Repositioning grassroots innovation in India's S&T policy: from divider to provider

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Analysis of the features attributed to grassroots innovation shows them to be common to all innovations whether in rural, industrializing or industrial locations and does not justify splitting innovation into one with the suffix 'grassroots' and another without it as done in India's current innovation policy. Examples and experience from industrialized countries bring out that innovation policies should adopt an integrated approach for all innovations irrespective of the location or process they emerge from. Enforcing the rural/non-rural duality that is inherent in India's S&T and R&D policy on innovation is misleading. The innovation agenda should shift from presenting grassroots innovation as a divider of the national innovation wealth to a provider of it.

Keywords: Divider to provider, grassroots innovation, innovation-divide, innovation policy.

THE term 'grassroots innovation' emerged from the systematic and sustained work of the Honeybee Network in India on innovations emerging from the knowledge, experience and skills embedded in communities and individuals outside the formal institutions of education, scientific research and industry and is equated to innovation in a rural environment for solving problems of and within a small community[1]. It is also characterized as applying technologies for solving rural problems based on locally available knowledge, skills and materials[2]. The term grassroots innovation finds increasing references in a variety of contexts[3] and technical change activities and practices involving trial and error[4]. Descriptions of innovation with the prefix 'grassroots' attribute certain features to it and present it as constituting a separate category of innovation. In contrast to the Indian practice, Western countries, either during their initial or later phases of their industrialization, never treated innovations as falling into those two categories (see note 1).

This article seeks to answer the following questions:

- Why does India, an industrializing nation, adopt a different approach and divide innovation into two categories?
- Should innovation policy in India be formulated on the basis of treating innovations with and without the prefix 'grassroots' differently?

In the next section, we start with a careful analysis of the attributed differences for innovations with and without the prefix 'grassroots' and proceed, in subsequent sections, with an analysis of the implications for India's innovation policy.

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Features attributed to grassroots innovation

To bring out the essential features of grassroots innovation, we begin by dividing socio-economic spaces into two contrasting spaces: a primarily non-industrialized space dominated by an agricultural economy in rural areas outside or at the periphery of the other socio-economic space occupied by formal structures of education, research and industrial economic activity ('agricultural' and 'industrial' spaces, for brevity). For clarity, we term innovations in the agriculture space as Type 1 and in the industrial space as Type 2. In the literature, grassroots innovations are often associated with rural areas or the agriculture space.

Type 1 innovation

The first feature to note is the nature of the Type 1 innovation. In the agricultural spaces, usually viewed as rural, technological innovation and technical change are necessarily based on learning by doing and modification of traditional practices. Going back in history, control of fire and use of stone implements and tools can be considered as examples of Type 1 innovation in its most rudimentary form. Before the emergence of industrialization, processing of metals to make useful products may be considered as a more mature form of Type 1 innovation. Experimentation was involved in such innovations, however, in the absence of science, the underlying theoretical basis and understanding that could connect the results of different experiments and observations was missing.

The second feature to note is the ownership of Type 1 innovation. Even in the emergent period of industrialization, people with technical skills were the innovators and the ownership of their innovations was based on their technical ability to use the material resources accessible to them. Innovation typically remained exclusively within select 'skills groups' such as guilds. Diffusion or use of such innovations outside the community was slow as the movement of skilled persons or the innovators limited it.

Thus we can discern the following main features of Type 1 innovations in non-industrialized socio-economic spaces:

- Innovations are based on the skills of individuals in a 'community' through learning by doing and improvization by trials.
- Exclusivity is based on innovator-embodied protection.
- Innovations diffuse within a small region because the mobility of the required skills is limited.

Although programmes of the Honeybee Network have adopted a deeper epistemic and holistic approach to grassroots innovation[5], the literature usually uses the above features for placing such innovations in the category of grassroots innovation.

Type 2 innovation

Let us now turn our attention to innovation in industrial socio-economic spaces. The industrial and scientific revolutions occurred almost simultaneously with both developments feeding into each other. Their coevolution created a new type of socio-economic space occupied by linked formal structures of education, research and industrial economic activity. In such spaces new systems of realizing economic value from Type 1 innovations could emerge, by forging linkages between insights and innovative activities of individuals with research and entities engaged in organizing production and marketing.

