

COLLOQUIUM

includes debate by practitioners and academicians on a contemporary topic

Grassroots Innovations for Inclusive Development: Need for a Paradigmatic Shift

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INTRODUCTION

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KEY WORDS

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China

Twenty-five years ago, when several of my students, teachers, fellow travellers, farmers, artisans, professionals, and policy makers got together to trigger a new social movement in the form of the Honey Bee Network, we were not sure how the world would respond to the aspirations of the creative, knowledge-rich, economically poor people. What we knew was that unless the development process built upon a resource in which poor were rich, we could never achieve a dignified, fair, reciprocal, and emancipating environment. It soon became clear to us that a whole range of policy, institutional, and social innovations will be needed to give traction to the creative communities and individuals. But how policy makers within and outside the country would respond, was not clear, given the fact that there was no template for such a change in National Innovation Systems around the world. Here was a home grown model which, as some of the contributions show in this colloquium, was making impact around the world.

Some of the key principles were: Cross-pollination of ideas by building lateral linkages among the people; sharing with knowledge providers not only what we did with the knowledge they provided but also a fair share of benefits that would accrue from the commercial or other applications of their ideas, and acknowledging their contributions to the policy and institutional discourse by not letting them remain anonymous.

Several policy and institutional impacts have followed: When the first *International Conference on Creativity and Innovation at Grassroots (ICCIg)* was organized in 1997, the

It soon became clear to us that a whole range of policy, institutional, and social innovations will be needed to give traction to the creative communities and individuals.

Gujarat Government came forward to set up the Grassroots Innovation Augmentation Network (GIAN) in collaboration with IIMA and the Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI). It shared the best incubator award from the President within a few years along with IIT Madras. In 2000, the National Innovation Foundation (NIF) was set up under the leadership of Dr R A Mashelkar, the then Director General of CSIR and Chair of Global Research Alliance after the announcement by the then Finance Minister in the Parliament in 1999. NIF became a grant-in-aid institute of the Department of Science and Technology in 2010-11. Given the emerging interest in innovation at IIMA, four workshops on Inventors of India were organized

at the Institute, bringing grassroots innovators as well as individual professional inventors and innovators together.

After considering about 6,000 patents granted and applied for during 1998-2008, around 250 creative people were invited and the first such workshop led to the setting up of the Centre for Innovation, Incubation and Entrepreneurship (CIIE) at IIMA with the initial grants from NIF and the Gujarat Government. The idea was to focus on mass impact and high-tech innovations. The social capital created by research on grassroots innovation came in handy to persuade the Gujarat Government to consider supporting the Centre at IIMA. But somewhere along the way, the focus seems to have got diluted. After all, one should learn to fail too sometimes.

The creation of a Micro Venture Innovation Fund (MVIF) in 2003 with the help of SIDBI triggered a major departure in the history of risk-funding of grassroots innovations. By funding innovators all over

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the country under single signature agreement without any collateral, a new model of distributed *in situ* incubation was established. More than 70 percent of the investment due was paid back by the innovator-cum-entrepreneurs. What was started experimentally in 1997 through GIAN became a part of the larger national experiment.

Several other experiments followed after this which Vipin explains in his contribution here such as the Grassroots Technological Innovation Acquisition Fund (GTIAF) to acquire the rights of IP protected innovations to make them public goods such that these are available to small enterprises at no or very low cost. By reducing the transaction costs of such small enterprises to acquire innovative technologies, their competitiveness is improved and thus also the prospect for generating jobs. The innovators get compensated in advance even before social or commercial markets for such technologies emerge or are created.

Similarly, the concept of Technology Commons evolved based on the need to bundle lead technological innovations and their derivative innovations so that people-to-people learning, imitation, and replication would not only be tolerated but even encouraged. However, technology commons ensure that sharing of this bundle with firms is mediated only through licensing.¹

Ecosystem for Inclusive Innovation

With the diffusion of the Honey Bee Network and its philosophy around the world, several models have emerged in different countries to stimulate learning among creative communities

as well as between the formal and informal sectors. The

¹ Sinha, Riya (2008). The silent innovators, *One India, One People*, July, 15-17.

terms at which these exchanges take place in technological, educational, cultural or institutional space vary across countries and sectors. But it is evident that the range of creative expressions of common people in different domains offers a huge opportunity for overcoming asymmetries in access of disadvantaged communities to the various tools and skills of improving productivity, increasing social impact, and inclusion.

Inclusion may take place at five levels:

Regions or spaces which have been bypassed may get served by the innovation. Or the people within a given region looking for solutions to their problems find the developed innovative solution more accessible, thus leading to greater social satisfaction.

People who were excluded due to ineligibility, inability to afford, lack of awareness or capacity or appropriate skills are provided access to an extremely affordable and effective innovative solution by other innovators, a third party, the market or state agencies.

Environmental conditions in which the access to certain social needs get adversely affected because of drought or floods or other natural or human-made factors, can be tackled with the help of the new solutions that make it possible for the needs of the community to be met (say through amphibious vehicles or easier load carrying devices in mountains, or other institutional innovations, e.g. a boat carrying a teacher in the learning boat alongside a living boat carrying parents of children going for off-shore fishing in the sea).

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how educational quality has been improved through institutional innovations by primary school teachers in different parts of the country. Diffusion of these innovations can either trigger similar solutions by other teachers or stimulate different innovations aiming at similar improvements in the sector's performance. Liyan provides examples of how local institutions play a crucial role in China to improve sectoral performance.

Skills which are eroding fast due to lower demand, lower productivity, increasing hazards, a combination of these or other reasons could be revived

by innovations which help to overcome these challenges. A tree climber can make the task more remunerative, safer, and productive, thus bringing more skilled people into the workforce.

Emerging Challenges and Opportunities

The submissions included here point to various challenges which need to be addressed through policy or institutional innovations. Hoppers raises certain fundamental issues about the potential for social transformation in post-colonial South Africa. She discusses the relevance of the Indian experience in dealing with not only the assertion of the intellectual property rights of the local people but also in creating institutions which empower local creative communities. She feels that while the political system has changed, the institutional transformation to empower local communities is yet to take place adequately.

Wei feels that inventors associations have played an important role in China in promoting grassroots innovations apart from the state agencies, universities like Tianjin University of Finance and Economics (TUF), and the media. He suggests that the initiatives in India act as role model for incorporating grassroots innovation as an integral part of the National Innovation System in China too.

Liyan elaborates excellent progress made at TUFE in highlighting the contribution of grassroots innovations in China. Outside of India, China has the strongest presence of the Honey Bee Network, largely due to the contribution of Liyan and her colleagues and students. She shares examples where grassroots innovation (GRI) expanded the developmental potential of the formal sector, brought the government and the creative communities closer, and led to a harmonious development in China. She and her team have mobilized more than 6,000 grassroots innovations in China, many of which are patented and commercialized. The organization of several conferences in China, the latest being the ICCIG in collaboration with IIMA in December, 2012, brought many grassroots innovators from India and China together. The Chinese innovators also attended the innovation exhibition at *Rashtrapati Bhavan* this year and presented the innovation of a stair-climbing wheel chair to the Honey Bee Network. The last 15 issues of the Honey Bee Newsletter have carried examples of Chinese innovations, bringing knowledge and innovation systems of the two countries together and spreading the message of collaborative learning worldwide.

