The availability of risk absorbing or mitigating mechanisms is necessary. With climate change, the frequency, intensity and distribution of such risks might increase. The role of traditional knowledge as well as contemporary grassroots innovations in mitigating the adverse impact of these risks will become even more important. There is a need for a major global initiative to document, share, validate and value add the community perceptions and creative responses to various climate-induced and other risks. The innovation ecosystem has to recognize that the capacity to absorb risks is obviously uneven in society and therefore proper insurance and assurance mechanisms have to be generated in every policy dealing with inclusive development. The specific contribution that multimedia-multi language databases can make is to trigger cross cultural validation and dissemination of creative coping strategies across the world. The example of comparative database of GRI [Grassroots innovations] among India, China and Malaysia besides some other countries of Africa triggered by SRISTI and Honey Bee Network has demonstrated the potential for such cross cultural learning. When two civilizational societies like India and China struggle with similar problems and sometimes develop similar or dissimilar solutions, then sharing such solutions can help in overcoming civilizational inertia and improve the quality of life of the people.

It is not enough to have policies and supporting institutions in place. Appropriate indicators for monitoring the degree of inclusion being achieved have also to be developed and used. Several illustrative indicators given here will hopefully trigger discussion about the measures one can take to develop both general and context-specific indicators at different levels and of different complexity. It is not enough for the policy makers to use such indicators. The communities should also be empowered to develop and use indicators of inclusive innovation augmentation ecosystem so that they can monitor the performance of policy makers as well as academic and other communities. The accountability of various actors to each other is essential for any innovation eco system to harness creative tensions for common good. Way back in 1985-86, a question asked in Bangladesh still remains to be institutionalized in most parts of the world. We cannot find a global database at CGIAR [Consultative Group of International Agricultural Research] or FAO or even UNESCO to indicate how many initiatives / technologies / R&D programmes were stopped, started or modified based on the feedback and triggers provided by creative communities and individuals. Discussion on such indicators and collection of systematic data will make us more accountable. It is a matter of great satisfaction that Malaysian Ministry of Science, Technology and Innovation has adopted the concept of Shodhyatra [learning and exploration walks] so enthusiastically. When we walk in summer in the hot regions and in winter in the cold regions, we not only undergo voluntary suffering but also create a new idiom of collaborative and empathetic learning. Honouring grassroots innovators at their doorstep and sharing earlier knowledge with them and other community members strengthens the innovation ecosystem at the most basic community level. Sustainable inclusive development will be achieved if interventions at different levels and in different sectors reinforce each other reducing the transaction costs of disadvantaged social groups. The exclusion does not merely increase the social alienation

but also decreases the mutuality and dignity in the development process. The social violence is only one consequence. The alienation of younger generation can impose unimaginably high cost in terms of dealing with lack of social trust and mutual accountability.

Many of the initiatives taken by Honey Bee Network have been institutionalized in India and some other countries but many more remain to be taken. It does not matter what label is used by different countries. What is important is to remember that the ethical principles underlying the Honey Bee Network and articulated much before CBD, WTO and other international agreements took place, will remain valid. Cross fertilization of ideas, overcoming anonymity and acknowledging and attributing the creative communities and individuals by the formal sector, and sharing of value added knowledge and benefits accruing therefrom in a fair and just manner are a *sine-qua-non* of an inclusive innovation ecosystem. I argued way back in 1984 in a paper on 'Why poor don't cooperate?' that "a change not monitored is a change not desired". I have elaborated in this paper, why.