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Recent Trend in Patenting Activity in India and its Implications for Agriculture§

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Abstract

The patenting activity is a mechanism to reward the innovators and therefore attracts more investment in R&D. Efforts to strengthen patents and other forms of IPRs were started with the TRIPS agreement in 1995 and these have led to increased patenting activity in the all member nations of the World Trade Organization. A major change in the Indian patent system came in 2005 when product patenting was introduced in all the fields of science. These reforms have also increased the scope for private investment in agricultural research. The study has revealed that the patent grants have increased significantly in all the fields of agricultural sciences, but most of these patents are owned by the foreign companies. The participation of foreign organizations has been increasing in India and they accounted for 75 per cent of the total patents granted during 2007-2012. Patent reforms thus have provided access to the technologies which previously were not available in India, particularly in the fields of transgenics, agro-chemicals and animal vaccines. Simultaneously, concerns for higher cost of protected technologies are also becoming louder and should be monitored to check monopolistic tendencies.

Key words: Patents, patent reforms, R&D, agriculture, India

JEL Classification: Q16

Introduction

Indian agriculture has undergone several changes in terms of technology penetration and product diversification, transforming it from a subsistence activity to a commercial one in many aspects. However, in recent years, the declining total factor productivity growth, shrinking land and water resources, and climate change have started posing threats to its sustainability and also to the national food and nutritional security. In order to provide technological solutions to these problems, there is a need to accelerate research and development efforts in the agricultural sector. In India, agricultural research is primarily a public-funded activity and the private sector participation is limited to the input sector, including seed, fertilizers and pesticides. However, in the wake of changing R&D policies, private sector participation is increasing in the areas like biotechnology, hybrid seed, plant protection chemicals, farm machinery and animal healthcare (Pray and Nagarajan, 2012). In order to strengthen this trend, an opportunity to appropriate research benefits needs to be created.

The intellectual property rights (IPRs) serve as an important instrument to appropriate research benefits and attract private investment in R&D. Thus, protection and commercialisation of IPs encourage knowledge creation, innovation, and access to technology and contribute to higher productivity growth. It is particularly beneficial for the developing countries like India that have low R&D investment intensity. The

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protection of IP in the context of agriculture is mainly provided by patents and other forms of legal protection like protection of plant varieties (Naseem *et al*., 2010). Patents are also an excellent source of information and give exclusive rights to the inventor for a specific period to appropriate research benefits. The information and knowledge of trends in patents can also be used for technology forecasting and policy formulation (Singh *et al*., 2010).

In order to comply with the TRIPS (Trade Related Aspects of Intellectual Property Rights) agreement, Indian patent regime has been made stronger. The patent reform of 2005 introduced product patents in all fields of science, including pharmaceuticals, drugs, chemicals and agriculture that were not under product patent regime earlier. Until 2004, there was only a slight improvement in patent filing, but after 2005, patenting activity got accelerated, particularly in the fields of chemical sciences (Kadri and Saykhedkar, 2011; Dwivedi *et al*., 2013; Dahibhate and Patil, 2012). However, the number of patents in agricultural sciences is likely to be less due to exclusion of animals, plants and parts thereof and methods of agriculture (Guruprasad *et al*., 2003). Some information on the major consequences of these reforms is available for pharmaceuticals and IT sectors, but the developments in patenting activities in agriculture have not been documented well. In this paper, we have analysed the trends in patenting activity in different fields of science in India with a focus on agriculture.

Patent Reforms

The Patent Act in India is more than 150 years old. It was first enacted in 1856 and has been amended several times since then. However, a comprehensive legislation, the Patents and Designs Act, 1911 was a major development and it provided protection to all process inventions, except those relating to atomic energy, for a period of 16 years. The Patent Act 1970 provided protection of process innovations for pharmaceuticals and agro-chemical products for a short period, viz. seven years, for pharmaceuticals, agro-chemicals and food products and 16 years for other categories. The methods of agriculture were not patentable.