It is worthwhile to mention that India is perhaps the only country where the head of the state, the President of India, hosts an exhibition of innovations by common people at the President's house. Undoubtedly, this motivates the local creative people in a manner that cannot be achieved by any other approach. The President also honours grassroots innovators in the biennial award functions organized by the National Innovation Foundation. Former President Dr A P J Abdul Kalam honours creative children under the Ignite competition at IIMA every year in a function organized by NIF. This year, the exhibition of children's innovations will be on November 19, 2013

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Vipin brings out the story of the recent transformations at NIF, vividly highlighting how thousands of ideas, innovations, and traditional knowledge examples have been pooled through the volunteers of the Honey Bee Network from all over the country, creating an unprecedented global benchmark. He also shows diffusion of these innovations widely through open source as well as IP protected routes. It is quite apparent that the next challenge lies in scaling up innovations much more widely. But underlying his case is also a concern for the long tail of innovations. One cannot make scale the enemy of sustainability. Thus, niche specific localized development

and diffusion of innovations are no less important for inclusive or harmonious development. He also highlights how local knowledge is leading to breakthroughs in scientific and technological fields. The example of development of anti-corrosive property of graphene derived from a natural resource used by a tribal community with the help of a large company and a leading national laboratory has opened immense opportunities for many more derivative innovations. This will lead to sharing of benefits with the tribal community in Western and Central India.

Marianne makes an important case for companies which are opening up to learn from ideas from outside. Exchanges with providers of ideas and innovations need to become less asymmetrical and more reciprocal, respectful and sustainable. She argues that the search for frugal solutions has indeed caused the formal sector to recognize, utilize and support the commercial diffusion of grassroots innovations. Empowerment of innovators in the informal sector and adequate reciprocity is yet to manifest. She reviews various corporate approaches to inno-

vation such as open innovation, swarm creativity, user-driven and networked innovation or empathetic innovation systems. While the Honey Bee Network was one of the first open innovation platforms bringing formal and informal sector together, it is stressed that companies have not yet fully assimilated the culture of creating proper mutuality towards actors in the informal sector. Vijaya has presented a very interesting and optimistic overview of innovations in a critical sector, that is, school education. After reviewing the challenges of making the primary education system more inclusive and efficient, he emphasizes on the need for teacher-driven innovations. Many of these not only break new ground in making education more joyful and effective but also lead to many institutional changes in the working practices. The creation of an innovation cell in every District Institute of Education and Training is itself an institutional innovation which is likely to make scouting and diffusion of innovations by teachers at grassroots much more effective. Among a few examples presented, he highlights how providing a take-home library in a box creates new learning opportunities not just for children but also their families. Likewise, making a public example of the children, who attend classes regularly and also make significant improvement in their learning performance, helps in creating new role models for influencing children through peer learning.

It is true that incorporation of grassroots innovations in the school curriculum is still lacking at the state and central levels. It is also true that wider social awareness about the tremendous pervasiveness of grassroots innovations is still inadequate despite *shodhyatras* involving thousands of kilometers of walk through villages and cities. There is still huge scope for more engagement between companies and creative communities. One can count many other inadequacies of the grassroots innovation movement. However, the increasing interest of professional students of higher education in augmenting the options of grassroots innovators gives us a new hope. That the appeal is much more intense among larger mul-

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tinational companies such as GE, DMS, R&B, French railway (SCNF) etc., than the national companies, is a redeeming sign. When the Indian companies see the European society learn from grassroots innovators, they may take cue and start paying more empathetic attention.

Resource allocation in the central budget for the purpose is still inadequate but the situation is likely to change. Emergence of a portal of technology projects by undergraduate and post-graduate students developed by SRISTI as www.techpedia.in provides a new opportunity of linking problems of the informal sector and small industries with the agenda of technology institutions. The Gujarat

Technological University has created an excellent example of forging such linkages with the help of the SRISTI techpedia.in team. Karnataka has also taken lead in launching the platform at the state level, and now gradually, many other states are realizing the need to engage with youth.

Unfortunately, the National Innovation Council has not yet realized the need for doing the same and supporting start-ups by young people with its so-called inclusive innovation fund. But that will also change. Kerala has decided to allocate one percent of the state budget for supporting start-up

enterprises by young entrepreneurs. Karnataka has decided to set up innovation clubs in every college. The President of India, Shri Pranab Mukherjee, has decided to launch National Innovation Clubs in each of the Central Universities during his visits. These clubs will *search, spread, sense (unmet needs of the society), and celebrate* innovations at the grassroots level. He will also inaugurate innovation exhibitions during these visits. Inclusive development is not possible without bringing in the ideas of children, youth, and informal sector in the development process. India has made a beginning by painting a very large innovation canvas. Hopefully, much greater interest and involvement of academia, industry, local institutions, and educational channels will help develop a more creative, collaborative, and compassionate society worldwide. ♡

Grassroots Innovations for Sustainable Development

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Within the scope of the definition of sustainable development, the 1987 report of the World Commission on Environment and Development – Our Common Future² talks about the essential needs of the world's poor. Though not explicitly mentioned, presumably the poor being mentioned were economically poor and the needs being economic or materialistic. Many discussions, debates, reports, papers, and books have since talked about the economics of the poor, totally missing the attributes, so-called economically poor may be rich in. The Honey Bee Network³ (HBN), started in 1988, coincidentally a year after the release of the above report, set out to explore the creative faculty of the people at the grassroots. During this process, the HBN also tried to understand whether needs were related only to consumption or also to expression. Whether or not a different paradigm for inclusion and sustainable development emerged was another consideration.

Most of the grassroots innovators and traditional knowledge holders reduced entropy by utilizing the limited resources available in creative ways, restraining consumption, reusing components, and thereby reducing waste. They may address the needs of the affluent sometimes but mostly meet the needs of those who cannot afford most of the available solutions for the purpose.

Working closely with grassroots innovators, traditional knowledge holders, and local communities, the HBN tried to identify whether sustainability was embedded in the

development of an innovation, its use, disposal or in a combination of stages of the value chain or its domains of application. Grassroots innovations have been adding value and creating new demand or meeting existing demand in a more cost-effective manner. It has been observed that most of the grassroots innovators and traditional knowledge holders reduced entropy by utilizing the limited resources available in creative ways, restraining consumption, reusing components, and thereby reducing waste. They may address the needs of the affluent sometimes but mostly meet the needs of those who cannot afford most of the available solutions for the purpose. As a result, the majority of solutions developed by them are frugal and sustainable in a local context. Within a community, much of the local wisdom gets accumulated over a period of time

through experimentation during adverse conditions. Often, the survival of individuals alone or as a member of a community hinges crucially on the knowledge generated during difficult times, under great stress (Gupta, 1988)⁴. Many a times, with proper scientific validation and inputs, such local knowledge can expand the domain of application of an existing product, process or technology. An example to illustrate this is the traditional use of a natural material to make clay non-stick pans. A detailed scientific study recently revealed that this natural material is capable of enhancing the anti-corrosive properties of a particular metallic alloy. The HBN has documented

² World Commission on Environment and Development. "Our Common Future, Chapter 2: Towards Sustainable Development". Accessed on August 30, 2013 through <http://www.un-documents.net/ocf-02.htm>

³ In order to remove inadequacies in knowledge generation and consumption, Honey Bee Network (HBN) was founded in the year 1988 by like-minded individuals signifying philosophy of discourse that is fair, authentic and accountable. A honey bee pollinates flowers and takes away the nectar of flowers without impoverishing them. It does an important function of cross-pollination; similarly, the network strives to promote people-to-people linkage so that learning takes place. Green grassroots innovators and traditional knowledge holders have the right to know the developments if any, in valorising or processing their knowledge when accessed by outsiders. The Network seeks Prior Informed Consent from them to ensure its accountability towards knowledge providers. This acknowledges their contribution, inculcates pride and builds trust. A reasonable share of benefits has to go back to providers of knowledge, just as bees don't keep all the honey for themselves.

