

# Institutionalization of grassroots innovation in India

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*India's economy has a large informal sector, which is generally associated with low labour productivity and poverty in the country. India became the first country to recognize the innovative ability of the informal sector and support it. Grassroots innovations scouted in various parts of India are now provided a complete cycle of support and integrated into the formal sector through networking cooperation with research institutions, businesses and governmental organizations at various levels. This article traces the genesis of the system of support for grassroots innovation in India through the institutionalization of the innovative activity of the informal sector. The specifics of this process can be taken into consideration by countries wishing to unleash the innovative potential of the informal sector.*

**Keywords:** Grassroots, incubation, innovation, microfinance, system.

MOST studies on innovative development are based on the concept of national innovation systems (NIS) created by Freeman<sup>1</sup> and Lundvall<sup>2</sup>. The concept has been extended to aspects of regional and cluster development, and new models of innovation development have been created: the triple helix model by Etzkowitz<sup>3</sup> and the rain-forest model<sup>4</sup>. This concept is also the subject of criticism<sup>5</sup>. Both the criticism and the concept itself are located within the terms of the formal economy and its institutions, policy and enterprises.

The same may be said about the main guidelines for collecting and interpreting innovation data for description and analysis of countries' innovation systems, the *Frascati Manual*, *Oslo Manual* and *Bogota Manual*. The first editions of the *Oslo Manual* covered six main areas of research: corporate strategy, technology diffusion, sources of information for innovations and obstacles to innovation, inputs in innovation, role of government policy and innovation output<sup>6</sup>. Developing countries have also contributed to further exploration of the concept, as was done, for example, in the *Bogota Manual*<sup>7</sup>.

The Organisation for Economic Co-operation and Development (OECD) released the 3rd edition of the *Oslo Manual*<sup>8</sup> with a new annex devoted to the specifics of developing countries. Although one such specific feature is a large informal sector of the economy, informality was considered as one of the negative exogenous systemic factors for innovation.

India has a large informal economy. According to the report of the National Commission for Enterprises in the

Unorganised Sector<sup>9</sup>, informal employment in India is 98% in the agricultural sector, 75% in industry, and 72% in services. This is a dominant share of mostly primitive and underdeveloped enterprises and labour-intensive jobs for India's less-skilled workers with an extremely low level of wages. It means low productivity in basic manufacturing and services, one consequences of which is a spread of inequalities: regional, social, economic. Thus, the informal sector is viewed as a source of low-technological and labour-intensive employment and has never been considered an area of innovative activity. India is the first country to recognize the innovative ability of the informal sector and to develop and support innovations of the informal sector.

Research on innovative activity at the grassroots level has been performed mainly by the scholars involved in the grassroots innovation (GRI) movement in India. Articles by Anil Gupta form the basic pool of publications about GRI. International Development Research Centre (Canada) funded GRIID (Grassroot Innovations for Inclusive Development) Project to explore issues concerning GRI development and successful functioning within the national innovation system. The final report contained a massive volume of information about political, economic, and ethical aspects of GRI, and also provided many case studies of grassroots innovation practices and products successfully developed and implemented in India<sup>10</sup>.

This article aims to provide a systematic view of the process of institutionalization taking place in India, to trace the genesis of the system of GRI support in India from the local to the national and then the international levels, to outline the main characteristics and results of this process, and finally, to present evidence that innovative activity of the informal sector, when

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institutionalized, can be integrated into a national innovation system.

### Key terms

For better understanding of the issues, two key terms must be defined.

#### *Informal sector*

The informal sector includes economic activity outside of government regulation in the form of unregistered enterprises and employment. The OECD excludes from the informal economy the services rendered by household members, volunteer services provided to the community, and nonmarket economic activities (products and services that are not for sale, for example, building a house) because of the inability to measure their cost (revenue, employment and share of GDP). The OECD also does not include the economic activity of the agricultural sector in many developing countries because this sector is too large and difficult to quantify.

In this article, the term 'informal sector' extends the concept of the informal economy given by OECD. The informal sector is considered here as the environment in which the activities of individuals and groups of individuals (communities, households), both within enterprises and independently, produce goods and services for the market (sales and profit) and for use within people's own households or community without material gain.