A major step towards the promotion of patenting activity was the TRIPS agreement of 1995, after which the Patent Act in India was amended in 1999, 2002 and 2005. In 1999, a mail box approach was provided for filing product patents in pharmaceuticals and agricultural sectors, under which any person having a product invention can file an application for a patent and the patent will be granted when product patenting will be enforced. Besides the mail box provision, it also provides exclusive marketing rights to the inventor and thus can invite foreign patent and investment. The second amendment was done in 2002, by increasing the term of patents from 14 years to 20 years. In 2005, the amendment allowed product and process patents in all fields of science. However, methods of agriculture, essentially biological processes, plants and animals in whole or any part thereof, cannot be patented, but genes, micro-organisms, etc. with significant human interventions can be patented.

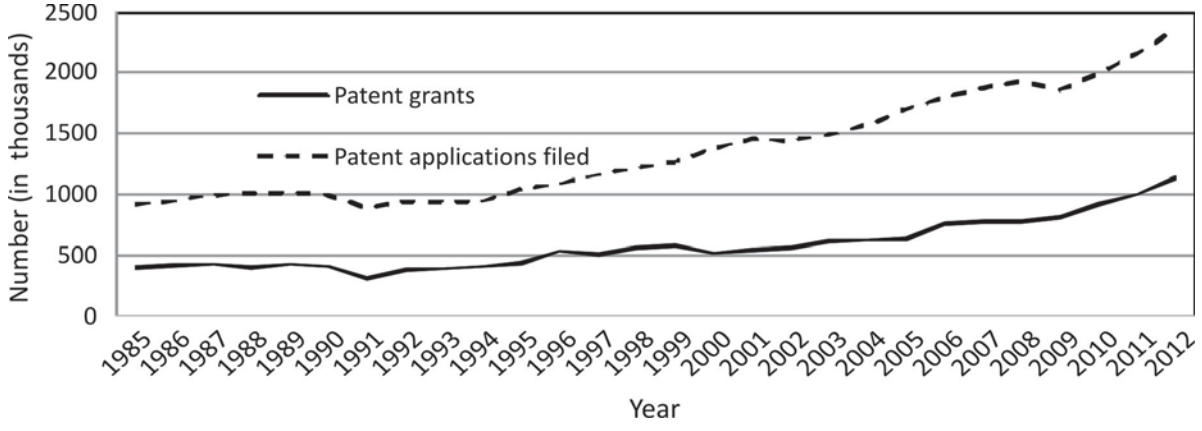
Data Sources

The data on patenting activities were taken from the World Intellectual Property Organization (WIPO) and the Indian Patent Office (IPO). The WIPO maintains a global database of patents, while the IPO maintains data related to patents in India. Information covering entries such as patent applications filed, number of patents granted, total counts by filing office, total residential and non-residential applicants, patents grant by fields of technologies, etc., were taken from the IP database of WIPO for the period 1980-2012.

The IPO database was used to compile the data on patents granted in various fields of agricultural science in India for the period 2007-2012. The fields were defined as per the international patent classification (IPC) of the WIPO.

Global Trends in Patenting

The number of patent applications filed and granted in the world has depicted increasing trends during the period 1985-2012 (Figure 1). The number of patent applications filed and granted was 9,21,715 and 3,97,580, respectively in 1985, and these increased to 23,47,700 and 11,34,500, respectively in 2012. The patent filing remained more or less constant during 1985 to 1995, but increased significantly after the TRIPS agreement in 1995. The average annual number of patent applications filed in the world during 1985-1994 was 9,60,392, which increased to 15,95,950 in



Source: WIPO, IP statistics

Figure 1. Trends in the number of patent applications filed and patents granted in the world, 1985-2012

the post-TRIPS period (1995-2012). The number of patents granted before TRIPS agreement (1985-1994) was 66,06,596 and it doubled in the post-TRIPS period (1995-2012). The average annual patent grants during 1985-1994 was 3,92,459, while in the post-TRIPS, it increased to 6,79,522 patents.