⁴ <http://www.sristi.org/anilg/papers/socio.Ecological.pdf>

tens of thousands of similar examples where existing resources are used to develop replicable solutions, which are effective and environment-friendly and in some cases extend the frontiers of science and technology.


The National Innovation Foundation – India (NIF)⁵ was set up with the help of the Ministry of Finance and the Department of Science and Technology in 2000, after a decade of work of SRISTI and HBN. With the help of HBN volunteers, NIF has built a database of over 1,75,000 ideas, innovations, and traditional knowledge examples from over 500 districts of the country. Most of these have the potential to improve the quality of life of ordinary people. For instance, the multipurpose food processing machine developed by innovator Dharamveer from Haryana is capable of processing various herbs/fruits to obtain juice, pulp, essence, oil, etc. The innovator has sold over 180 machines in different parts of the country, which have provided livelihood opportunities to over 1,500 families. While NIF has been filing applications for appropriate IP protection of these innovations and traditional knowledge, it has also been expanding the public domain. This is built on the realization that both the pool of open source and IP-protected technologies, are necessary to support livelihood options of communities. The operationalization of the Grassroots Technological Innovation Acquisition Fund (GTIAF, see Gupta, 2005)⁶ in 2011-12 by NIF is an attempt to lower the transaction cost for diffusion of socially useful technologies, provide an entrepreneurial opportunity at the

In this decade of innovation, the dream of an inclusive India cannot be fulfilled unless the knowledge of the people at the grassroots is visualized as one of the fundamental drivers of the sustainable developmental process.

local level to gain access to new innovation at no or low cost and build horizontal linkages. This also provides an opportunity to the users/ entrepreneurs to modify the innovation to suit local conditions, thereby improving acceptability. The innovation of a motorcycle driven multi-purpose tool bar, an agricultural implement (Bullet Santi) by Mansukhbhai Jagani of Gujarat in the mid-1990s is an example of how such diffusion and improvisation occurs. The innovation has been replicated by a number of local fabricators over the years, each variance developed as a result of incremental needs. Over 10,000 de-

derivatives of Bullet Santi have been sold and over 200 fabricators now make various versions of this innovation. This led to the evolution of the concept of Technology Commons, implying that people-to-people copying of the innovation was permissible while a company could access this bundle of technologies only through a license (Sinha, 2008)⁷. This is not only true for mechanical innovations, but also for many plant varieties that have spread through farmer-to-farmer networks. The HMT variety of Dadaji Khobragade of Maharashtra has diffused over one lakh acres in five states. Such knowledge diffusing/sharing mechanisms

can empower creative individuals and communities, promoting people-to-people learning in the process and generating a spirit of self-reliance, which is essential to work towards sustainability.

For the last 25 years, the HBN has been arguing and asserting that acknowledging people's knowledge, including them in the development process, and building upon their knowledge is essential for inclusive sustainable development. The lessons from grassroots innovators, who have respect for nature, concern for future generations, compassion for each other, and abundant generosity to share their knowledge with others, need to be appropriately noted and acted upon. In this decade of innovation, the dream of an inclusive India cannot be fulfilled unless the knowledge of the people at the grassroots is visualized as one of the fundamental drivers of the sustainable developmental process. 

⁵ National Innovation Foundation – India, set up in 2000 by the Department of Science and Technology, built upon the Honey Bee philosophy, has taken major initiatives to serve the knowledge-rich, economically poor people of the country. It is committed to making India innovative by documenting, adding value and protecting the intellectual property rights of the contemporary unaided technological innovators, as well as of outstanding traditional knowledge holders on a commercial as well as non-commercial basis.

⁶ The Grassroots Technological Innovation Acquisition Fund was envisioned to allow NIF to acquire the rights of technologies from the innovators generating public goods, which NIF can then make open source. Some of them can be pooled and blended to form new products, which can be licensed to small entrepreneurs so that a large number of such entrepreneurs can take up the products and take them to localized markets. This will promote decentralized production since the supply chain costs would otherwise be huge.

⁷ Op cit., Sinha (2008).

The “Grassroots” in the Public System: Teacher-driven Innovations for Inclusive Educational Development

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The growing preoccupation with ‘inclusive development’ in recent times has come to symbolize the suspicion that our current economic growth and development models are contributing to greater socio-economic disparities, and, therefore, marginalization of those groups which are unable to participate in the process of development. Given the close links between education and development, an exclusionary process of development is bound to dilute the focus on inclusion that educational policy making in India has had since the time of independence. A concern for equity and the belief that education is an instrument for reducing social inequalities have motivated the various policies and Education Commissions that have shaped education in the past^{8,9,10}. Beginning with the Constitution’s Article 45 in the Directive Principles of State Policy which provided for free and compulsory education to all children up to 14 years of age and ending with the Eighty-Sixth Constitutional Amendment Act, 2002, which made this a fundamental right, we have had a slew of initiatives aimed at promoting equity and inclusion of the historically-deprived sections of our society.

These initiatives, especially in elementary education¹¹ have produced good results as far as inclusion along the

A concern for equity and the belief that education is an instrument for reducing social inequalities have motivated the various policies and Education Commissions that have shaped education in the past.

dimensions of access, physical infrastructure and out-of-school conditions for equity are concerned¹². Other studies, for instance, the ASER 2012 (Rural) report¹³ indicate that enrolment in the 6-14 age bracket in rural areas is high (though girls in the 11-14 age group still pose some problems), private school enrolment is rising all over the country, indicating both that access is no longer an issue and that state schools are not delivering up to expectations, and that school facilities have improved over time. Creating out-of-school conditions for equity, for instance, through targeted attention to specific communities that

have been outside the scope of educational development, is closely related to the broader issue of access to schooling. In addition, key amendments that have influenced the out-of-school conditions for equity include the 42nd Constitutional Amendment (which made education a concurrent subject, thus ensuring that spatial inequality across the various states could be countered by central action), and the 73rd and the 74th (decentralization through *panchayati raj*, ensuring devolution of some power and authority to local bodies). The structures which followed, including the Village Education Committee, and the School Management Committee under the *Sarva Shiksha Abhiyan* and now under the Right of Children to Free and Compulsory Education Act (2009), also addressed this dimension of out-of-school conditions for equity.

including the Village Education Committee, and the School Management Committee under the *Sarva Shiksha Abhiyan* and now under the Right of Children to Free and Compulsory Education Act (2009), also addressed this dimension of out-of-school conditions for equity.

⁸ Government of India. (1966). Report of the education commission 1964-66: Education & national development. New Delhi: Ministry of Education, Government of India.

⁹ Government of India. (1992). National policy on education 1986: Programme of action 1992. New Delhi: Ministry of Human Resource Development, Department of Education, Government of India.

¹⁰ NCERT (National Council of Educational Research and Training). (1972). Eleventh national seminar on elementary education, Report on Primary Education. New Delhi: NCERT.

¹¹ This article focuses only on elementary education.