#### *Grassroots innovation*

There is no universal definition of grassroots innovation. For instance, Hilmi considers GRI an 'innovative product or process created at the bottom of the pyramid, usually due to necessity, hardship and challenges'<sup>11</sup>. Bhaduri and Kumar define grassroots innovators as '...individual innovators, who often undertake innovative efforts to solve localised problems, and generally work outside the realm of formal organisations like business firms...'<sup>12</sup>. Chinese experts suggest defining GRI as innovative activities of improving products, techniques, and crafts in a random and extensive way by the grassroots people who have grasped the corresponding techniques and skills. They extend it by inclusion of private research institutions and private enterprises as collective innovators<sup>13</sup>. Smith, Fressoli and Thomas consider GRI within grassroots innovation movements as socially inclusive innovation processes<sup>14</sup>.

Anil Gupta provided three different terms characterizing the innovations at, for and from the grassroots<sup>15</sup>. According to Gupta's classification, GRI is the innovation of uneducated people (without a professional

degree), who are self-employed outside the formal sector and develop their innovation completely without any outside help from formal institutions and organizations. He considers the exclusion of these innovators from the formal sector to be the main characteristic of grassroots innovation.

For this study, we utilized Gupta's definition of GRI because it stressed the complete separation of grassroots innovation from the formal sector. This makes the Indian experience of integrating of this type of innovation into the formal innovation system unique.

### Genesis of a system of institutional support

In the mid-1980s, Anil Kumar Gupta of the Indian Institute of Management, Ahmedabad (IIM-A), researched techniques of traditional farming in Bangladesh. In the course of his study, he came across many unique techniques and technologies invented by people who often were illiterate. He had the idea of recognizing the existence of such inventions and using them for the benefit of industry and the inventors themselves.

In 1988, Gupta along with a group of volunteer students and staff went to the villages of Gujarat in search of innovative solutions of ordinary people. In time, these people united by this idea became the Honey Bee Network (HBN). The honeybee symbol was chosen because, as a honeybee collects pollen from the flowers and shares it with flowers connecting them into mutually beneficial network, similarly the people of HBN extract knowledge and share it for common benefit, creating a knowledge network.

One of the initial, basic and ongoing activities of HBN is holding expeditions in different parts of India twice a year in search of grassroots innovations (*shodh yatra*, journey of exploration). The participants are volunteers. The results are technological and non-technological innovations based on traditional knowledge, thus on the creativity of ordinary people. Over several years, HBN collected more than 150,000 ideas, innovations and traditional knowledge practices (not all unique or distinctive) from over 500 districts throughout the country<sup>16</sup>.

HBN became the first brick in the future system of grassroots innovation support. It provided the initial step of scouting and documentation of innovation carried out by persons from the formal sector such as the students who participated in *shodh yatras*.

Innovations that were scouted needed to be validated and verified, so the Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI) was founded in 1993 with the support of the IIM-A, using its lab infrastructure and human resources. SRISTI's laboratories performed the primary microbiological, entomological and chemical analysis of materials or products scouted by HBN.

The first model of cooperation with an educational institution was developed here. If more sophisticated equipment was needed for GRI verification, SRISTI sent the samples to the appropriate laboratory of cooperating research or educational institutions.

SRISTI became the organization to raise the issue of protection of intellectual property rights (IPR) of grassroots innovators. The first aim of this organization is to help in protecting intellectual property of inventors and innovators who are from the grassroots, most of them with no financial ability or even knowledge of how to patent their inventions or to find other ways to protect their IPR. SRISTI's assistance to them involves public and private patent agencies (see dynamics of patenting in Table 1).

SRISTI's other activity is connected to patent law and practices as a whole and to needed policy change at the national and international levels. SRISTI has participated in meetings of the World Intellectual Property Organisation, and has campaigned for an International Network for Sustainable Technological Applications and Registration. Development of such a registry would allow people to share knowledge globally and provide a low-cost clearing house for connecting innovations with investment and entrepreneurial support<sup>17</sup>.

This step in institutionalization had two main results: a shift from individuals networking to institutions networking, and raising the question of IPR protection of grassroots innovators.