Country-wise Patents Granted

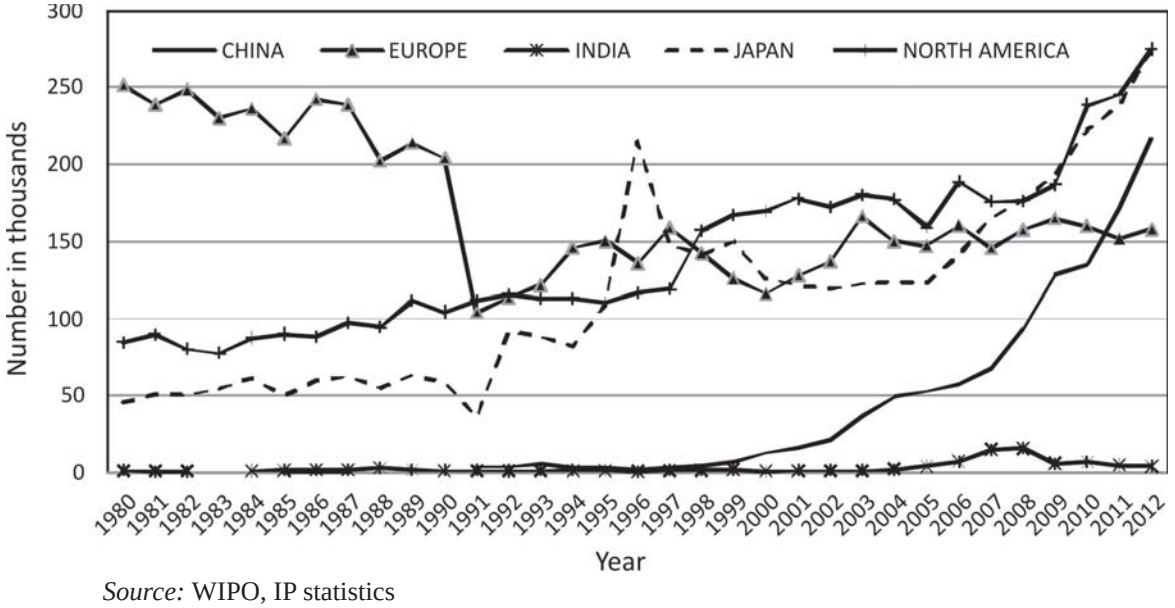
A comparative analysis of the total patent grants in some selected countries, viz. China, India, North America, Japan and Europe, is shown in Figure 2. The total patent grants during the period 1980-1990 were the highest in Europe, but it showed a declining trend thereafter. The number of patent grants was comparatively low for Japan and North America, but it showed an increasing trend over the years. After 1995, the number of patent grants increased significantly in Japan, reaching the peak in 1996 and then continued to decline until 2004. However, after 2004, patent grants to Japan started increasing and in fact, Japan and North America held the higher number of patents than any other country. The number of patent grants in India was very low during this period.

The performance of developing countries, except China, has not been much impressive in terms of patent grants. The Chinese science system was not able to compete with the developed countries, but after 1991, the patenting activity in china grew rapidly. In India, patenting activity was not significant during 1980-1995, as the average number of annual patent grants was 1,650 only. India has made significant changes in the patenting regime, and has encouraged R&D system also to protect its IPs. As a result, the number of patents granted has increased from 1,501 in 1980 to 4,328 in 2012, but it is negligible in comparison to other countries selected for the study.