¹² Government of India (2012). *Report to the people on education, 2011-12*. New Delhi: Ministry of Human Resource Development, Government of India. Accessed on August 28, 2013 through http://mhrd.gov.in/sites/upload_files/mhrd/files/RPE_2011-12.pdf

¹³ ASER Centre. (2013). ASER 2012: Main findings. Accessed on August 28, 2013 through <http://www.asercentre.org/?p=157>

However, two other dimensions which operate on the inclusion-exclusion continuum, retention of children in school, and quality of education (learning outcomes), continue to be challenging, in spite of recent interventions, like the *Sarva Shiksha Abhiyan*, that have specifically targeted these dimensions.¹⁴ As noted above, keeping girls in the 11-14 age-group in school is problematic. A second issue that is not well-understood is irregular attendance. This phenomenon has a direct link with poor learning outcomes. The Government of India¹⁵ notes that though drop-out rates have come down at the elementary stage, and that steps are being taken to promote participation of girls and to bring dropped-out children back into school, yet, “decline in the dropout rates at both primary and upper primary levels need to be viewed in the light of increase in the repetition rates at both the levels. Suitable strategies thus, need to be adopted not only to improve the overall retention rates and reduce the dropout rates both at the primary and upper primary level but also to improve quality of teaching so as to plug the repetition rates” (p. 25). This is an honest assessment, which should point towards socio-economic factors that prevent regular school attendance among some sections of the society. The gaps in learning outcomes are also of concern. It is reasonable to assume that state schools are catering more and more to only the marginalized sections of the society, and thus when ASER Centre (2013) notes that more than half of the children in grade five are only at grade two level when it comes to reading and that such children also show poor math abil-

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ity, it is a matter of concern. The failure on the dimensions of retention and quality is a serious threat to inclusive educational development. Given that economic development and educational development are closely linked, exclusion in the economic sphere is likely to lead to a negative impact on retention of children in school and learning outcomes. As noted above, the access and infrastructure dimensions are less likely to be affected, since a realization of the need for schooling has become well-accepted and massive investments have already been made over the last decade in schooling infrastructure. In other words, the disparities of human capital between those sections which benefit from an exclusionary growth process and those sections which are marginalized (assuming these sections depend to a large extent on state schools), will widen.

If this is the situation with respect to retention of children and quality of education, in spite of well-meaning policies, how is it that many teachers within the same state system are able to achieve their educational goals and thus contribute to the narrowing of retention-quality gaps? The answer lies in the “grassroots innovations” that such teachers develop. These innovations are contextually-relevant solutions to problems of irregular attendance (which ultimately leads to poor retention) and of quality of education (usually made more severe by lack of home support for learning, or lack of facilities at home). Can these innovations offer lessons for traditional policy making?

The rest of this article focuses on the role that such innovations, which are also “step changes” from previous practice, can play in reforming public systems. Hartley¹⁶ makes a distinction between innovation and improvement, combining them in a 2x2 matrix, with each having two levels, high and low. The quadrant, where innova-

¹⁴ A sixth dimension of inclusion, usually under-addressed, is knowledge inclusion—drawing on children’s prior knowledge so as to enrich the formal curriculum. For instance, the biodiversity knowledge of children belonging to forested, biodiversity-rich areas can be the base for educational innovations in the formal curriculum that seek to valorise the knowledge that such children, usually socially marginalized, possess. See Chand, V. S., Shukla, S. R., & Gupta, A. (1997). Ecological knowledge of rural children: Educational innovation and natural resource conservation. Paper presented at the International Conference on Creativity and Innovation at the Grassroots, Indian Institute of Management, Ahmedabad, January.

¹⁵ Op cit., Government of India (2012).

¹⁶ Hartley, J. (2008). The innovation landscape for public service organizations. In J. Hartley, C. Donaldson, C. Skelcher, & M. Wallace (Eds.), *Managing to improve public services* (pp. 197-216). New York: Cambridge University Press.

tion and improvement are high, implying a change in the educational landscape, is our focus here. Innovations in this quadrant offer a way out of the stagnation that many state schools face. These innovations are at the “grass-roots”, being teacher-driven, and by virtue of happening within the public sector, qualify as employee-driven innovations in public systems¹⁷. In spite of the fact that the public system lacks a visible rationale for innovation like market competition, and that there are a number of barriers to innovation^{18,19,20,21}, innovation happens in public systems much more often than administrators realize^{22,23}.

Two features of such grassroots employee-driven innovations are that they conform to the ‘bottom-up’ criterion (starting at the worker and workplace levels) and they lead to a reshaping of organizational practices through worker interaction. While the first is evident in teacher-driven innovations, the second is usually absent, given that innovative teachers usually work in isolation, in socio-economic contexts that are often very difficult. It is this second feature that, if realized, should help in peer learning and contribute to the development of innovation in the public education system. This is the rationale for a project at the Indian Institute of Management, Ahmedabad, which seeks to bring together innovative elementary teachers in the state system and the educational research and training bodies of the state, in a collaborative effort to identify teacher-driven innovations, validate them, and promote peer learning.

Given that economic development and educational development are closely linked, exclusion in the economic sphere is likely to lead to a negative impact on retention of children in school and learning outcomes.

To begin with, in the state of Gujarat, Innovation Cells have been established in every District Institute of Education and Training.²⁴ Between March and August of 2013, 5,212 innovative teachers were identified and their work documented by the project. The first level of validation was also completed. This, in other words, means recognition for those who are trying to innovate and improve the educational landscape. Many of their innovations address problems related to retention and quality; in other words, a mapping of how teachers at the grassroots, in the public system, have addressed these two threats to inclusive educational development, is now possible. (See the three examples of validated innovations at the end of the paper.) This is work in progress, but should result in (a) making available validated work, in usable formats, to other teachers, teacher training networks, and education administrators, and (b) a grassroots innovations resource pool that assembles distributed ideas, for policy makers to learn about locally-informed best practices or to develop new policy directions. In addition, the mapping of the innovations should offer more insights

into the kinds of grassroots innovations that are possible. For instance, a number of innovations are best described as empathetic innovations. A school teacher started the practice of feeding the girls in the school sprouted legumes when a blood test conducted by a health check-up drive of the government indicated high levels of anaemia. Not surprisingly, achievement levels have gone up. Some innovations are children-inspired activities; others are driven by parents.

The Innovation Cells will now facilitate the creation of decentralized networks of innovative teachers in their districts, resulting in the development of appropriate training material as well. This approach, which is being piloted in the state of Gujarat, is applicable to other states and other developing countries that depend heavily on the public system and face threats to inclusive educational development as a result of high educational inequalities and socio-economic deprivation.

¹⁷ Høyrup, S., Bonnafous-Boucher, M., Hasse, C., Lotz, M., & Møller, K. (Eds.). (2012). *Employee-driven innovation: A new approach*. Basingstoke: Palgrave Macmillan.

¹⁸ Potts, J., & Kastle, T. (2010). Public sector innovation research: What's next? *Innovation: Management, policy and practice*, 12(2), 122-137.

¹⁹ van Duivenboden, H., & Thaens, M. (2008). ICT-driven innovation and the culture of public administration: A contradiction in terms? *Journal of Information Policy*, 13(3,4), 213-232.

²⁰ Kirby, D.A. (2006). Creating entrepreneurial universities in the UK: Applying entrepreneurship theory to practice. *Journal of Technology Transfer*, 31, 599-603.

²¹ Ozcan, S., & Reichstein, T. (2009). Transition to entrepreneurship from the public sector: Predispositional and contextual effects. *Management Science*, 55(4), 604-618.

²² Op cit., Gupta (2010).

²³ Op. cit., van Duivenboden, H., & Thaens, M. (2008).

²⁴ Details of the project are available at www.teachersastransformers.org

A Few Examples of Validated Innovations.....