The earlier system for GRI support using volunteers and IIM-A facilities could not provide the fast-growing number of innovations with funds and infrastructure for incubating them if the inventor decided to become an entrepreneur. The solution was to set up Gujarat Grassroots Innovation Augmentation Network (GIAN) together with the Gujarat state government in 1997. It was registered as a trust and a society. GIAN is governed by a

board of representatives of the Government of Gujarat, IIM-A, commercial bodies such as Gujarat Venture Fund Limited, and social organisations such as Self-Employed Women Association, SRISTI and Gopaldham (Gopaldham is an organization for economic development of villages and the informal sector).

GIAN uses various frameworks of commercialization of innovations. Innovators may create their own companies to sell products, create a company together with an experienced entrepreneur, or transfer technology for further commercialization by a third party. Technology transfer can be implemented in different configurations, for example participation in the share of profits and equity participation. GIAN actively helps innovators in obtaining patents for their inventions, both in India and abroad. Patent Assistance Cell (PAC) established within GIAN has two main functions: to provide IPR awareness for grassroots innovators and to assist in all patent-related areas including filling IPR applications. Through close cooperation with governmental institutions and organizations, GIAN managed to reduce the cost of patenting for grassroots innovators to a minimum. For example, under a scheme of the Industries Department of the Gujarat government, 50% of the total expenses for filing and processing the patent applications is reimbursed by the government<sup>18</sup>. From 1997 to 2008, GIAN filed 39 patents in India out of which 20 were awarded. Seven patents were filed in the United States (US), of which four were granted<sup>19</sup>. This result was modest, first of all due to specifics of grassroots innovators, for most of whom even a low cost for IPR protection is not affordable. How to provide IPR protection of innovations of poor people remained a sensitive and open question.

Thus, GIAN has become the first Indian technology business incubator focused on incubation and commercialization of grassroots innovations. Moreover, GIAN's model was replicated in other states of India. Today, GIAN has grown into a large network, covering the north (GIAN North including Punjab, Haryana, Rajasthan, Uttarakhand, Delhi and Chandigarh), west (GIAN West including the Gujarat, Maharashtra and Goa), south of India (cells of GIAN in Tumkur and Madurai) and Srinagar (North India). There is also a cell in Assam (East India). The growing number of branches became a network of national significance and needed more systematic and scaled support from the central government.

In February 1999, in his budget speech in Parliament, India's finance minister Yashwant Sinha, announced the formation of the National Innovation Foundation (NIF); on 28 February 2000, the NIF formally came into existence with a budget of approximately 5 million USD<sup>20</sup>. It was established by the Department of Science and Technology (DST), Government of India and chaired by R. A. Mashelkar, Secretary of the Department of Scientific and Industrial Research. NIF raised the activity of HBN, SRISTI and GIAN to a new level. It became the

**Table 1.** Scouted and patented grassroots innovations and GRI based on traditional knowledge (TK)

Year	Scouted GRI and GRI (TK)	Patents filed
2001	1,643	2
2002	19,461	13
2003	25,809	38
2004	16,455	16
2005	31,744	5
2006		31
2007		51
2008	24,442	41
2009	35,000	20
2010	4,156*	45
2011	7,636*	210
2012		85

\*Innovations received through national competition.

Source: Constructed on the basis of Annual Reports of NIF from 2000–01 to 2011–12.

integrating node in the institutional infrastructure of the system of GRI support and development.

In 2006–07, DST scaled up its support to the NIF. Instead of trying to augment its annual budget, which would not have enabled generation of adequate financial resources, NIF became an institution under DST, receiving annual grants from the Government of India while maintaining its autonomy, flexibility and informal culture.

Five main activities are performed within the NIF which integrated the activities of HBN, SRISTI and GIAN:

- Scouting and documentation.
- Value addition, research and development (R&D).
- IPR protection and licensing.
- Information and communication technologies application and dissemination.
- Business development and microventure.

The NIF as a governmental organization at the national level, thus, extended the cooperation network into the formal sector, establishing many horizontal connections with governmental and non-governmental organizations, research and educational institutions, and private companies in order to carry out all five types of its activity (Table 2).

Department of Business Development was established as a part of the NIF to ensure the transition from innovation to business enterprises. The basic goal of Department of Business Development is to build a value chain around GRI to facilitate their transition into self-supporting sustainable enterprises. The ultimate objective is to make these innovative products available to the masses of people through the market mechanism or in other ways.