Thomas Alva Edison (1847–1931) was perhaps the first to pilot such a linked system. By organizing a team of people skilled in engineering, physics, chemistry, mathematics and model-making, he was able to do R&D **on** his Type 1 innovations (emphasis on 'on' may be noted) and disaggregate and codify the processes involved in making new products[6]. Formal, scientific R&D enabled acquiring causal understanding of the technical change process involved in innovations. This method of R&D on individual observations and discoveries gradually spread and it became possible to understand the 'know why' and 'know how' of technical changes. This understanding enabled making machines for replicating the technical change process and for making new products on a large scale. Application and use of innovation got delinked from the technical skills of the innovator. This delinking changed the channel through which innovation was protected and diffused. The knowledge of what technical change can be brought about by innovation got documented in a patent and machine could reproduce the skill required for its application. In other words the importance of innovator in the protection, application and diffusion of his innovation became less and was gradually replaced by a formal legal system of documented patents. Once patented or embedded in machines through the R&D conduit, innovations could diffuse into any production system and big corporations that invested in R&D, acquiring patent, machines for mass production and organizing production with standardized skills could emerge.

The economic success of innovation based on R&D and organized production systems in the industrial socio-economic space was so spectacular that the R&D institutions which were the conduits for innovations to enter the markets came to be viewed as the location of innovation. The strength of the R&D effort and the number of patents became important elements for indexing and measuring the innovation capacity of a country, as done for example in the Oslo Manual[7]. Patents and machine-embodied codified forms of innovation became the basis of the financial returns to the stakeholders, the innovator and the production organizations. Moreover, innovations could diffuse over long distances aided by the growing communication and transport systems. The thus constituted Type 2 innovations began diffusing in the literature from the 1940 onwards and became the sole claimant to the term 'innovation'[8].

Thus the main features of Type 2 innovation in the context of industrial spaces can be discerned as follows:

- Developed through the R&D conduit.
- Uses organized structures of production and marketing.
- Protected by a system of innovator-disembodied patents and machines.

The last two features are a consequence of the use of the R&D conduit and that makes formal, scientific R&D the essential feature that distinguishes Type 2 from Type 1 innovation.

The common features of Type 1 and Type 2 innovations

We revert to the features attributed to Type 1 (grassroots) innovation:

- Based on skills and understanding of individuals in a *community* (italics may be noted).
- Protection is innovator-embodied.
- Diffuses within a small region.

We have seen that the last two features differ in Type 1 compared to Type 2 innovation because innovations are

developed through the science-based R&D conduit. However, the first feature we shall argue referring to historical examples of the development of the aeroplane and of the Internet, is common to both and cannot be used for dividing innovation into two categories.

The Wright brothers took to the air in 1903, well before science could describe the principles of flying. Imitating the birds, the Wright brothers observed that it should be possible to devise a human contraption for taking to air. By trial and error they succeeded in their first flight. This innovation indeed had all of the features of Type 1 innovation. However, the industrializing socio-economic space did not ignore this innovation, but did R&D on it and developed it further with stronger materials and powerful engines leading to the large-scale commercialization of the aeroplane. The journey of this Type 1 innovation to commercial success was long because it occurred in the period when the industrial space was still in its nascent stages. R&D, organized manufacturing and production activities and the inter-links between these were still emerging. An important point is that the origin of that Type 1 innovation did not prevent the industrializing space to view it as worthy of connecting with R&D.

Whereas the aeroplane provided an example from the past, the development of the Internet provides an example of a Type 1 innovation in the contemporary, mature industrial socio-economic space. The Internet emerged from an IT platform based on 'the skills and understanding of individuals in a *community*, developed by physicists wanting to share data through learning by doing and improvization by trials. These are the typical features of Type 1 innovation and yet also in this case the industrial space connected it with advanced R&D.

The experience of industrialized countries shows that they, neither at initial nor at advanced stages of industrialization, made distinction between innovation on the basis of where it first manifested, in individuals like Wright brothers or in a *community* like that of physicists. The prevailing strategy was to put all innovations through the R&D conduit into economic activity. The feature attributed to grassroots innovation that it is based on skills and understanding of individuals in a 'community' through learning by doing and improvization by trials does not justify splitting innovations into two. Even if we wished to divide innovations into two categories, the only valid criterion for this would be innovations yet to enter the R&D conduit and innovations already in the R&D conduit. The feature that Type 2 innovation diffuses through innovator-disembodied protection is not a dividing feature of innovation, but is a consequence of its entry into the R&D conduit.

India's S&T and R&D policy divide

An S&T strategy specific for rural development is in many ways a unique feature of India's S&T policy, in contrast to the innovation policies of present-day industrialized nations. The origin of this duality in India can be traced to developmental debate, during and after independence, whether priority should be accorded to industrialization on one hand and to rural occupations on the other. The debate was never resolved, but a compromise was struck. Large-scale industrial development and development of cottage and handicraft occupations in rural areas were both accepted as legitimate strategies. As a consequence, S&T programmes were also split into two streams. But the stream connecting R&D to industrialization emerged as the dominating (elite) S&T trajectory appropriating the major share of the scientifically and technologically trained human resources and of the R&D infrastructure and financial resources. The other (subaltern) stream received assorted efforts under the heading of S&T for rural development aimed at finding solutions through R&D for problems faced by marginalized rural communities[9].