Priti Rupchand Gandhi, Kalol, Gujarat

My little home library: The child gets a lot of time to spend at home, but is constrained by the lack of reading material. Thirty aluminium boxes were first collected; in each, a set of 20-25 books (of interest to children, like children's stories, tales of expeditions, biographies) was placed. The set also contained books that were of interest to the elders at home, who could read them if they were literate or semi-literate. A child took home one box, at the beginning of the month, and brought it back at the end of the month. In this way he could cultivate a reading habit and could read all the books over three years – classes 6 to 8. The children are told clearly that they have to take care of the books at their homes. Testing of the reading abilities of the children is the tool used by the teacher to monitor the initiative.

Tasleema Hussain Sheikh, Junagadh, Gujarat

Songs for teachers: Many of the poems in the English, Gujarati, Hindi, and Sanskrit textbooks of Classes 6 to 8 are best taught through song so that learning is more enjoyable. But teachers do not know how to convert the po-

ems into songs; also, male teachers hesitate to sing. Tasleema created melodies for all the poems of the four subjects, sung the songs along with her students, and recorded them. Many of the songs have been uploaded on YouTube; given the difficulties in access to the internet, these songs will now be put in DVD format for other teachers and children. Feedback from teachers who have used the songs is a monitoring tool for the teacher.

Dinesh B. Prajapati, Surendranagar, Gujarat

Regularizing attendance: Irregular attendance affects learning. Many of the reasons for such irregularity, for instance, the need to work during critical times of the year, are not in the control of the teacher. But Dinesh developed a method which offered an incentive that was grounded in local culture. He honoured the children with the highest monthly attendance and those who showed the most improvement over earlier months. He made the

A school teacher started the practice of feeding the girls in the school sprouted legumes when a blood test conducted by a health check-up drive of the government indicated high levels of anaemia. Not surprisingly, achievement levels have gone up. Some innovations are children-inspired activities; others are driven by parents.

'awardees', holding coconuts in their hands, lead a procession to the localities of the influential members of the village, with a children's band accompanying the group. This solved his problem of irregular attendance to a considerable extent. ♡

Grassroots Innovation for Building a Harmonious China

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The term, "inclusive development" is not generally heard in China. Instead, the focus here is on building a "harmonious society" that gives ample scope to nurture people's talent and creativity, enables sharing of the social wealth brought by reform and development,

and forges a close relationship between the people and the government. Although grassroots innovations (GRIs) or the innovations by the poor are attuned to the needs of local people and the quality and quantity of available resources, the benefits are not only for the poor, but also

for the general public. Thus GRIs can contribute to a harmonious China.

The innovative initiatives of the poor release their creativity and solve problems ignored by the formal sector

GRIs are common in China. Since the promulgation of the Patent Law of the People's Republic of China in 1985, about half of the patents granted belong to individuals including grass-roots innovators. On the Internet, GRIs can be easily searched by using the key words, 'farmer invention' and 'the name of the invention'.

GRIs can be in the form of innovation clusters and innovation chains. Innovation clusters are around a product while innovation chains are along an industry. During the International Conference on Innovation and Creativity at the Grass-roots (ICICG) held in December 2012 at the Tianjin University of Finance and Economics (TUFE), China, a GRI exhibition was organized. As an example of GRI chain, more than 30 GRIs along the corn industry were displayed. Box 1 gives an example of a GRI cluster around used bicycles – the innovations that led to tool-making or even saving lives.

GRIs bring social wealth to China to benefit the poor

Several GRIs have found wide applications. For example, the non-row corn harvester developed by farmer Guo Yufu in Tianjin can harvest corns of different sizes with variable row spacing. Before his innovation, corn harvesters could only be used for harvesting corn with fixed row spacing. Another example is the winter production of greenhouse cucumbers without supplementary heating. This innovation initiated in the early 1980s, has not only enriched the vegetable baskets of millions of households in the north of

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the existing products to suit the local conditions. They are simple in design and can be easily used. A survey of 1,885 farmer innovators conducted in 2010 at the TUFE supports the above statement. Research shows that the average holding periods of the patents of the utility model, design, and invention are of 2.8, 2.5, and 3.5 years, respectively.

Most rural poor are entrepreneurs out of necessity, a fact that is especially true for the poor and remote agricultural areas lacking external investments. Entrepreneurship based on GRIs makes up for the omissions and deficiencies of rural markets to some extent.

China, but also allowed the poor to get out of poverty by growing greenhouse vegetables.

GRIs contribute to innovations in the formal sector as well. For example, development of high yielding variety of rice and effective cultivating techniques require persistent and careful observations of the farmers in the field. Thousands of farmers who use the seeds developed by the formal sector either adapt the products/services to match the local socio-economic or cultural conditions, or offer suggestions to the formal sector on how to improve them.

Unlike the innovations in the formal sector, a large number of GRIs are in the public domain, which can be used for free by any individual/organization. Many GRIs are modifications of

Most rural poor are entrepreneurs out of necessity, a fact that is especially true for the poor and remote agricultural areas lacking external investments. Entrepreneurship based on GRIs makes up for the omissions and deficiencies of rural markets to some extent. In rural China, many small and medium enterprises (SMEs) are GRI-based enterprises, which largely promote rural economic development. For many rural workshops owned by the poor, innovation for survival has become their natural choice for development.

GRIs unite the government and the people

The Chinese government enhances

rural and pro-poor development through learning from grassroots innovators and offering them the support of science and technology to improve and disseminate their innovations widely. In China, it is common for grassroots innovators to collaborate with professionals not only for their research and development but also for the diffusion of their innovations. Many local research institutes owned by grassroots innovators receive regular support from the local governments.

The Chinese government enhances rural and pro-poor development through learning from grassroots innovators and offering them the support of science and technology to improve and disseminate their innovations widely.

institutionalized by the government. For instance, the China Association for Science and Technology supported and popularized the Chinese Onion and Garlic Research Association, which was set up in the early 1980s by several farmers in Tianjin to share farming techniques. What the farmers did was an organizational innovation in rural China as there were no research institutes/universities undertaking such research at that point of time. In addition, the major political innovations in rural China have been

Several organizational innovations at the grassroots are

triggered by the grassroots innovators since the economic reform in the late 1970s. ✓

Box 1: GRIs with Used Bicycles

Farmers make multi-function farming tools out of used bicycles. Some examples of the innovations include:

- Adapting a bicycle plow for weeding, hoeing, and even for applying fertilizers.
- Converting the bicycle wheels into a power device to draw water from wells.
- Replacing the hoe with the bicycle for sowing carrots and beets (in Sichuan province).
- Modifying the bicycle to make it amphibious.
- Developing a mechanism to give the rider a massage while riding.
- Enabling the power-aided bicycles to convert kinetic energy into electrical energy while going downhill to make cycling uphill much easier.
- Creating battery-powered anti-theft devices and an automatic braking system while tilting for electric bicycles.
- Devising a bicycle breathing-machine which has even saved a 15-year-old village girl's life in Anyang, Henan Province.

Grassroots Innovations for Inclusive Development: A South African Example

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We don't have to look far to see that colonialism, modernity, and the disciplines that accompany them provided the framework for the organized subjugation of the cultural, scientific, and economic life of many

on the African continent and the Third World in general. This subjugation extended in a spectrum from people's "way of seeing", their "way of being", their way of negotiating life processes in different environments, their sur-

vival techniques, to technologies for ecologically-sensitive exploitation of natural resources²⁵.

INSTITUTIONAL TRANSFORMATION

A change in the context such as that existing in South Africa has to be undertaken at many levels. At the *legislative level* are found changes in the constitution, laws, and the broad structures that undergird the national system. At the *policy level* are found the content and strategies – what is to be changed, how, in which direction, and by whom. Here ministries are found focusing at different sectors. At the *grassroots level* are changes in livelihood, attitudes, productivity, and innovation. Between policy and grassroots, however, lie *institutions*, containing trained experts that ought to be equipped with mental and other tools to respond to the agenda for change as necessary.