Innovations appearing at the grassroots level are triggered most often by needs of everyday life in circumstances of limitations in resources. Many such inventions are very useful not only for the innovator but for other people who face similar problems in everyday life. Most often, these are problems of drinking water, nutrition, health, and lack of energy sources: problems of high social importance. These GRI are diffused with the participation of municipal, state and central government authorities at various levels. Several examples of such projects are as follows:

- Pulley with stopper with a lever arrangement that ensures one-way movement of the rope and bucket. The DST, Rajasthan, is considering installation of this innovative pulley in five villages in Rajasthan.
- Check dam, taken up for replication with the assistance of GIAN (West) in Rajasthan. A check dam with a series of semicircular structures was constructed in a village near Jaipur by the local community with the help of Morarka Foundation. Seva Mandir offered to replicate it in the Udaipur region the next year<sup>21</sup>.

The commercialization of GRI is carried out mainly through cells of GIAN. However, the scarcity of financial resources remained a constraint for this process. Many grassroots innovators could commercialize their innovations by themselves, but for some, there were many difficulties in securing funds to start a business. In addition to high risks and low profit, there is a problem of access to formal funding through financial institutions, and lack of eligibility of grassroots innovators for loans because they do not have the financial guarantees and collateral. Institutionalization of GRI funding was a unique and innovative solution to this problem.

In October 2003, Micro Venture Innovation Fund (MVIF) was set up with financial assistance of Rs 40 million (about US\$ 1 million) from Small Industry Development Bank of India (SIDBI), with an additional sum of Rs 10 million to meet the transaction costs of managing the fund.

MVIF is a unique organization, providing financial assistance to grassroots innovators on one signature, with a simple framework agreement without any guarantees and guarantors. These funds provide financing exclusively for risky innovations with limited or no commercial market. One of the main criteria for the selection of projects for funding is their social value and social good. Funding is provided directly or through regional incubator-type organizations such as GIAN and its cells. In its 10 years of existence (2003–2013), MVIF supported 185 projects in the total amount of Rs 35.57 million, and disbursed Rs 31.54 million; the total amount repaid was Rs 15.58 million (ref. 22).

Another novelty in funding GRI was setting up Grassroots Technological Innovation Acquisition Fund (GTIAF) in 2012. It works mainly with GRI with high social impact. The GTIAF acquires rights to technologies from the innovators for generating public goods. It prevents people from waiting for 10 to 20 years for getting their first return out of their unique solution or innovation. Some of the acquired GRI are open source, and some of them can be pooled and blended to form new products. These can then be licensed to a large number of small entrepreneurs at low or no cost to promote large-scale diffusion of the technologies. In 2012, 24 farmers from 8 states, who had developed over 39 improved varieties of 15 crops (such as paddy, wheat, mustard and beans), received Rs 120,000 from the GTIAF. In total, the NIF has acquired rights to 70 technologies at the cost of Rs 275,000 (ref. 23).

NIF has become an apex institution of a system of GRI support in India. It has managed to involve organizations of various types and even of other countries in networking to support every step of innovation development from idea to product mass diffusion.

A good illustration of NIF's activity is the motorbike–polycultivator invented by Mansukhbhai Jagani in a small village in Gujarat. To help his family survive, Jagani had

