

Constructing indicators from patent specifications: What they reveal and what they imply?

SUJIT BHATTACHARYA

NISTADS

Pusa Gate, K.S.Krishnan Marg

New Delhi, India

sujit@nistads.res.in

The study distinguishes some of the rich sources of information that can be extracted from a patent document and can act as an indicator to measure some of the technological features of patenting activity of a firm/country. The paper attempts to highlight this through empirical examination of patents granted to Indian institutions in the US. The applicability of the indicators that are distinguished and meaning they can convey are addressed in this study.

1. Introduction

The analysis of patent information is considered to be one of the most established, directly available and historically reliable methods of quantifying the output of a science and technology system (Soete & Wyatt, [1]). As Griliches [2] has pointed out that inspite of significant amount of variation, a patent does represent a minimal quantum of invention that has passed both the scrutiny of the patent office as to its novelty and test of investment of effort and resources by the inventor and his organisation into the development of this product or idea, indicating thereby the presence of a non-negligible expectation as to its ultimate utility and marketability.

According to Grupp [3] a patent has three qualitative properties, which requires attention namely (a) the exclusive right of exploitation, (b) the information function, and (c) output function. The exclusive right of exploitation grants to its owner monopoly for a specified period of time to exploit the proprietary knowledge embedded in a patent. The second i.e. information function is in the context of the technical knowledge contained in a patent that is available to others. The third i.e. output function provides some measure of R&D outcome. In spite of variability in the quality of patents, patents are probably most reliable measure of innovation activity. It is important to understand a patent – what it contains, what are its different elements and its other characteristics before it can be used as an indicator to measure innovation activity.

A patent specification can broadly be distinguished under three major sections— (a) covering history of the application, (b) the technical details of the invention and (c) the claims. The information relation to the history of the application includes: Priority date (date of first filing world-wide) and country of priority (where the patent was first filed), Date of filing in the country concerned, Date of grant, the list of inventors (individuals) their address and country of residence and the legal owners of the patent.

The technical details include the classification of the patent (attributing the said patent under technological class(s)), summary of the invention, background and scope of the invention, etc. Patents that have cited this patent (includes examiner citations and applicant citations) preferably should be included in this section as it help define the novelty and inventiveness of the invention. The examiner

citations are on the front page of the patent document whereas applicant citations are present in the later part of the patent document. Examiner citations have direct implications in granting the rights to the applicants for a said invention. Examiners use the citations to check the novelty, non-obviousness and delimit the scope of the claimed invention. Applicants on the other hand cite to show the background/state of art in the area in which the said invention claims novelty and how its claimed invention is different and novel. It is legal duty of applicants to disclose any knowledge of the prior art in the USPTO.

The last section is the claim section. This is the most important part of the patent document as protection is granted on the basis of the claims [4]. The patent office after detailed examination of the patent application identifies the subject matter in the patent that is novel and hence protectable. The legal owners of the patent can exploit the invention on the claims that the specification contains. The claims can be the basis of identifying whether protection is given for a novel process or product or both.

The present paper attempts to utilize some of the elements of the patent specification to show that they can signal some important trends. The study also points out that it is important to understand the patent process, specification and other attributes of patenting system to provide proper meaning to the indications that are revealed by the indicators used. The patents granted to Indian entities were taken as an empirical data to show the usefulness of the indicators used.

Methodology

The data set was constructed from patents granted by the USPTO (United States Patent and Trademark Office) to Indian entities for the period 1990-2002. Patents were downloaded from online USPTO site. The indicators that were used are elaborated below.

Indicators used in this study

(a) Type of patent as an indicator

Indicators applied are distinguished in terms of the characteristic of the USPTO and general provisions that are uniform in majority of the countries.