Institutional change is crucial to the success of a transformation exercise because it is in the institutions that one finds the institutional cultures from the previous systems; institutional norms constructed in a previous dispensation; power of the insiders, “in-groups”; yet it is also the location of the professional cadres who are expected to be the architects of change in the wider society.

SCIENCE, EXPLOITATION AND PROTECTION OF RURAL COMMUNITIES

The perception that science and technology are *not servicing* the rural community in the first instance is not without foundation. Most scientific

Most scientific practices have an urban orientation, and appear to have clientele that in the first instance are in urban areas, and who already have the benefit of earlier versions of the particular application. The challenge here is to get a re-orientation and a service orientation in the field in such a manner that scientists begin to conceive of rural people as their counterparts.

Science must become more inclusive, and take greater cognizance of other knowledge systems such as the Indigenous Knowledge Systems (IKS), and the contributions and needs of such knowledge communities in the rural areas.... The current policy framework appears inadequate to support and nurture the promotion and protection of IKS in South Africa.

practices have an urban orientation, and appear to have clientele that in the first instance are in urban areas, and who already have the benefit of earlier versions of the particular application. The challenge here is to get a re-orientation and a service orientation in the field in such a manner that scientists begin to conceive of rural people as their counterparts. A service orientation also affirms the fact that science and technology should become more accountable to the citizens. The institutional change therefore is pertinent to reversing this state of affairs.

These institutions should re-interpret their roles and functions in the light of the effects of the past policies and the objectives of the new dispensation. Science must become more inclusive, and take greater cognizance of other knowledge systems such as the Indigenous Knowledge Systems (IKS), and the contributions and needs of such knowledge communities in the rural areas.

A significant mix of South African society, policy-makers, civil society, academia, and the scientific research community, has been grappling with the complex issue of “indigenous knowledge” and the challenges and responsibilities of the state and society in respect of promoting and protecting the rights and status of the holders, in most instances, communities.

However, the current policy framework appears inadequate to support and nurture the promotion and protection of IKS in South Africa. India provides South Africa with a valuable reference point from a lot of common comparative and vantage positions. India successfully defended her national right to the ownership of Intel-

lectual Property Right (IPR) from its indigenous community (turmeric) against a powerful multinational

²⁵ SARCHI Retreat (2013). Establishing discourse and protocols for innovations from below as restorative action to communities, Concept Paper.

pharmaceutical company in the USA. It is a developing country with pockets of poverty and pockets of wealth and so is South Africa. However, a dividing line exists such that communities using IK remain consistently impoverished and marginalized. The majority of the people in India are indigenous and continue to practice and use indigenous knowledge in their day-to-day activities. Like South Africa, India was once a colony of Great Britain and therefore has suffered the same level of plundering and subjugation as South Africa.

Most of the legal instruments elevated the European models of IPR to the detriment of the local knowledge base and thus created a hostile policy framework against indigenous knowledge. Most of these institutions consider indigenous communities as anthropological research samples rather than an integral and valuable part of the national human resource base. During the Ice age, India and South Africa were parts of the same continent, Gondwanaland, and consequently, many of the plant varieties used by indigenous people of these two countries may be very similar²⁶).

CONCLUSIONS

It is recognized that the protection of IKS innovations is quite complex. It requires a broadened notion of the traditional research and research and development parameters. It requires interrogating the existing intellectual property regime, and supporting the development of an IPR system that can take cognizance of other models of ownership, and developing protocols and codes of conduct to govern the relationship between the scientific community and local communities, with the latter seen as owners of knowl-

Institutional change is crucial to the success of a transformation exercise because it is in the institutions that one finds the institutional cultures from the previous systems; institutional norms constructed in a previous dispensation; power of the insiders, “in-groups”; yet it is also the location of the professional cadres who are expected to be the architects of change in the wider society.


Innovations do not come out of the blue, but are typically derived from one’s previous experience, and “empowerment” is used to denote people’s demands to be recognized, consulted, and valued.

edge. In effect, it requires scientists and academics to become facilitators of a dialogue through research and development, between the fields of theory, practice, and policy.

Sustainable development, defined as “the enlargement of people’s choices and capabilities through the formation of social capital so as to meet as equitably as possible the needs of current generations without compromising the needs of future ones” has to be emphasized within a framework of close inter-sectoral strategies.

This approach to development works to restore trust in social and political interactions, an important aspect of restoring the social and ecological fabric of society in general, while underlining non-coercive social regulation that holds societies together and gives them a humane character.

It recognizes that innovations do not come out of the blue, but are typically derived from one’s previous experience, and “empowerment” is used to denote people’s demands to be recognized, consulted, and valued. This goes with efforts to enhance the power of individuals, groups, and organizations in society; to changing the balance of power in favour of those who were kept out of the mainstream of economic, social, cultural activity as a consequence of colonialism and apartheid²⁷ (UNDP, 2000).

Therefore, institutions must be called upon to facilitate this return to humanity. 

²⁶ DST IKS Brief, 2000

²⁷ UNDP (2000). Sustainable human development: From concept to operation: A guide for the practitioner. UNDP Discussion Paper pp:7; UNDP (2000). South Africa: Transformation for Human Development 2000. pp:147-148.

Banuri, T.; Hoyden, G.; Juma, C.; Rivera, M. Sustainable Human Development, from concept to operation: A guide for the practitioner. UNDP Discussion Paper, NY, USA, 1994.

Grassroots Innovations to Help in Inclusive Development²⁸

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What is Grassroots Innovation?

To me, what is remarkable about Grassroots Innovation (GI) is the inventions and smart ideas put into action by the grassroots inventors for increasing the social and economic benefits of the people. Though the grassroots inventors are a class of people in the society, with relatively lower education level and poorer economic condition, they are not necessarily less creative. In fact, as Mr. Ze-dong Mao, the former president of China (1949-1976), said, poor people will always find a way out to change and better their lives.

Why Emerging Economies like China need GI?

In the past 30 years, reforms, mainly in the economic domain, have been the driving force of development in China. The effect of the so-called “reform bonus” is quite significant. However, the concern now is: Will this bonus continue? What will be the next Big Thing to drive the country’s development in the next 30 years, especially while facing economic slowdown in this post-crisis time? The government has already given the answer:

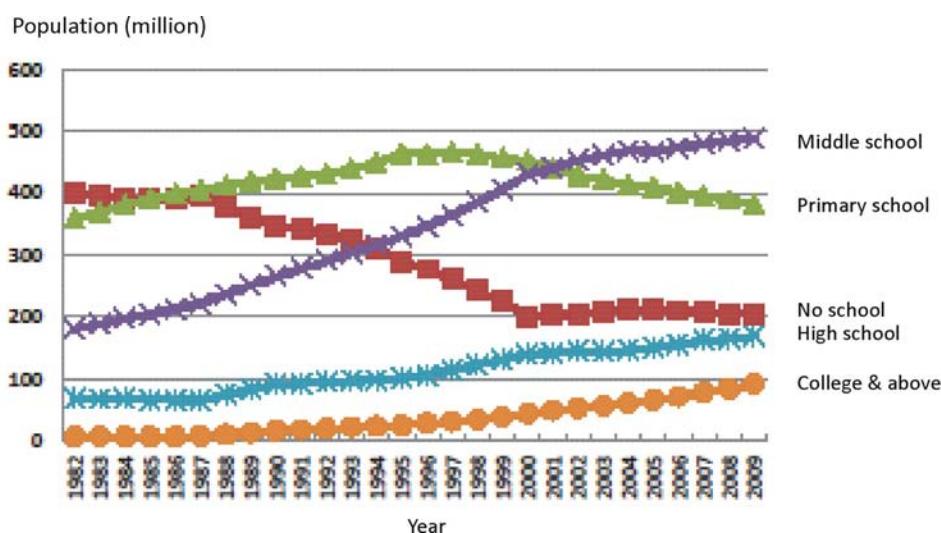
Innovation.