## GENERAL ARTICLES

**Table 2.** Main collaborators and counterparties of NIF

Organization	Organization and country of origin	Activities
United States Agency for International Development (USAID)	Government organization, US	USAID granted financial awards to three Indian grassroots innovators through its India–Africa Agriculture Innovations Bridge Program, aimed at sharing Indian innovations with African countries for increased food security and nutrition under Feed the Future, the US government’s Global Hunger & Food Security Initiative.
Tata Agrico, 2013	Private company, India	Implementation of pilot projects at the stage of commercialisation at the local level. Agrico co-brands the technologies developed by the grassroots innovators registered at NIF.
Electronics and Quality Development Centre (EQDC), 2012	State government organization (Gujarat), India	EQDC will provide: Infrastructure facilities and guidance for prototyping of innovations <ul style="list-style-type: none"> <li>• Mentoring and certification services</li> <li>• Testing support.</li> </ul>
ISIS Innovation, Oxford University, 2012	Higher Education Institute, UK	ISIS Innovation Limited is Oxford University’s technology commercialization company. Activity to be performed includes international marketing, accelerated technology assessment and commercialisation pathways, strategic support, training and entrepreneurship, technology development support, relationship with industry and investors, and technology and company acquisition support.
Indian Council for Medical Research (ICMR), 2011	Public institution, India	Validation of traditional knowledge found and collected by NIF; adding value to herbal knowledge.
Council for Advancement of People’s Action & Rural Technology (CAPART), 2010	Government agency, India	NIF will assist selected members of organisations and state bodies to adopt/expand methods and systemic approaches to scout, document, and promote grassroots innovation through knowledge sharing and networking. Technologies will be identified for social and commercial diffusion after validating and improving.
Future Ideas Company Ltd, 2010	Private company, India	Commercialization of ready-for-sale innovations, technologies and products. Implementation of projects in the framework of coinnovation lab ‘Khoj Lab’. In 2012, NIF and Future Group founded for-profit company ‘Idea India ka Innovations Pvt Ltd’ for conducting market research, developing and making products from GRI for global markets; 50% stakes would be held both by NIF and Future Group with NIF making its investment only in terms of technologies on behalf of the innovators. The company will bring out products that are truly ‘Indian’, and will be branded as ‘Idea India ka’.
Kerala State Information Technology Mission (KSITM), 2006	Public organization, India	Protection and preservation of traditional knowledge, promoting grassroots-level innovations, sharing knowledge resources, creation of Knowledge Registers, dissemination of innovations and traditional knowledge using ICT tools.
Indian Institute of Technology Kanpur, 2005	Central Institute (Public), India	Infrastructure assistance in the implementation of prototypes, testing and calibration of innovations; memorandum of understanding for GIAN-Tech, a Technology Incubation Cell, was signed with IIT Kanpur, to develop the products of Grassroots Innovators at IIT Kanpur.
CSIR, 2004	Public institution, India	Validation and adding value of grassroots innovation. R&D in four areas: herbal, mechanical, food processing and nutraceuticals (engineered foods with added health benefits, energy). Management and monitoring is done by joint committee, chaired by Dr R. Kumar (Indian Institute of Science, Bengaluru).
Small Industry Development Bank (SIDBI), Lucknow, 2003	Bank, India	Agreement establishing the Micro Venture Innovation Fund (MVIF).

Source: Constructed from Annual Reports of NIF (2001–2013).

to leave primary school; for the past 25 years, he has been running a small repair and fabrication workshop.

The traditional way of ploughing using bullocks was getting increasingly difficult due to lack of fodder for animals in the drought-prone areas of Gujarat. The need to replace the bullocks with mechanical alternatives led Jagani to his invention.

The idea was to convert a three-wheeler motorbike into a ploughing, weeding and sowing device by replacing the rear wheel with an attachment with two wheels and a tool bar. This motorbike–polycultivator is cheap, fuel-efficient, and easy to maintain. The invention had potential for local and global application. NIF arranged the transformation of the invention into a product by involving

Indian organizations and institutions from abroad. NIF requested National Institute of Design to develop a product design. GIAN provided value addition and help in patent filing in India. Besides India, patent was granted in the US (Indian Patent Number: 205097; US Patent Number: 6854404)<sup>24</sup>. As a pilot project, the Sloan School of Management at the Massachusetts Institute of Technology developed the business plan. Initially, Jagani manufactured the Santi in his workshop. Jagani's invention was adopted and even improved by other farmers. In May 2008, NIF and GIAN took the initiative to organize a workshop to test the ideas emerging from the original innovator as well as those who copied and improvised Jagani's design. About 30 innovators, users and another 20 stakeholders met to discuss ways and possibilities of design and functions improvement. Thus, this innovation was diffused and extended in functionality by other farmers<sup>1</sup>.

The case of Roshan Lal Vishwakarma is an example of NIF activity to strengthen grassroots technological innovations and important traditional knowledge by creating markets for India's grassroots innovators through collaboration with leading corporate houses. Vishwakarma, from Madhya Pradesh, invented sugarcane bud chipper equipment that can separate more than 300 buds per hour. It saves 90% of the material of sugarcane, which can be utilized for making sugar. It also reduces transportation of seed material as it needs only 13 quintal buds for sowing instead of 125 quintal as in traditional practice of sowing buds. Micro Venture Innovation Fund at NIF provided him a loan of Rs 125,000/USD 1,965 for promotional activities and raw material purchase to fill small batch orders. NIF filed a patent (1501/MUM/2008) for the technology in the innovator's name<sup>25</sup>. Despite the patent not having been granted yet due to bureaucratic delays, Vishwakarma set up a company, Jay Ambey Steel Fabrication and began production of the bud chippers.

