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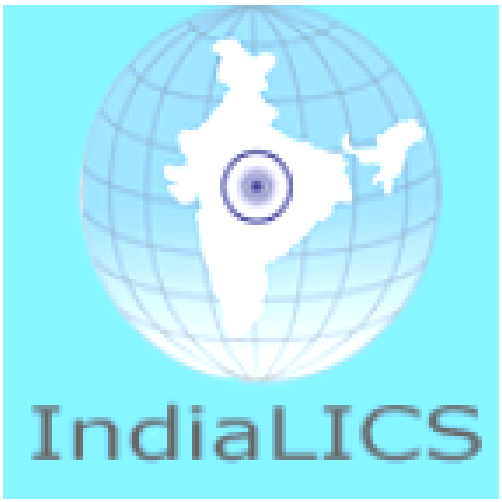

Patents and grassroots innovations: rethinking intellectual property rights in the informal sector

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Patents and grassroots innovations: rethinking intellectual property rights in the informal sector

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Abstract

This paper aims to explore the role of intellectual property rights (IPR) for informal sector innovations with special reference to grassroots innovations in India. Drawing on the literature on patents and innovations in the formal sector, we examine whether the theories and rationales which promote IPR can stimulate innovations in the informal sector too. In India, grassroots innovations represent informal sector innovations and the management of their intellectual property is one of the main activities of National Innovation Foundation (NIF). IPRs as an institution have supported innovations by firms and industries which have a large market and resources to commercialise their products. Grassroots innovations on the other hand represent a culture of individual innovators who innovate out of adversity and needs, most of whom are unaware of IPR. By conducting interviews with grassroots innovators and collecting patent related data of grassroots innovations from secondary literature we seek to explore whether the current institution of IPR could provide same set of incentives and motivations to the informal sector innovators as it has to certain industries in the formal sector. The study finds that most of the grassroots innovators are unaware of these rights or the process of filing patents and also consider the entire patenting process very complex to understand.

Keywords: Intellectual property rights, Informal sector innovations, Grassroots innovations, India

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1. Introduction

Intellectual property rights (IPR) in general and patents in particular are considered to be the major drivers of innovation today. They have been studied and researched by a number of scholars in the past and present, but almost all of those studies focus on innovations emerging from the formal sector. The main proposition of the advocates of a strong patent regime is that it encourages and contributes towards economic progress of any nation. New ideas and technologies are considered to be the primary source of economic growth in the modern world. Hence it is argued that incentives should be provided to those who undertake risky and costly investments to generate these new ideas and technologies. The incentives proposed were in the form of IPRs which gives the knowledge producer a monopoly over his idea for a limited time period. The proponents of IPR argued that if the new knowledge, which is valuable, is not protected then it will lead to imitation and hence reduce the potential profits of the inventors and subsequently the motivation to engage in the innovative activities will decrease (Maskus 2000; May 2007; Mazzoleni and Nelson 1998; May and Sell 2006).

The instruments of IPR like patents and copyrights have led to an increase in the innovative activities in many industries and sectors like biotechnology, pharmaceuticals and chemicals. The firms in these sectors invested heavily in R&D knowing fully that once the innovations are successful, they will be able to recover the costs incurred by them through commercialising their products. Hence it can be argued that a global IPR regime did trigger innovations in the formal sector. Today, informal sector are also considered and widely recognised as reservoir of knowledge and economic activities. Many innovations are generated from the informal sector. However, the innovations in the informal sector are quite distinct from the innovations in the formal sector (Bhaduri and Kumar 2011). The informal sector innovators are unaware about patents and other instruments of intellectual property protection.

Innovations in the informal sector are also termed as ‘grassroots’ innovations, ‘base-of-pyramid’ innovations, inclusive innovations, pro-poor innovations, and frugal innovations (Kumar and Bhaduri, 2014). The Government of India in the year 2000 established a National Innovation Foundation (NIF), an autonomous organisation under Department of Science & Technology, to provide adequate help and support to the grassroots innovators for further development of these innovations. Providing intellectual property protection to these innovations is one of the primary activities of NIF. NIF, on behalf of the grassroots innovators, have so far applied patents for around 742 innovations in India and US.

Grassroots innovations are defined as bottoms-up innovations which are extremely practical solutions in harsh and poor circumstances. These innovations provide a different solution from the mainstream innovations and focus of local situations and problems. They are developed in a resource constrained conditions using the traditional knowledge on one hand and modifying the existing technologies on the other hand. The motivation for most of the grassroots innovators is not to get their innovations commercialised but to solve the problems of their family and community.

Taking the case of grassroots innovations in India, this paper aims to explore its present patenting scenario and the perceptions of grassroots innovators towards IPR. Drawing on the IPR literature, we explore whether patents could stimulated the innovations in informal sector in the same way as in some of the industries in the formal sector. It may be possible that creators of these innovations would find motivation and incentive which are different from IPR and other monetary incentives. The paper is specifically concerned with the

understanding of the grassroots innovators' perspective such as their awareness about IPR, their involvement in the patenting process, and whether IPR can help these innovations to diffuse in the market.