Trends in Patenting Activity in India

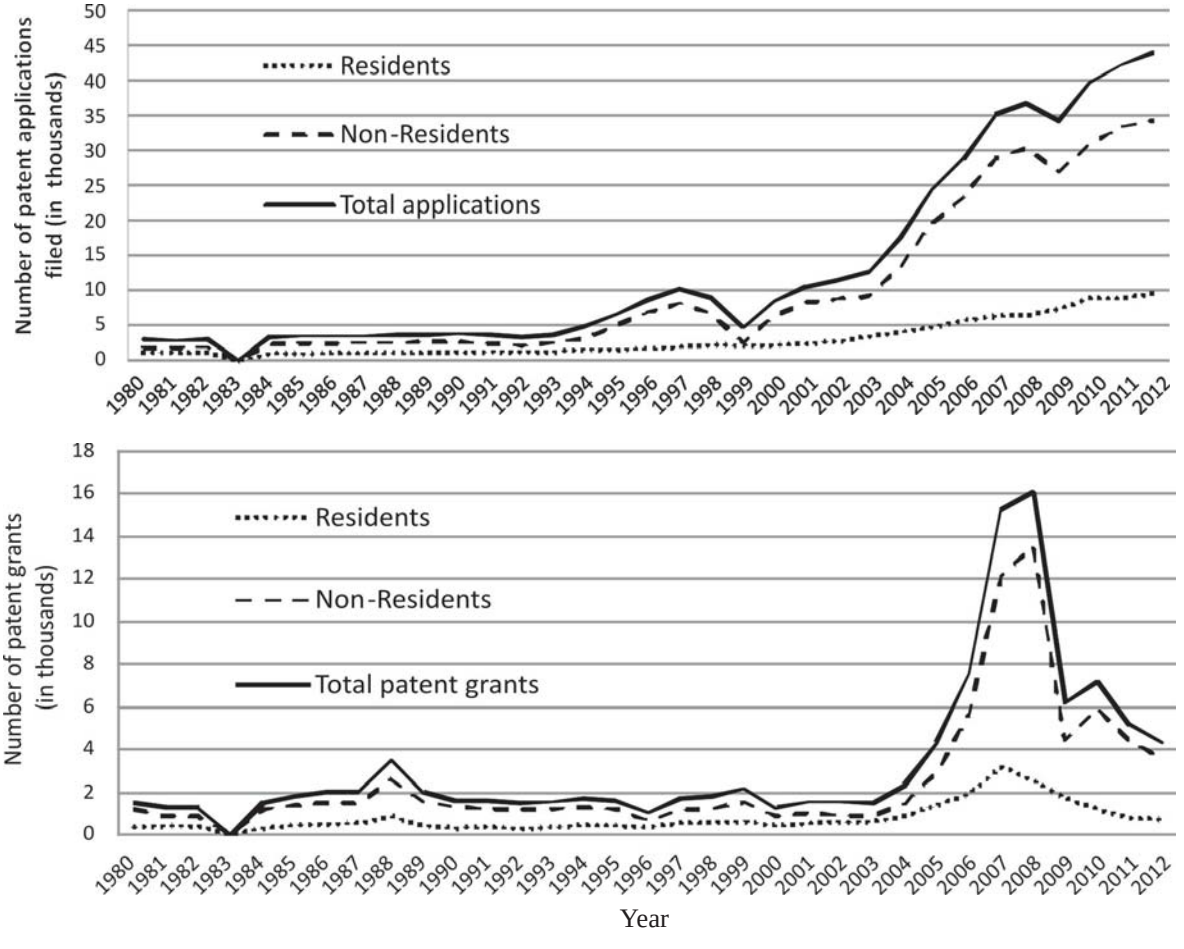
As seen from Figure 3, the number of patent applications filed in India followed an increasing trend and the applications filed increased significantly after the patent reform of 2005. The rate of patent application filing by the non-residential applicants has been growing exponentially, whereas the number of applications filed by the residents is lagging far behind. The number of patents granted in India remained more or less same during the period 1980-2004; the number being 1501 in 1980 and 1526 in 2004. However, after the third amendment in the Patent Act, the number of patent grants in India increased tremendously to 16,061 in 2008 due to the provision of both product as well process patents. The patent grants, however, followed a declining trend afterwards. This means that the patents filed in the mail box system were closed, or granted immediately after 2005, and there were only fewer new applications for consideration after 2008.

The number of patents granted to the non-residential applicants has been found to be higher than the grants to the Indian residents, more so after the introduction of product patents in 2005. The gap between patent grants to foreign and domestic applicants has widened over the years and the number of patent grants to the foreign applicants has become almost five-times of these grants to the residential



Source: WIPO, IP statistics

Figure 2. Country-wise comparison of patent grants



Source: WIPO, IP statistics

Figure 3. Total patent applications filed and patents granted in India, 1980-2012

applicants. This means that there is an increasing trend in protecting foreign IPs in India and commercializing them. Most of these patents are in pharmaceuticals, computer science, IT sector and biotechnology.