The innovation agenda in India is considered to be part of the S&T policy. The fact that science is not technology and that technology alone is not innovation, succulently expressed, as 'science ≠ technology ≠ innovation' is to be recognized[10].

In India's S&T policy the connection of R&D with rural areas comes through the S&T programmes for rural development implemented as R&D *for new* innovations that may solve problems in rural areas and not as R&D *on* innovations *existing* in rural areas. The dimension of R&D *on* existing innovations in rural areas is not part of the S&T policy. The view of socio-economic spaces divided into rural and industrialized or industrializing spaces inherent in the S&T policy has been carried over into the innovation agenda.

Unlike the industrialized countries that made R&D on innovations in whatever form and wherever they existed a part of their innovation agenda India has, following the S&T policy approach and without recognizing the distinction between R&D for innovation and R&D on innovation, put innovations in rural areas in a category outside the main stream R&D programmes.

The industrialized countries never had such an absolute divide, but there are and have been imbalances in appreciation. There was a time when the role of small companies was undervalued compared to the impact of the very large companies. The centre of the innovation effort was thought to be in the large research laboratories of the big, often international, corporations. They were seen to be the developers of breakthrough technologies and the radical innovations that changed the world and as a result received the dominant attention in the S&T policies of that time at the expense of small and medium enterprises (SMEs).

Current innovation policies tend to be more balanced and recognize that there are many forms of innovation and a variety of players are required for success. Large

companies are masters of incremental innovations and breakthrough technologies, whereas most radical new products are brought to market by SMEs. Furthermore, the interdependence between the players in the innovation arena has increased significantly. Large companies have outsourced most or all fundamental research to universities; the universities have created incubators for assisting techno-starters with their innovation efforts; large research centres have created facilities for start-up companies and SMEs for stimulating exchange of know-how and skills; regional authorities and governments create science parks and 'innovation corridors' for the same reasons. These cooperation and exchange facilities can be considered as the modern forms of 'innovation communities'.

Conclusions

So what should the innovation strategy of India be? Should the country adopt an integrated strategy for all innovations or label certain innovations as 'grassroots innovations' and keep these outside its strong R&D conduit based on from where and how the innovations emerged? Which questions should be addressed for finding a better way for building an innovation agenda?

First, an innovation policy needs to recognize that 'science ≠ technology ≠ innovation'. All new technological approaches or innovations, whether demonstrated in laboratories or amongst user communities in rural areas, may be viewed as 'emergent innovations'. R&D on such innovations for meeting requirements of other users or for wider diffusion is known to be a cost-effective route for the realization of their full economic and social benefits[11].

Secondly, the present innovation agenda appears to, by default, continue to view innovation as part or extension of a divided S&T policy. This has kept innovations with prefix 'grassroots' in a separate category leaving it to the concerns of those who, outside the mainstream, are in 'S&T for rural development' stream. Mainstream R&D considers such innovations, just as it does R&D for rural development, as a peripheral agenda. However, this approach minimizes the possibilities of realizing the full economy value of grassroots innovation and deprives the innovators of their due share. If this situation is not addressed and corrected, the nation will not only remain deprived of the economic value of innovations already manifest in rural spaces, but will also perpetuate and widen the divide between rural and industrial spaces. It is to be noted that India's aspirations of inclusive development calls for removing rather than reinforcing features in innovation policy that exclude rural spaces[12].

Thirdly, successful innovation policies need to recognize that a variety of companies and innovators are needed for bringing different innovations successfully to the customers. A simple split into two categories of innovation does not represent the complexity of the total innovation effort. The basic requirements are the same for all innovators – access to know-how and risk capital, and a sound entrepreneurial climate – but the way this is provided may have to differ. A successful innovation policy requires an all-inclusive integrated approach.

It may therefore be wiser to adopt an approach that reconstructs grassroots innovations as providers to the national innovation wealth and not as dividers of it. Innovation policy and strategy dialogue should shift from undermining the importance of grassroots innovation (exemplified for example by viewing grassroots simply as *Jugaad*) and focus on ways of formulating national systems of innovation and remove bottlenecks that prevent innovators and innovations in rural spaces to become part of the mainstream R&D effort.

Note

1. Grassroots innovation in the Western world is a relatively recent phenomenon. They are community-led initiatives for sustainable development, using green technologies in areas such as energy, housing and food. It is often associated with new value systems and attempts for creating new lifestyles and alternative social institutions. The settings and purpose of these initiatives are profoundly different from grassroots innovation in India and from the definitions used in this article.

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