Lincoln, in one of his famous speech referred to patents as *fuel of interest to the fire of the genius in the discovery and production of new and useful things* (May and Cooper 2014). This speech was highly quoted by scholars, proponents and advocates of a strong patent regime. Grassroots innovations offer an interesting case to explore the institution of IPR. Innovations in the formal sector are developed keeping in mind the commercialisation aspect. Today rather than finding solutions to the local needs, innovations are done for problems having a global market (Kumar 2008). This is evident in the case of pharmaceuticals, where firms have invested heavily in innovating lifestyle drugs, rather than orphan drugs (Troullier et al. 2001). Patent regimes have also been used by the firms for stalling rather innovating new products (Mansfield 1986; Suarez-Villa 2009). It is also argued that small firms and individuals have less value for patents as compared to the big entities (Bessen and Meurer 2008). Grassroots innovation offer different characteristics than formal sector innovations in many ways. These innovations are developed using locally available raw materials and the traditional knowledge. The intrinsic motivation for creating these innovations is to help the family and community of the innovator. Patents serve only as an extrinsic motivation which drives out the intrinsic motivations in the long run (Bhaduri and Kumar 2011). Therefore this paper explores the various theories and rationales promoting IPR keeping in mind the characteristics of informal sector innovations and the perceptions of the grassroots innovators. We seek to explore whether the current patent regime can provide the same set of incentives and motivations for innovations emerging in a different context or if it needs a relooking.

The paper starts with a critical review of literature on IPR which will help us to conceptualise IPR and the various theories which promote them. The section will also conceptualise grassroots innovations for a better understanding of this phenomenon. It then offers a discussion on the current patenting scenario of grassroots innovations in India and the role of organisations like NIF and other private intellectual property firms in filing applications on behalf of the grassroots innovators. Before concluding, the paper also discusses the perceptions of grassroots innovators regarding the whole patenting process and explores whether IPR is affecting the development and diffusion of these innovations in the market.

2. Literature Review

2.1. Patents and innovation

IPR are considered to be one of the most authoritative methods for protecting the creations of mind such as inventions and innovations. World Intellectual Property organisation (WIPO) defines intellectual property as "creations of minds such as inventions, literary and artistic works and symbols, names, images and designs which are used in commerce" (WIPO). Due to their commercial value these innovations and inventions are accorded the status of property. Intellectual property is divided into two categories of industrial property and copyrights (May 2007). Industrial property includes patents, trademarks, industrial designs and geographical indicators whereas the copyrights involves literary works like novels, plays, films, artistic works and architectural designs. Thus, broadly, intellectual property involves legal rights which are a result of intellectual activity in the industrial, scientific, literary and artistic fields. WIPO, which is a specialised body of UN,

administers intellectual property across the world. Intellectual property is regarded as an important policy instrument today for making an impact on the economic and technological progress in the country. The most far reaching commercial dynamics of IPR were revealed with the emergence of World Trade Organisation's Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement of 1995.

The normative justifications of IPR can be traced in the property theories of various thinkers. The Ownership theory of John Locke (1690), Hegel's Personality theory (Spinello and Bottis 2009), and Utilitarianism Theory of John Stuart Mill and Jeremy Bentham are often cited to justify IPRs on philosophical grounds. The rationale behind IPRs was proposed by economists like Machlup and Penrose (1950), Machlup (1958) and later on evaluated by scholars like Kaufer (1989), Mazzoleni and Nelson (1998) and Anderson (2004). These rationales and theories which justify a strong IPR regime in the world can be categorised as following:

1. Market Creation: According to this theory, the new inventors and creators of any idea desire for a strong protection of their creative and intellectual activity in the market. Since markets are vulnerable places these IPR protections help the inventors against the failure of markets.
2. Incentive and Motivation: This theory justifies IPR by claiming that special rights for emerging and existing creators and inventors will motivate them to continue with their future activities. These incentives serve as the reward for the inventors and will encourage more innovations across the world.
3. Entrepreneurial Development: This rationale justifies IPR by arguing that as long as IPRs are enforced and protected in the right manner in a society it will lead to a growth in the entrepreneurial activities in the world.
4. Information Disclosure and Exploration: According to this theory IPR are society's award to the inventor for disclosing their inventions to the world which will lead to further exploration of a broad prospect.

There have been a number of studies in the past by scholars to analyse the importance of patents to the firms which invested heavily in R&D. The study of Scherer (1965) in the US and Taylor and Silberston (1973) in the UK concluded that except for pharmaceutical firms none of the firms regarded patents as either effective or necessary to appropriate returns on investments from R&D. Similar kind of studies were also done by various scholars in the 1980s and 1990s and the situation seemed to be very much the same (Mazzoleni & Nelson 1998). The claim that IPRs induce commercialisation is also challenged by studies which concluded that innovations of large firms are actually based on inventions which are bought by them from smaller firms and private inventors (Mueller 1962).

It was assumed that the institution of IPR will motivate the individual innovator for further innovations but it was unable to do so (Noble 1977; Kingston 2005). The sudden increase in corporate research led to increase in patenting by larger firms which saturated the patents which were assigned to small and individual inventors because they were either driven out of the race or absorbed into corporate research (Suarez – Villa 2009). Invention and innovation thus became a corporate affair in the latter half of the twentieth century and the power of research shifted from individual to corporate inventors. The individual inventor has a much smaller role to play today as they once did. A vast majority of patents in US used to go to the individual inventors who would sometimes commercialise their innovations or licence their rights. However, the share of patent grants to individual and small inventors in US decreased from 25 per cent in 1963 to 12 per cent in 2003 (Bessen and Meurer 2008).