Through the TRIPS (Trade Related Intellectual Property Rights) agreement of the WTO (World Trade Organisation), there has been significant progress towards harmonization of patent rules and regulations in different countries. However, TRIPS itself provides provisions for some exceptions and allows alternate forms of protection. A significant difference between other patent offices and the USPTO is in terms of providing a broad scope of patent protection. In USPTO, patent protection is granted under three different types: utility patents, design patents and plant patents. *Patents granted are distinguished under the above three types in this study. This indicator helps to assess the intensity of activity in each of the three types and its implications.*

Utility patents protect the functional characteristics of a process or a product. Products of all types, chemical compositions and processes, manufacturing methods, electronic circuitry, computer software and biotechnology as well as business methods are but a few of the types of inventions which can be protected by utility patents. The principal attribute of a utility patent is that it describes and claims the structure, composition, or operation of a products or process invention. The scope has been expanded to include computer software and business methods. Design patent differ from utility patents in that a design patent covers only the ornamental appearance of a useful products. The design elements, which are claimed to be unique and distinctive, must be ornamental and not functional in the structure of the product. Plant patents provide protection to plant varieties. The subject matter of the application would be a plant which developed or discovered by applicant, and which has been found stable by asexual reproduction.

(b) Country of ‘priority’ as an indicator

A patent confers national property rights in that it protects an invention only in the country in which it is granted. Inventors seeking international rights therefore have to file applications in each country in which they want patent protection. A 'Patent Family' can be defined as all patent documents filed in different countries to protect the same invention. At the most basic, the family comprises a 'Priority Patent Application' and all 'Subsequent Patent Applications' that relate to it. The priority patent application is the first application filed to protect the invention.

Important information that can be extracted from the 'Priority Patent Application' is 'Priority Date' (date when the patent was first filed) and the 'Country of Priority Application' (country where it was first filed).

(c) Process/product patent as an indicator

A patent can claim invention for the process of manufacture (process patent) or the final product (product patent) or both (process & product patent). Thus patents held by a firm/country in different technological areas distinguished in terms of process/product patents provide insights of their technological portfolio. For example a firm having both process & product patent for an invention has a wider monopoly. In some areas such as pharmaceuticals, product patents play an important role in future appropriation in the market.

(d) Joint Assignment as an indicator

Legal rights of a patented invention rest with the assignee(s). In majority of the cases patents are assigned to the firm/organisation in which the inventors work. For a technology that is jointly developed, assignees are respective organisations. Thus joint assignment indicates cooperation between firms in technology development. Thus joint assignment data provide some assessment of technology collaboration between firms.

(e) Impact based on patent cited

A patent that is highly cited means it is 'prior art' to a large number of subsequent patents. It is assumed that a highly cited patent is important and signifies a technical advance. Similarly, a patent that is highly cited by journal articles plausibly indicates its scientific significance. Thus by uncovering the intensity by which patents of a firm/ country are cited by other patents/journal articles provides some indication of the impact of the granted patents.

Indicators Constructed

All specifications (full text) of patents granted to Indian entities (1990-2002) were downloaded from the online USPTO database. The type (utility/design/plant) of each patent was extracted from each specification. 'Country of Priority Application' (also referred to as priority country, OECD [5]) were extracted from the INPADOC database.

Each specification provides details on ownership of the said patented invention. All patents that had more than one assignee were covered under joint (collaborative) patents. Patent Assignment database was used for validation as well as covering any missing gaps in the USPTO database. The Patent Assignment Database generated by the US patent office shows the information the person filing a copy of the executed assignment writes on the "Record form cover sheet" which is the form applicant is obliged to file along with the copy of the actual assignment document. Thus this database provides a more accurate assignment data.

Patent is a legal document and on the basis of the claims monopoly rights are provided to a patentee. Legal rights can be towards process, product or both. Patents were identified under these three categories on examination of claims in each document.

Number of times a said patent was cited by other patents was extracted. Similarly, all selected patents that were cited by journal articles were uncovered in this study. The web-of-

science was used for this purpose. Thus citations to selected patents by journal articles included only those journals that were covered by this database. However, the journals covered by this database are accepted as satisfying minimum criteria of quality and excellence. The cited data was restricted to ‘examiner’ citation only.