For more than a decade, the central government of China has repeatedly addressed the importance of innovation, taking actions towards moving resources from less efficient to more efficient sectors. The only problem is perhaps paying most, if not all, attention to the innovation by the “elites”, while focusing less on, if not neglecting, the possibilities of innovation by the grassroots.

Now, let’s take a look at the educational level of the population in China. The distribution of population in China across educational levels, according to the *China Human Capital Report (2012)*, compiled by a research team led by Prof. Hai-zheng Li from Georgia Institute of Technology, is shown in Figure 1.

Another set of data from the *China Household Finance Survey Report (2012)*, compiled by the researchers under the leadership of Prof. Li Gan from Texas A&M, shows that people’s incomes are highly correlated with their education levels (see Table 1).

Figure 1 Population Distribution across Education Levels



²⁸ The author wishes to thank Prof. Anil Gupta of IIMA, India, for inviting and inspiring him to write this essay, and Dr. Yun-peng Su from Tianjin University, China for his contribution in collecting the data.

Table 1: Correlation of Income with Education Level

Education	No School	Primary School	Middle School	High School	College & above
Annual Income (10k)	1.24	1.74	2.05	2.73	6.64

Considering this pyramidal (instead of olive-shaped as in the West) population distribution of education and income levels in China, relying on the elites on the top of the pyramid to push the innovation forward, while leaving the large part on the bottom away from participating, would be the same as neglecting a huge gold mine underground. So, to continue the miracle of development that has taken place in China since 1978, we do need to mobilize all parties, elites or grassroots, to innovate. To transit to an innovation-driven economy, as stated by the Chinese government years ago, to raise the income level of the nation, and to promote a more balanced and inclusive development of the country, grassroots innovation is definitely one of the key driving forces.

What GI will Bring to Us?

Raise awareness about the contributions by the grassroots innovators for the society. Grassroots innovations would reveal that knowledge and creativity of these innovators can significantly benefit the society, both in terms of social and economic development.

Result in a less divided society. The contributions will not only be valued by the society, but will also better the economic situation of the grassroots innovators. There is, perhaps, no anti-poverty programme like grassroots innovation which can help the grassroots inventors in establishing their ability to create wealth through their own knowledge, wisdom, and efforts. This will help narrow the gap between

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the rich and the poor, leading to a more inclusive and balanced, as well as harmonious world.

Bring us new thinking of promoting innovation. Almost the entire existing system of promoting innovation is based on the idea of intellectual property protection (IPP), mostly with the patent mechanism. This is justified as some of the innovations need costly resources and long years of education and knowledge accumulation; without a proper security, nobody will be ready to take such risks. The IPP system will thus motivate people to pursue innovation. However, this patent-based IPP system may block the spread of grassroots innovation. Considering that many inventions by the grassroots are low-cost and mainly aim to better their own lives or increase the efficiency of their own production, and considering that GI inventions will have tremendous social impact if they can be spread to other grassroots, we do need a brand new system of promoting innovation, not necessarily under the patent-based IPP ideas.

How Should China Promote GI Further?

Aiming at an “Innovation-driven Country”, China has made great progress in promoting innovation. Government agencies at different levels, state or provincial, have developed special programmes to support the grassroots innovation. These programmes are mostly operated by the Department of Science and Technology, or Agriculture Administration. The Inventors’ Associations at the national and local levels are also playing an important role and serve as a good communication platform for the grassroots innovators. Some major media like CCTV-7 air programmes demonstrating the grassroots inventions. The next step, I would say, should include

GI into the National Innovation System. This will be a more strategic approach to advance GI in China. The practices, like National Innovation Funds or Honey Bee Networks, in India would be a model

There is, perhaps, no anti-poverty programme like grassroots innovation which can help the grassroots inventors in establishing their ability to create wealth through their own knowledge, wisdom, and efforts.

for China too. Moreover, the actions at Chinese universities, such as those led by my former colleague, Prof. Liyan Zhang, should also be enhanced further. ✓

Reciprocal and Responsible Innovation for Sustainable and Inclusive Development

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Two of the major challenges that companies face are (i) to stay innovative and (ii) to respond to the challenges of sustainability and inclusive development. The latter requires to get away from a linear way of thinking of 'make, use, dispose' towards approaches that reflect systemic complexity and circularity (see, for example, cradle to cradle design).^{29,30,31,32} Not only does systems thinking require more efficient use of resources, creating less harmful impact on environment and society (see also eco-efficiency, socio-efficiency, and corporate sustainability management^{33,34}), but also a systematic transition of how to organize the diverse and dispersed range of skill-sets in our society. When it comes to developing sustainable and inclusive innovations, often it cannot go without the

knowledge and skills of various disciplines coming together. A more collaborative, multi-, inter- and trans-disciplinary approach of reintegrating dispersed, specialized knowledge³⁵ and innovating together for more sustainable and inclusive outcomes is needed.

Companies have started to open up and follow an approach of networked innovation^{36,37,38}, user-driven, democratic innovation^{39,40}, and open innovation⁴¹. Companies collaborate and also co-create with organizations from other sectors of the society and search for knowledge, new and creative ideas and innovations among user groups, students, and common people. Collaborative innovation

²⁹ Boulding, K.E. (1966). The economics of the coming spaceship replace with earth. In Jarrett, H. (Ed.), *Environmental Quality in a Growing Economy*. Baltimore: John Hopkins University Press.

³⁰ Stahel, W.R., & Reday G. (1981). *Jobs for tomorrow: The potential for substituting manpower for energy*. New York: Vantage Press.

³¹ McDonough, W., & Braungart, M. (2002). *Cradle to cradle: Remaking the way we make things*. New York: North Point Press.

³² Ellen MacArthur Foundation (2012). Towards the circular economy: Economic and business rationale for an accelerated transition, Accessed through www.thecirculareconomy.org

³³ Schaltegger, S., & Sturm, A. (1989). Ökologie-induzierte Entscheidungsprobleme des Managements. Ansatzpunkte zur Ausgestaltung von Instrumenten. [Ecology induced management decision support. Starting points for instrument formation.] WWZ-Discussion Paper No. 8914. Basel, Switzerland: WWZ.

³⁴ Schaltegger, S., Burritt, R., & Petersen, H. (2003). *An introduction to corporate sustainability management, striving for sustainability*. Sheffield: Greenleaf Publishing Limited.

³⁵ Schaltegger, S., Beckmann, M., & Hansen, E.G. (2011). Transdisciplinarity in corporate sustainability, *Business Strategy and the Environment*, 20(5), 348-350.

³⁶ Granovetter, M. (1985). Economic action and social structure: the problem of embeddedness. *American Journal of Sociology*, 91(3), 481-510.

³⁷ Powell, W. (1990). Neither market nor hierarchy: network forms of organization. In: Staw, B., & Cummins, L.L. (Eds.), *Research in Organizational Behaviour*, 12, 74-96. Greenwich CT: JAI Press.

³⁸ Pratt, A.C. (1997). The emerging shape and form of innovation networks and institutions. In J. Simmie (Ed.), *Innovation networks and learning regions*, London, UK: Jessica Kingsley Publishers, 124-136.