Thus, the whole patent system seems to support the corporate system of innovations rather than individual and small innovators.

The incentive and motivation rationale to innovate also seems to support those innovations which have a large market for its diffusion. The study by Mansfied, Schwartz & Wagner (1981) for example found that about 90 per cent of pharmaceutical innovations and 20 per cent of chemical, machinery, and electronics innovations would not have been introduced without an effective patent system. The drug discovery and development targeted at the parasitic and infectious diseases in low income nations of the world came to a standstill as pharmaceutical companies were unable to recoup their investments in R&D for products to treat diseases which are prevalent in low income nations of the world (FM't Hoen 2002). Thus, IPR led to prohibitive pricing of many essential pharmaceutical drugs which made these basic medicines needed for survival in many low income nations of the world very costly and thus contributed to the limited access to these essential medicines (Pecoul et al. 1999). Hence, the motivation to solve the local problems of a nation with product innovations not having much potential for diffusion and commercialisation cannot be provided by IPR.

User innovators, who develop technology for their own use rather than to sell, derive benefits from developing and using their inventions, which motivates them to invest the required efforts in innovation (Strandburg 2005). Strandburg (2005) defines this user innovator as any inventor for whom the "intrinsic value for using the invention exceeds the cost (in time, money, and so forth) of developing the invention". Patents prove ineffective for either motivation or dissemination of such user inventions. Some individual and corporate inventors regard IPRs as neither effective nor useful in excluding the imitators or providing returns in the market. These innovators opt for free revealing of their innovations to the communities (von Hippel 2005). Small and individual innovators particularly find more incentives in free revealing their innovations rather going for IPRs. This free revealing not only helps in positive image of the innovation but also contributes in better diffusion and further improvement of the innovation.

2.2. Informal sector innovations in India

The 'informal sector' as a concept was given by British anthropologist Keith Hart (Hart 1973) in the context of Ghana. The economic aspects of informal sector got huge attention from latter researches due to its size and impact. In India, the data of National Sample Survey Organisation (NSSO) shows that more than 90 per cent of the employment in agricultural sector and almost 70 per cent employment in non-agricultural sector fall under the category of informal sector (Mitra 2014). It is the dominant sector of Indian economy showing considerable improvement in terms of productivity, wages and capital accumulation, and also performed better than the organised sector in terms of investments and accumulation of fixed assets (Makers of India 2014). Informal sector is quite diverse and equally diverse are the sources of knowledge which shapes the activities of the sector and the innovations within them. Innovations in the informal sector are constraint based and done under the conditions of scarcity and depending upon the locally available resources. These innovations are not driven by R&D and mostly consist of improvisations and adaptation of the existing technology (de Beer et al. 2013). These innovations are invisible to the outside world as no appropriate metric is available for measuring these innovations.

The impetus given to the informal sector innovations have a long history which can be traced in the writings of Indian philosophers like Gandhi and Tagore. Gandhi's views on technology are evident through his speeches and writings in his book Sarvodaya (1954). He

opposed heavy industrialisation and said government should emphasise on cottage and rural industries. Gandhi regarded the *Charkha* or the spinning wheel as the only available means for driving away poverty in the villages. He regarded *Charkha* as valuable machinery and continually sought to improve it as per the Indian conditions. Similarly Tagore also wanted to encourage the development of handloom industries and revive the rural life. This is evident in the Tagore's model of rural reconstruction (Ray et al. 2005). These views were however partially side lined after independence when India under its first Prime Minister Jawaharlal Nehru went forward with a state owned heavy industrialisation after the second five year plan. It was in the 1970s when the Gandhian views returned in the form of appropriate technology movement. This time again the emphasis was on intermediate and low cost technologies. The ideas behind alternative technology movement were developed by British economist Ernst Fritz Schumacher, which were the cornerstone of his book Small is Beautiful (1973). Alternative technology, according to Schumacher, was an intermediate technology that would be much more productive than intermediate technologies and at the same time cheaper than the sophisticated and capital intensive technologies used by the industrialised nations (Akubue 2000). The movement however failed and was not able to fetch the results as anticipated. The main reasons given for this were the failure to engage the grassroots ingenuity and local communities in the technology development initiatives (Smith et al. 2014).

'Grassroots' innovation as a movement began in India in the 1990s to bring the innovations and alternative technologies of economically poor into the mainstream market through proper diffusion and recognition. The rationale behind this movement was that innovators at the grassroots were far more capable than anyone else to produce innovations which are better fit with the local market, the resource constrained conditions and the opportunities which are available in the emerging nations. The movement was started by Honey Bee Network in the year 1988-89 in Gujarat by Prof. Anil Gupta of Indian Institute of Management – Ahmedabad and a network of individuals comprising of farmers, artisans, researchers and NGOs to scout he alternative technologies and traditional knowledge practices of the people (Abrol and Gupta 2014). Later in 2000, Government of India set up an autonomous institution National Innovation Foundation (NIF), under Department of Science and Technology, which works for the development of the grassroots innovations, experience and technical skills of the informal sector innovators so that proper up gradation and diffusion of these innovations can take place.