Patenting Activity in Agricultural Sciences

The patenting activity in different fields of agricultural science was also studied using the IPO database. The patent search was carried out following the International Patent Classification (IPC) for the period 2007-2012. As seen from Table 1, the number of patents granted was the highest (682) in biocides and pesticides group (A01N) that accounted for 66 per cent of the total patents granted in agricultural sciences. It was followed by patents granted in the area of new processes for obtaining plants and plant tissue culture, animal husbandry, horticulture, cultivation, forestry and catching and trapping devices for animals and obnoxious plants. The number of patents granted has been found minimum in manufacturing of dairy products (8) and shoeing of animals (7) during the study period.

Since a large number of patents were granted to the non-residents, the share of different countries in patent grants was examined and it is depicted in Table 2. A perusal of Table 2 reveals that out of a total of 980 patents granted in agricultural sciences in India during the period 2007-2012, India ranked first in the number of patents granted with 229 patents (23.3%), followed by the USA with 227 patents (23.1%) and Germany 192 patents (19.5%). The UK, Japan, the European Union and Australia were the other countries together having 208 patent grants in India. It is important to note that most of the patents granted to foreign nationals or agencies were in the field of chemical sciences (biocides, pesticides, etc.), with the highest number to Germany (180), followed by the USA (158), the UK (55) and Japan (43). But, the patents granted to the Indians were comparatively diverse, and only around 50 per cent were in the field of chemical sciences. As seen from Table 2, only USA had some patents in the field of tissue culture (19) and animal husbandry (15).

Institutional Ownership of Patents

To know the pattern of research investments, it is important to examine the institutional ownership of patents granted in different fields of agricultural science in India. As seen from Table 3, the private companies held a higher number of patents in agricultural sciences in India (86.8%) as compared to the public institutions (13%) for the period 2007-2012. The share of private sector in the number of patent grants was the highest in biocides, pesticides, herbicides (598 patents), followed by horticulture (44 patents), animal husbandry (42 patents), catching & trapping apparatus for animals (39 patents) and plant tissue culture (35 patents). In the public sector also, the number of Indian patents granted was the highest in biocides, pesticides (62

Table 1. Trends in patents granted in different areas of agricultural sciences, 2005-06 to 2010-12

Area (code)	2005-06	2007-09	2010-12	Total
Soil, machinery (A01B)	1	13	4	18
Planting, sowing, fertilizing (A01C)	5	26	17	48
Harvesting, mowing (A01D)	8	13	6	27
Threshing, storing (A01F)	2	14	3	19
Horticulture, forestry (A01G)	5	37	14	56
Tissue culture technique (A01H)	2	30	26	58
Manufacture of dairy products (A01J)	-	4	4	8
Animal husbandry (A01K)	3	34	20	57
Shoeing of animals (A01L)	-	4	3	7
Catching, trapping of animals (A01M)	8	32	16	56
Biocides, pesticides, herbicides, pest repellants, pest attractants, PGRs (A01N)	22	483	177	682
Total	56	690	290	1036

Source: IPO database

Table 2. Top countries in the total patent grants in different fields of agriculture, 2007-2012

Area (code)	USA	India	Germany	Japan	Australia	EU	UK	Total
Soil, machinery (A01B); Planting, sowing, fertilizing (A01C)	16	16	3	10	3	0	0	60
Harvesting, mowing (A01D); Threshing, storing (A01F)	6	12	3	1	3	0	8	36
Horticulture, forestry (A01G)	7	21	0	6	0	2	0	51
Tissue culture technique (A01H)	19	22	2	2	1	2	1	56
Dairy products (A01J); Animal husbandry (A01K)	16	23	1	1	2	4	1	62
Shoeing of animals (A01L); Catching, trapping (A01M)	5	27	3	5	3	0	9	55
Biocides, pesticides, herbicides, pest repellants/ attractants, PGRs (A01N)	158	108	180	43	8	33	55	660
Total	227	229	192	68	20	44	76	980

Source: IPO database

Table 3. Institutional ownership of patent grants in agricultural sciences in India, 2007-2012