The need to scale up the production arose after involving Tata Agrico to market this innovation. Tata Steel's oldest brand Tata Agrico and NIF signed a memorandum of understanding (MoU) to market the innovations through Tata outlets. The bud chipper innovated by Vishwakarma was a pilot project of this MoU. MVIF granted Rs. 900,000/USD 14,147 to scale up the manufacturing capacity of the sugarcane bud chipper to meet the order of 1500 pieces generated by Tata Agrico. Tata Agrico agreed to pay a mutually agreed fixed margin to the innovator on the sale of every unit of the machine<sup>26</sup>.

Thus, NIF is an intermediary for interaction between the informal, unorganized sector that is performing innovative activity and the government. It allows communication of the real needs and demands of these people to the government. NIF also provides an interface, a platform for cooperation with universities, research institutions and companies.

## The international level

The international activity of NIF and HBN, SRISTI and GIAN within it, is of two types:

- Implementing the HBN model and philosophy in different countries.
- Networking cooperation aiming to create a global network of knowledge and virtual infrastructure for GRI support.

At first, SRISTI initiated steps to identify similar networks in different parts of the world to involve them in scouting and documentation activities. Two networks were found: Tianjin University of Finance and Economics (China) and Brazilian Association of Science Parks and Business Incubators (ANPROTEC). Both participated in scouting and documenting local innovations. In 2007 at Tianjin, the participants of the International Conference on Global GIAN from Asia, Africa, Latin America, Europe, Canada and the US announced the launch of an 'online platform to recognise, respect and reward green grassroots innovators and traditional knowledge holder'<sup>24</sup>. It was the beginning of building Grassroots to Global (G2G) network that is intended to become an off-line and online incubation platform, Global GIAN<sup>27</sup>.

International cooperation on the institutional level began with the signing of a MoU between NIF and the Malaysian Innovation Foundation or Yayasan Inovasi Malaysia in 2011. In 2012, NIF signed an MoU with South Regional Center for Science and Technology, Mozambique. The parties agreed to share resources and expertise to develop specific programmes for grassroots innovators in line with the common objective of reaching out to youth, women, people with disabilities and grassroots communities. This partnership is to be developed within the G2G vision of marketing grassroots innovation from one country in another.

This can be considered an initial step in international institutional networking to support GRI activities in all countries: scouting and documenting, adding value, commercialization, and diffusion for commercial and social use around the world. The need and possibility of international cooperation in the field of GRI development is conditioned by the specifics of GRI, and is a major initiative to solve problems of poverty in the agricultural population, a large sector in many countries of Asia, Africa and South America.

## Conclusion

In India, the institutionalization of innovations from the informal environment has had specific features:

- The institutionalization process is built on 'bottom-up' principles. It is completely conditioned by reality

(existing problems, available resources) and demand-based. It maintains a high level of efficiency and utilization of resources. This is typical also for grassroots innovations themselves.

- Organizations for support and promotion of GRI are not hierarchical, but rather horizontal, based on networking principles. This is the same principle they use for cooperation with organizations and companies of the formal sector. It decreases expenditure of time and resources, making this cooperation faster and more effective.
- The main function of organizations within this institutional architecture is to provide channelling of internal (within the informal environment) and external (with the formal sector) communication. This ensures the entire chain of processes by enabling innovative product development (scouting, verification, validation, testing, prototyping, IPR protection, commercialization, technology transfer, social diffusion) and decreases transaction cost at all stages.
- This type of institutionalization is scalable on the regional, national and international levels.

One of the most important results of the institutionalization of innovations from the informal environment in India has been awareness and recognition of the innovative capacity of the informal sector and people who generally were considered as burden on the national economy. Along with the institutions that were created (SRISTI, GIAN, NIF, MVIF and GITAF), the capacity of the formal sector to integrate grassroots innovators in the national innovation system as its equal participants expanded greatly. For people in the informal environment, this indicates the possibility of economic growth, self-development as entrepreneurs and promotion of creativity.

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