Grassroots innovations are defined as bottom up social innovations and extremely practical solutions which involves knowledge and behaviour in hard and poor circumstances (Rao 2006). These innovations bear similar characteristics of the Schumpeterian understanding of innovations where individuals are the main actors of innovative activities and not corporate R&D units (Bhaduri and Kumar 2011). These innovations represent incremental and minor changes to existing technologies by using the traditional knowledge of the innovators' communities. The innovations are created in a highly informal set up without any available solutions or regulatory framework. Hence, grassroots innovations are developed by the people out of their needs as a solution to their own problems. Gupta (2014) describes these innovations as mostly created by people who are uneducated without professional degrees. The innovators are mostly self-employed who develop these innovations completely without any help from the formal sector, institutions and organisations (Gupta 2014). An important characteristic of grassroots innovations are that they are developed by individual innovators having bare minimum fund and financial resources to solve the local problems by working outside the realms of formal organisations (Kumar and Bhaduri 2014) and are therefore completely dependent upon locally available resources and knowledge. Some

features of the grassroots innovations as described by Hua, Jian, & Lin (2010) are that grassroots innovations are practical low cost bottom up innovations initiating at grassroots, which are spontaneous and interest driven.

One of the models to diffuse the grassroots innovations in the market initiated by NIF is known as 'Technology Commons' model, under which the users of innovation and other innovators are allowed to copy the technology developed by the innovators and modify them according to their own use. The commons model puts no kind of restriction on the self-employed innovator to copy and adapt the innovations of other innovators. Commercial firms are however required to obtain licenses from the members of the commons.

There are various terms which are used to define the innovations in the informal sector like *jugaad* and frugal innovations (Birtchnell 2011; Radjou, Prabhu, & Ahuja 2012). However both are distinct from grassroots innovations in characteristics. *Jugaad* are neither scalable nor sustainable and hence different from other low-cost innovations (Agnihotri 2014). Radjou et al. (2012) defines *Jugaad* as 'an innovative fix, an impoverished solution born from ingenuity and cleverness". They argue that it is followed by Indians in their everyday life to make the most of their available resources. This labelling of grassroots innovations as *Jugaad* is also criticised by scholars saying that socio cultural context of grassroots innovations and the use of traditional knowledge require a more empathetically understanding (Gupta 2013). *Jugaad* as a term also dilutes the importance of the meaningful and economically useful activities of the informal sector as it captures only a subset of activities in the informal sector innovations involving short term and medium duration activities (Kumar and Bhaduri 2014). Frugal innovations on the other hand are characterised as having world class quality, scalability, affordable price, and universal access (Prahlad 2006). Frugal innovations involve large firms and companies to develop new products using lesser resources and making them accessible to a large number of consumers (Prahlad and Mashelkar 2010). Several examples from Tata Nano to satellite launches by Indian Space Research Organisation are cited to describe frugal innovations. Hence, *jugaad* and frugal innovations differ from grassroots innovations. While *jugaad* are quick fix solutions without any long term value made by local and indigenous people, frugal innovations are made by experts, engineer and technologists targeting people at the base of the pyramid as their potential customers. Grassroots innovations are developed by individuals for their own use or the use or of their community to make the work easy by providing long term solutions to local problems.

3. Methodology

The research is exploratory in nature, where we seek to explore the role of IPR in grassroots innovations in India. The grassroots innovators we questioned for this study described their understanding of the whole patenting process and what benefits they perceive from these rights. Although, there are more than 150,000 innovations which have been identified by NIF, we have restricted this study to the innovators whose patents have been filed. Also, it is difficult to find such grassroots innovators at one place (Bhaduri and Kumar 2011); hence we conducted this study to a limited number of cases. Data, for this paper, were collected by semi-structured interviews from 20 grassroots innovators. We conducted telephonic interviews to explore the views of grassroots innovators and later we also met some of them at the *Sattvik* Food Festival 2016[1] held at IIM Ahmedabad to corroborate the results of the telephonic interviews. The sampling for the semi-structured interviews was done using the non-probability methods. Information from the qualitative interviews was supplemented with secondary literature on grassroots innovations such as reports and