Area (Code)	Total	Private sector	Public sector	Residentials			Non-residentials		
				Total	Private sector	Public sector	Total	Private sector	Public sector
Soil, machinery (A01B)	17	14	3	4	2	2	13	12	1
Planting, sowing, fertilizing (A01C)	43	35	8	12	6	6	31	29	2
Harvesting, mowing (A01D)	19	16	3	6	3	3	13	13	-
Threshing, storing (A01F)	17	14	3	6	3	3	11	11	-
Horticulture, forestry (A01G)	51	44	7	21	16	5	30	28	2
Plant tissue culture technique (A01H)	56	35	21	22	10	12	34	25	9
Manufacture of dairy products (A01J)	8	7	1	3	2	1	5	5	-
Animal husbandry (A01K)	54	42	12	20	12	8	34	30	4
Shoeing of animals (A01L)	7	7	-	2	2	-	5	5	-
Catching, trapping of animals (A01M)	48	39	9	25	17	8	23	22	1
Biocides, pesticides, herbicides, pest repellants, pest attractants, PGRs (A01N)	660	598	62	108	59	49	552	539	13
Total	980	851	129	229	132	97	751	719	32

Source: IPO database

patents), followed by plant tissue culture (21 patents). In case of the residential patent grants, the share of public sector is closer to the share of private sector in the total patent grants during the period 2007-2012, while in non-residential patents, private sector holds remarkably larger share (719 patents out of the total 751 non-residential patents).

Implications for Indian Agriculture

In spite of agriculture being a major source of livelihood for millions of people in the developing countries, the rate of technology replacement is rather low, constraining the productivity growth. The situation in India is; however, comparatively better because of

strong presence of public R&D and a higher research intensity of 0.4 per cent in agricultural GDP (Pal *et al.*, 2012). Investment in R&D can provide a solution to these problems. The exchange of knowledge and access to protected technology can help in addressing some of the emerging challenges like climate change, food and nutritional security and environmental protection. The protection of intellectual property rights with a strong patenting system can encourage inventions and their commercialization in the form of market products (Lei *et al.*, 2009). This section examines the implications of increase in the rate of patenting in India, especially those granted to foreign nationals. The implications have been examined in terms of access to technology and expected economic benefits.

Through IPRs the access to advanced technologies has been made possible from the developed nations to the developing countries. The patents provide a channel through which technology can flow from one country to another. The trends observed earlier have indicated an increase in the patent grants to foreign companies in India after the reforms of 2005. Therefore, the major technological spill overs from the developed countries are likely to be in the areas like pesticides, herbicides, broad range insecticidal compositions, Bt gene, seed technology and genetic engineering.

On the other hand, most of the domestic technologies under protection are concentrated in the areas like biocides, seed technology, soil and machinery and tissue culture. The important areas where the patents are being granted to the Indians are methods of making various formulations of biopesticides, methods of making biofertilizers-biofungicides, development of low-cost and eco-friendly synergistic compositions, methods for developing abiotic stress-resistant seeds, developing transgenics, methods for improving restorer lines for hybrid seed production, and methods for increasing oil contents of some crops. Therefore, most of the economic benefits of access to foreign technologies are likely to accrue through higher reductions in yield losses due to biological stresses. Some of these benefits shall be realized in the rainfed areas where weed intensification is high.

Conclusions

The study has observed a substantial increase in the number of patent applications filed and patents granted in the world during the period 1985-2012, with the growth picking up in the early-1990s. In India, the number of patent grants has increased significantly after the introduction of patent reforms in 2005 and accumulation of the applications during the transit period. The patent grants have increased significantly in all the fields of agricultural sciences, but most of these patents are owned by the foreign companies. The number of Indian patents granted to foreign companies has been found three-times higher than those granted to the domestic inventors. Among the foreign countries, the highest number of Indian patents has been granted to the USA, followed by Germany and the UK, mainly in the fields of pesticides and insecticides.

The number of Indian patents owned by the private sector has been increasing rapidly in comparison those owned by the public sector. This indicates an increasing access to proprietary technology and thereby, stronger presence of the private sector in the input markets. This may increase the cost of farm inputs based on these proprietary technologies. Therefore, the public R&D needs to address these challenges by strengthening Indian companies in public-private partnership mode of technology generation and commercialization.

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