³⁹ Von Hippel, E. (1986). Lead users: a source of novel product concepts, *Management Science*, 32(7), 791-805.

⁴⁰ Von Hippel, E. (2005). *Democratizing innovation*. Cambridge, Mass: MIT Press.

⁴¹ Chesbrough, (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business Press.

networks (COINs) combine most recent knowledge, talent, and trends into swarm creativity^{42,43} to harness the strength of networked actors online for the co-creation of new products, services, and solutions. An increasing number of crowdsourcing platforms such as Innocentive and NineSigma have come up. Companies and public sector organizations initiate innovation challenges and invite those who have novel and innovative ideas, skills, and complementary knowledge to participate, contribute, co-create, and collaborate.

Despite networking, integrating users, and opening up, all these efforts still do not necessarily lead to innovative outcomes that are more inclusive and sustainable. Inclusive and sustainable innovations need to (i) include the excluded, i.e. be affordable also for the economically poor, low-income user groups and accessible to those in the informal sector of society who are not connected to basic infrastructures such as a good education system, social welfare, the internet, etc., and (ii) be sustainable, i.e. accountable, transparent, fair, and responsible towards ecology, economy, and society in a balanced manner. Frugal solutions bear the potential to be just that – affordable, accessible, and accountable – through an approach that aims at “more with less for more”⁴⁴, i.e. more outcome with less resources for more people. Frugal solutions are not easily achieved and often created by those who are outside the formal sectors of society. People in the informal sector face resource shortages, hardships, and challenges of subsistence that many times do not leave them any other possibility than to draw on their knowledge and skills and come up with creative, low-cost solutions. Companies have been trying new approaches to achieve frugal solutions such as reverse in-

People in the informal sector face resource shortages, hardships, and challenges of subsistence that many times do not leave them any other possibility than to draw on their knowledge and skills and come up with creative, low-cost solutions.

novation⁴⁵ and embedded innovation⁴⁶. Though these approaches aim at solutions that are affordable and accessible, they acknowledge the people at the bottom of the economic pyramid only as untapped market but not as untapped source of creativity⁴⁷.

The work of the Honey Bee Network, which is an open innovation platform bringing together actors of the formal and informal sectors of society, shows that economically poor people in the informal sector are rich in knowledge, creativity, and innovations. With the help of SRISTI (Society for Research and Initiatives for Sustainable Solutions and Institutions) and many volunteers, thousands of traditional knowledge and contemporary practices as well as innovative solutions have been scouted and documented in the Honey Bee Network’s database. These include practices of biodiversity conservation, healthy living through a more organic, nutritious diet, herbal remedies for human as well as veterinary diseases, innovative means of reducing drudgery, new seed varieties, novel agricultural equipment and machinery that can also be afforded by smallholder farmers and

easily be adapted to individual needs depending on soil structure and method of cultivation, and many more practices, ideas, and innovations.

Many of these grassroots innovations are empathetic innovations⁴⁸ and solutions to problems that need to be urgently solved but are easily neglected by those who do

⁴² Gloor, P.A. (2006). *Swarm creativity: Competitive advantage through collaborative innovation*. New York: Oxford University Press.

⁴³ Gloor, P.A., & Cooper, S.M. (2012). The new principles of a swarm business. *MIT Sloan Management Review*, Spring 2007. Accessed through <http://sloanreview.mit.edu/article/the-new-principles-of-a-swarm-business/>

⁴⁴ Prahalad, C.K., & Mashelkar, R.A. (2010). Innovation’s holy grail. *Harvard Business Review*, July–August. Accessed through <http://www.andersbraekken.com/RESOURCES/Innovations%20Holy%20Grail.pdf>

⁴⁵ Immelt, J.R., Govindarajan, V., & Trimble, C. (2009). How GE is disrupting itself. *Harvard Business Review*, October. Accessed through <http://www.fast-bridge.net/wp-content/uploads/resources/How%20GE%20Is%20Disrupting%20Itself.pdf>

⁴⁶ Simanis, E., & Hart, S. (2008). Beyond selling to the poor: Building business intimacy through embedded innovation. Working Paper. Ann Arbor: Erb Institute. Accessed through <http://erb.umich.edu/Research/Initiatives/colloquiaPapers/Simanis%20Hart%20Embedded%20Innovation%20Revised%20Final.pdf>

⁴⁷ Gupta, A.K. (2006). From sink to source: The Honey Bee Network documents indigenous knowledge and innovation in India, innovations. Summer 2006. MIT Press. Accessed through http://www.policyinnovations.org/ideas/policy_library/data/FromSinktoSource/_res/id=sa_File1/INNOV0103_p49-66_gupta.pdf

⁴⁸ Gupta, A.K. (2010). Empathetic innovations: Connections across boundaries. Working Paper No. 2010-09-02, September. Ahmedabad: IIMA.

not face the same hardships. For example, Chintakindi Mallesham is from a traditional weavers' family in Nalgonda District, Andhra Pradesh. With years of dedicated effort and almost no resources available, he has developed an *Asu* machine that helps the women of his region to make silk *sarees* in the Pochampalli tradition (Geographic Indication Status since 2005) without the painful process of hand-winding the yarn (locally termed as *Asu*) by moving the arm back and forth 9,000 times before the weaving process can start. The machine has not only reduced drudgery but also increased productivity by four times and thus also improved the livelihood condition of weavers and women in the region.⁴⁹

Other solutions in the database of the Honey Bee Network are herbal creams for skin diseases or pain relief that are based on traditional knowledge of healers and communities taking into account an environmentally accountable approach to biodiversity conservation. When Dharamveer Singh, a financially constraint rickshaw puller, developed an affordable food processing machine that made him a successful entrepreneur, it helped smallholder farmers to make and sell their produce such as jams, sauces, and aloe vera gel, etc. from various local plant sources. The machine has also been exported from India to Kenya to support the growth of Kenya's small scale food processing industry. Another success story is that of Mansukbhai Prajapati, a potter who developed an eco-friendly clay fridge and became a successful entrepreneur with his company MittiCool. The database also contains a green-power bicycle washing machine that runs without electricity and was developed by Remya Jose, a school girl from a village in Kerala, when she was 14 years old. Furthermore, a farmer, Mansukbhai Patel, came up with a cotton stripping machine that eliminated child labour

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in those areas where it was introduced. Amrutbhai Agrawat, a serial innovator, developed, among many other devices, a pully with stopper that has helped women in India and other countries to take rest when fetching water from deep wells. Many more innovations that are either eco-friendly or have a positive social impact can be found in the database.

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in the formal sector with those who come up with frugal ideas and solutions in the informal sector. It is an open innovation platform that also includes those creative people and communities who do not have access to basic infrastructure and can communicate only in their local language. One of the biggest challenges is to make these grassroots innovations available and accessible on a larger scale. Better designs are needed and stronger links

between formal and informal sector need to be forged.

We have to see how actors from the formal and informal sectors can work together to co-create and implement innovative solutions. For this to happen, relations need to become less asymmetrical and exploitative than they have been in the past. A more reciprocal and responsible approach is needed that through empowerment (and reshaping of norms and values through institution building) and engagement (by learning from each other through capacity building and reverse capacity building) would lead to mutually reinforcing learning processes,

mutual understanding, and trust. Then, blending of formal and informal science, knowledge, and skills can take place in such a way that more long-term oriented, sustainable, and inclusive outcomes and innovations can be achieved that in turn would contribute to larger social good. ✓

⁴⁹ [http://www.sristi.org/hbnew/innovator_profile/19\(3\).pdf](http://www.sristi.org/hbnew/innovator_profile/19(3).pdf)