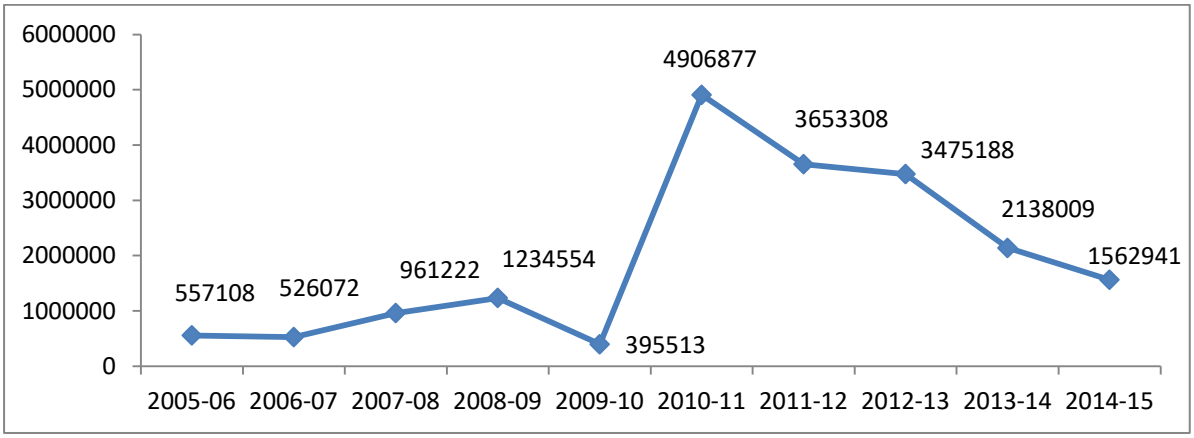
publications of NIF and the role of patents and innovations in general. We also interacted with some of the NIF officials at their offices in Ahmedabad and Gandhinagar in Gujarat.

4. Patenting informal sector innovations: the current scenario

Providing intellectual property management to the innovations of the grassroots innovators is one of the primary activities of NIF. A dedicated intellectual property cell of NIF is involved in the prior art searches, drafting and filing the applications by coordinating with the various intellectual property firms. The patent cell of NIF also provides legal assistance to the innovators in the form of negotiating and licensing their technologies, legal support in the case of infringement of their intellectual property rights. The screening of patent applications of the grassroots innovations which are based on traditional knowledge is also done by NIF to avoid filing applications whose practices are entered in the national register.

The amount spent by NIF on intellectual property related activities in the last 10 years is evident from their budget allocation for this procedure. The amount is spent to pay the requisite fees along with the various forms and the fees of the intellectual property firms hired by NIF who prepare the patent and other IPR applications of the innovators. The amount spent by NIF on IPR related activities has increased considerably since 2005-06 (Figure 1).

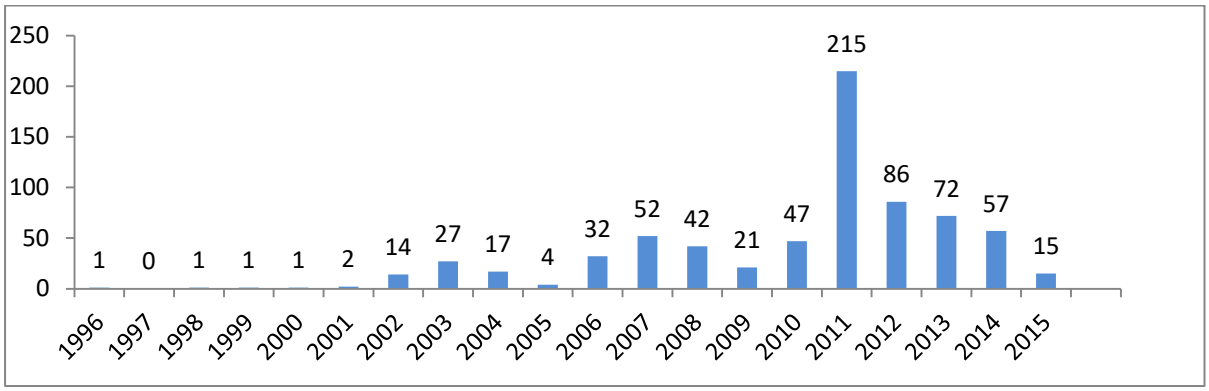
Figure 1: Expenditure incurred by NIF from 2005-06 to 2014-15 on IPR related activities (in Rs)



Source: own compilation; NIF Annual Reports, 2005-2015

Till date NIF has filed 742 patent applications which include a total of 707 applications for patents on behalf of the grassroots innovators in India, 8 in US and 27 PCTs. Apart from patents, there are also 15 designs and 37 plant variety protections which have been applied on behalf of the grassroots innovators. The first patent application for grassroots innovation in India was filed in 1996. The number of applications in the subsequent years did not increase until 2002 when a total of 14 patents for patents on behalf of the various grassroots innovators were filed (Figure 2).

Figure 2: Patent applications for grassroots innovations filed by NIF



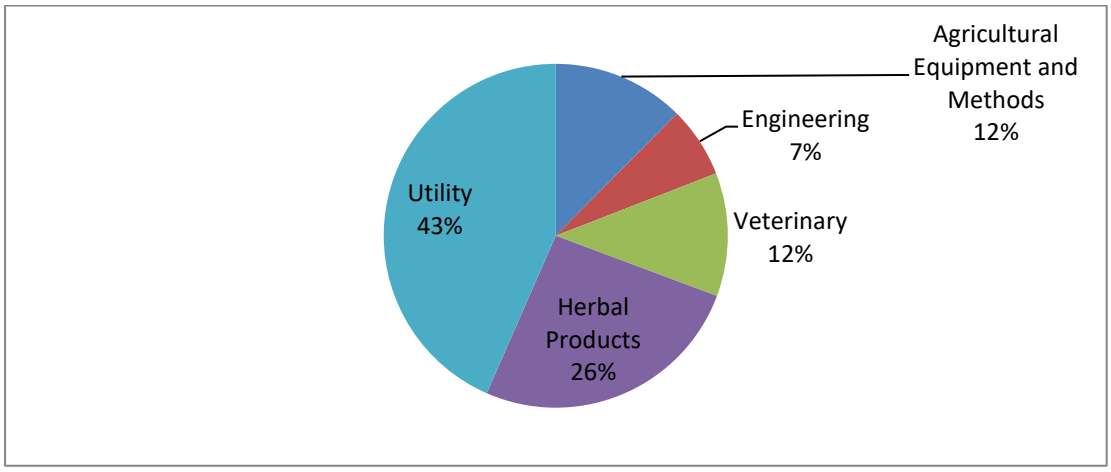
Source: own compilation; National Innovation Foundation, http://nif.org.in/ipr

The innovations for which patent applications have been filed in India are very diverse. Some of these innovations are purely for agricultural purpose while others can be used by anyone. We have divided these innovations into different categories to understand what type of innovations is patented the most. The technology catalogue of NIF has categorised innovations into four different types which are agricultural equipment, agricultural (general), engineering and utility. In our study, we use five different categories to distinguish these innovations which are Agricultural equipment and Methods, Engineering, Herbal Products, Veterinary, and Utility (Figure 3). All these categories are defined as under.

- **Agricultural Equipment & Methods** – These are those products and methods innovated by the grassroots innovators which can be used only in the agricultural sector. These contain machines which were developed by the innovators that can be used only by farmers and methods which can be used in irrigation, cultivation and sowing of fields.
- **Engineering Products** – These are the products which can be used in diverse sectors like masonry, chemicals, handicrafts and textile industries.
- **Herbal products** – These are the products which are developed by the innovators by the use of local plants or forest products. Some of them are household processed and can be used by anyone for various purposes. Most of them are medication to treat body pains, headaches, joint pains and diseases like diabetes.
- **Veterinary products** – These are also products which are made by using the local plants and forest products. They are used to cure various diseases of the livestock and household animals which are kept by the people.
- **Utility products** – The utility products are those which can be used by anyone in the household. These products increase the satisfaction of the consumers using them. The products are diverse like kitchen use products, entertainment devices, security devices, leisure products and children products like toys.

The different categories of grassroots innovations patents filed in India are illustrated in the figure below (Figure 3).

Figure 3: Different categories of grassroots innovations



Source: own compilation; NIF, http://nif.org.in/ipr

Utility products make up for the most number of patentable grassroots innovations. Out of 707 patents filed for grassroots innovations, 303 are for utility products constituting to 43 per cent of the total innovations. Herbal products comprises of 183 or 26 per cent of the total patent applications filed. Agricultural equipment and methods make up a total of 12 per cent of total grassroots innovations for whom patents have been filed in India. There are 88 such innovations for which patents have been filed in India. There are 82 veterinary products for which patents have been filed, which are 12 per cent of the total grassroots innovations patent applications filed in India. Engineering related grassroots innovations for whom patents have been filed are 47 or seven per cent of the total patent applications for these innovations.

Apart from 707 patents filed in India, NIF has also filed patents in the US, Patent Cooperation Treaty (PCT) applications, plant variety protections and design registrations on behalf of the grassroots innovations. Table 1 lists all these IPRs for grassroots innovations filed by NIF in India and elsewhere.

Table 1. IPRs filed by NIF in India and elsewhere on behalf of the grassroots innovators

IPRs filed	**Total**
Patents filed in India	707
Patents filed in US	8
PCT applications	27
Designs Applications	15
Plant variety protection	37
Total	**794**

Source: own compilation; NIF, http://nif.org.in/ipr

Hence the current patenting scenario of the grassroots innovations in India can be seen in the above Table 1. Though the majority of the patents are filed in India, eight of the patents for grassroots innovations have also been filed in US. There are 27 patents which have been filed under Patent Cooperation Treaty, 15 design registrations and 37 plant variety protections for various crops varieties. This section focussed on the current patenting trends of the grassroots innovations. It is evident that NIF acts as an intermediary organisation which facilitates the patenting process of the grassroots innovations. Not only that, business

development is also one of the primary activities of the NIF. It has successfully commercialised around 10 per cent grassroots innovations. In the next section we discuss how these IPRs are affecting the grassroots innovations.

5. Patenting informal sector innovations: lessons from grassroots innovations

This section elaborates our discussions with the grassroots innovators. We tried to know how aware the grassroots innovators are regarding IPRs, who inform them about these rights, and what and how much benefits the grassroots innovators have received because of these rights.

5.1 Grassroots innovator and IPR: The role of NIF

We asked the innovators whether they were aware of IPRs like patents before developing their innovations. Only 2 out of our 20 respondents said that they knew about these rights before. The rest had no idea about patents or any such rights. This clearly shows that obtaining patents were never in their mind. Unlike firms and companies in pharmaceuticals, chemicals, petroleum and machinery who would not have innovated a product if a strong patent law was not in place (Mansfield 1986), these grassroots innovators innovate creative products only to help themselves, their family, friends and communities to ease their work without any additional costs.

Since all the patents for grassroots innovations in India are filed by NIF, we discussed with the grassroots innovators how they come in contact with NIF. Whether it is NIF who contacts them or it is them who approach NIF. From the 20 innovators in our study, 16 were approached by NIF directly or indirectly once the news of their innovation spread. The other 4 were approached during one of the *Shodh Yatra*[2] These innovations are then selected on the basis of novelty and prior art searches by NIF officials to apply patents for them.

As discussed earlier, it is NIF which educates the grassroots innovators about IPR. The innovations of the grassroots innovators are scouted by different volunteers, interns and research fellows and those which are patentable are selected by different sections within NIF which are dealing with innovations related to mechanical and engineer innovations, veterinary innovations and utility innovations. On our discussion with the officials of NIF in the patent cell, we came to know that since most of the grassroots innovations are incremental and quick fix solutions, those which are patentable are selected on the basis of novelty and long term usage criteria after a prior art search for them is done.

We also enquired from the grassroots innovators regarding their knowledge about the patents filed on their behalf by the NIF; most of the grassroots innovators are unaware about the application process and the filing of patents. One of the grassroots innovators from Rajkot replied that all he knows about the patent filed for his innovation is that he signed a few papers through NIF. Other than this he had no idea, how and where patents are filed, and the costs or benefits associated with it.

There are certain fees which are required to be paid along with all the requisite forms to the patent office. We came to know that none of the innovators had to pay anything as fees from their own pockets. All the patents and other IPRs are filed by NIF through various intellectual property firms which are based in cities like New Delhi, Mumbai, Chennai, Bangalore, and Kolkata. These firms charge high fees for drafting patent applications and given the income pattern of the grassroots innovators, it is safe to assume that none of them

could afford the fees which these intellectual property firms charge for filing and drafting the patent applications.

Big firms in the formal sector who innovate by investing heavily in their R&D file a number of patents every year. These firms can easily afford the fees of the patent attorneys and IPR firms. This is because the big firms can easily recover the patent costs as they are capable to commercialise and diffuse their innovations using all the effective channels. However, this is not with the case with the grassroots innovators whose innovations barely diffuse outside their village and community. One of the grassroots innovator from Jaipur who got patents filed for his Biomass Gasifier innovation through NIF, told us that it would be very difficult for him to file patents on his own as intellectual property firms charge as high as 3 lakhs to draft their patent applications. This sum was unaffordable by the innovator to pay from his working capital.

5.2 Experience of grassroots innovator in patenting process: Benefits and motivation

We also discussed the overall experience of the grassroots innovator in the entire patenting procedure. 11 out of the 20 innovators questioned responded that they were never involved in it except for signing the relevant papers. They don't have to go anywhere for signing these papers also as NIF people approach them for all this document related work. Most of our respondents also replied that they were not interested in knowing or learning the patenting procedure as it was too complex for them to understand.

As discussed earlier in the paper, patents are said to provide many benefits to the innovator in the form of successfully commercialising their product in the market, get adequate returns on investment, and providing further motivation and incentive to innovate more. However, grassroots innovators replied that the main benefit for patenting for them was respect and recognition which they received in their society. Since several newspapers and other media covered their story, and they were also felicitated by their local and state level government at various ceremonies, the only reward of their ingenuity through IPR was recognition.

Since patents are said to motivate the innovator for innovations as discussed by various scholars, we found that only seven out of 20 grassroots innovator were motivated to innovate more because of IPR. The rest of them replied that helping their family and community by developing techniques to save their time and energy is what drives them. As discussed earlier, extrinsic motivations like patents or other monetary benefits play a role only once the innovation is complete and awaits application (Bhaduri and Kumar 2011).

5.3 Patents, modifications and commercialisation of the grassroots innovations

One of the dominant theories often cited by the advocates of intellectual property is that IPR helps in commercialisation and diffusion of the innovation (Mazzoleni and Nelson 1998). These theories suggest that patent owners can easily get financing for their innovations in the capital market. Hence, for the small firms especially it is said that patents can get their innovations in the market. Even the philosophy behind IPR says that patents will serve as an award for the innovators and since they will have monopoly over their invention, they will be able to generate necessary investments which are required for commercialising their products in the market.

When we asked the grassroots innovators, whether patents have helped them to commercialise their innovation, all of the 20 grassroots innovators replied 'No'. Patents as

told by them had no effect on getting their product effectively to the market. Thus we argue here, that unlike products from the formal sector industries like pharmaceuticals, chemicals, and IT where patents have helped the innovator to successfully diffuse their innovation in the market; the same is not true for innovations from the informal sector. Formal sector firms invest heavily in R&D resources where the demand for the new product is perceived to be high and hence a big market is available. The grassroots innovators innovate out of adversity and needs because the products from formal sector are either not available or very expensive.

The formal sector innovations are made using all the necessary raw materials for long term usage and efficiency. The informal sector innovations are mostly made up of raw materials which are locally available in the innovators environment. Thus we asked the innovators whether their innovation has to undergo any modifications for making it patent worthy. We came to know from all the grassroots innovators questioned that their innovation has undergone some kind of modification. This modification was done both to improve the looks of the innovation and also to improve the efficiency of the product. Informal sector innovations are done under the conditions of scarcity and dependent upon the locally available resources (de Beer et al 2013). Since they are not driven by R&D, they mostly consist of improvisation and adaptation of the existing technologies. To make these innovations as patent worthy it is important to develop them further so that they are able to provide the same results and work in the same way for a long period of time. These innovations are hence modified by replacing the locally available quick-fix raw materials by industrial raw materials. This is done to provide effective results and also improving the looks of the innovation. The modifications are often done by linkages with the formal sector institutions. Grassroots Innovation Augmentation Network (GIAN)[3], one of the off shoots of the Honey Bee Network does the fabrication and prototype development of these informal sector innovations at industrial areas of Chammur and Naroda in Gujarat. All these linkages and other suggestions for modifications are provided to the grassroots innovators by NIF.

The selling price of the products by firms in the formal sector which innovate after heavy investments in R&D is usually high to recover the costs. This is particularly the case with pharmaceutical drugs whose prices increased considerably making their access difficult to the needy because of their unaffordability (Ley 2007). We asked our respondents about the prices of their products post filing of patents in the market. Only two out of the 20 grassroots innovator questioned replied that the price of their innovation is same after filing of patents while the other 18 replied that the selling price of their innovations have increased since the filing of their patents. The grassroots innovators are also of the view that their innovation is selling at a price which is unaffordable for the people who would need them the most. Patents have contributed to increase in selling price of the commercialised grassroots innovations in many ways. Firstly, as discussed before the innovations developed by using the locally available resources are later modified by using better and industrial raw materials. This is done to make the innovated product of the grassroots innovator both attractive and efficient for a long term usage. The raw materials and the skilled labour which is required to make these modified innovations increase the unit cost of production. Secondly, the sales of most of agricultural equipment related grassroots innovations are bare minimum due to lack of proper diffusion with only one or two units sold in a year. Hence innovator is unable to invest his capital resources on large scale production. The raw materials which are procured from different parts of the country increase the prices and also the time to deliver these products upon receiving the order. One of our respondents an award winning grassroots innovator from Rajasthan, who innovated a compost aerator, said that since for making the machines proper raw materials from Haryana and Rajasthan are required, they have to buy these raw materials separately for each unit ordered. The transportation cost which is to be paid for

these raw materials is very high and even the labour which is required for installing these raw materials is not available every time. Hence, the prices of grassroots innovation have increased after patenting and commercialisation to cover the transportation costs for procuring raw materials and payment to the temporarily hired labourers required in making the finished product.

6. Conclusion

The grassroots innovators patent their innovation only because all the fees and other procedures are taken care of by the NIF. The cost of patents is high and the procedure is very complex for an average grassroots innovator to take patents seriously. In such a scenario, rather than patenting these innovations, there can be other mechanism which can allow the diffusion of these innovations easily and also improve them. Grassroots innovations are certainly generating knowledge in the informal sector but patenting these innovations restricts the dissemination of this knowledge to those who would need them.

The grassroots innovations which are primarily developed for helping the innovator's family and community, providing them intellectual property protection which are meant to benefit the firms and industries of the formal sector are not helping these innovations to commercialise effectively in the market. After patenting, the grassroots innovators regard these rights as neither helpful and nor effective in commercialising their innovations, finding licensees or increasing their sales. IPR in the case of informal sector innovations are blocking this flow of knowledge. The present patent regime is not suited to accommodate grassroots innovation in providing them the same sets of incentives and motivations. It may be useful if an institutional transformation in the IPR is advocated which will be better suited to accommodate the intellectual property of an informal sector innovation. A new national or regional level intellectual property mechanism which can be developed and recognised by various patent offices which are useful in both preventing these innovations from getting imitated by formal sector firms and at the same time diffuse these innovations to a large number of people who would need them and use them directly by modifying it according to their needs. Thus, rethinking a new protection mechanism which can protect and diffuse these innovations is required for the informal sector innovations.

The NIF applies for the patents on behalf of the grassroots innovators with a genuine concern about the people and their knowledge, which has been exploited in the past by various MNCs and big firms of the formal sector. However, the primary motive for providing IPR for innovations is challenged by the informal sector innovations. Hence, if NIF expands 'Technology Commons' to include all the grassroots innovations and link them with various communities, village, and other rural level institutions, these technologies can be properly showcased to the people who would need them. The knowledge generation and diffusion in the informal and unorganised sector is completely different from the formal sector institutions, hence for the innovations which are generated from the informal sector, a new institution should be promoted which can diffuse, protect and popularise these innovations to a large number of people who can benefit from using them.

Notes:

1. Sattvik was started twelve years ago and aims to promote conservation of agro-biodiversity and creation of demand for nutritional crops, which are rarely or less cultivated now. Farmers' fair of organic and eco-friendly agro- products and exhibition of grassroots innovations is a part of this festival (http://www.sristi.org/cms/sattvik2016)
2. *Shodh yatra* or the research journey is organised by Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI). SRISTI was formed to provide financial backing to the Honey Bee Network. The *shodh yatra* are organised in remote parts of the country to search for novel ways of doing things at grassroots level, developed without any intervention or help from the formal sector (http://www.sristi.org/cms/shodh_yatra1)
3. GIAN is an incubator of grassroots innovations and traditional knowledge GIANs have been setup at Ahmedabad & Jaipur for providing incubation support to grassroots innovators (http://www.gian.org/)

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