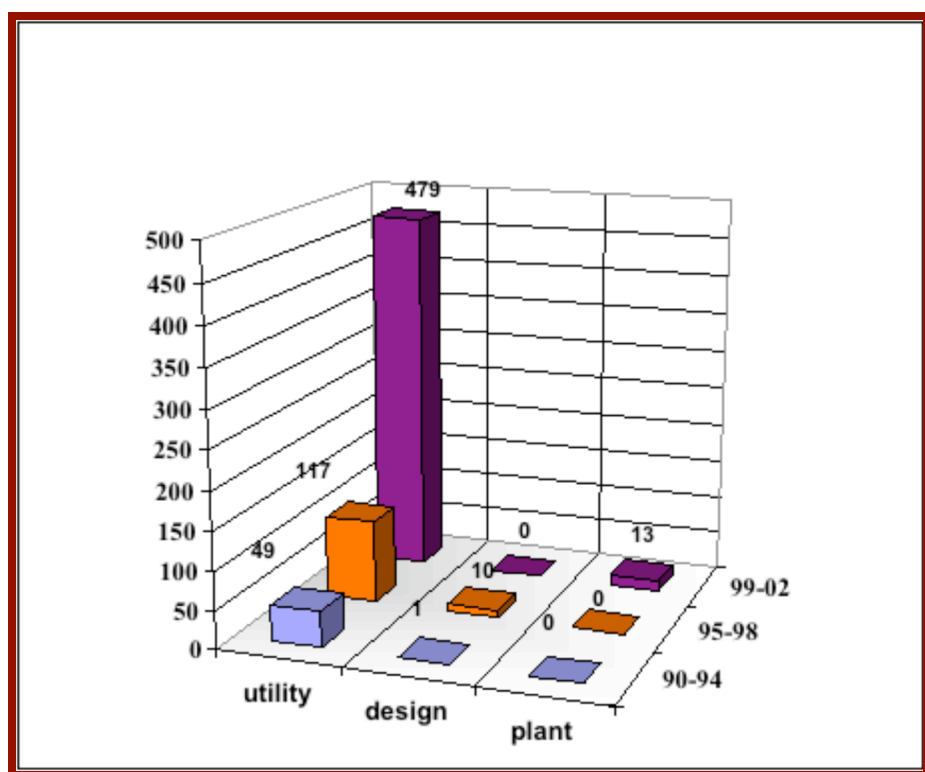
Results

There were 669 patents that were granted to institutions with legal address in India (termed as India Owned Patent, IOP for short) [6]. This was the selected data set for this study. The patents were distinguished under three periods: 1990-1994, 1995-1998, and 1999-2002. These three periods were termed as pre-WTO, post-WTO, and the Current period. The indicators as defined above were applied to this data set. The results described are specific to this data set. However, the main intention was to show the applicability of the above indicators.

A) Patenting Types

Majority of India Owned Patents (approx. 96%) were utility patents. The maximum numbers of utility patents were granted during the current period (1999-02). Most of the design patents were granted during the period (1995-98). All the plant patents were granted in the period 1999-2002. Figure 1 highlights the details.

Figure 1: Patent Activity under Various Types in Pre/Post and Current Period



Source: Indian Patenting Activity in International and domestic patent system. Report by NISTADS for the Office of the Principal scientific Advisor, Govt. of India (2005)

Design patents form an important category of patents. It provides an additional protection and possibility of appropriation to a patentee who has a design patent on its utility patent. The value can be increased further if there are a number of design patents protecting a

utility patent. Even if an organisation has no utility patent, it can be useful to have design patents. The design patents are easy to obtain and can be an effective way of enhancing the patent portfolio of an organisation. Thus Indian organisations/industry can take this opportunity of creating proprietary protection in design by patenting in US.

Similar to design patents, plant patents can also provide greater protection to utility patent or can be useful even if there are no utility patents covered by the said plant patent. Approximately 10,000 plant patents have been granted in USPTO and only a few countries (mostly top patenting countries) have plant patents. *Plant patenting is thus a small domain of patenting activity in USPTO, and India's patenting activity in this area is encouraging.*

B) Priority Patent Application

A count by 'Country of Priority Application' tells us more of the attractiveness of that country's patenting process: quality of intellectual property regulations, reputation of the patent office (rules, cost of patenting) and general economic features (size of the market) (OECD [7]).

Keeping in view the importance of this information, Information on priority patent application was given in 584 patents (out of 669 IOP). Table 1 exhibits this in details.

Table 1: Country of Priority Patent Application

Priority Country	90-94	95-98	99-02	90-2002
US	35	75	222	332
India	8	35	223	266
European Patent Office	4	5	6	15

Source: Indian Patenting Activity in International and domestic patent system. Report by NISTADS for the Office of the Principal scientific Advisor, Govt. of India (2005)

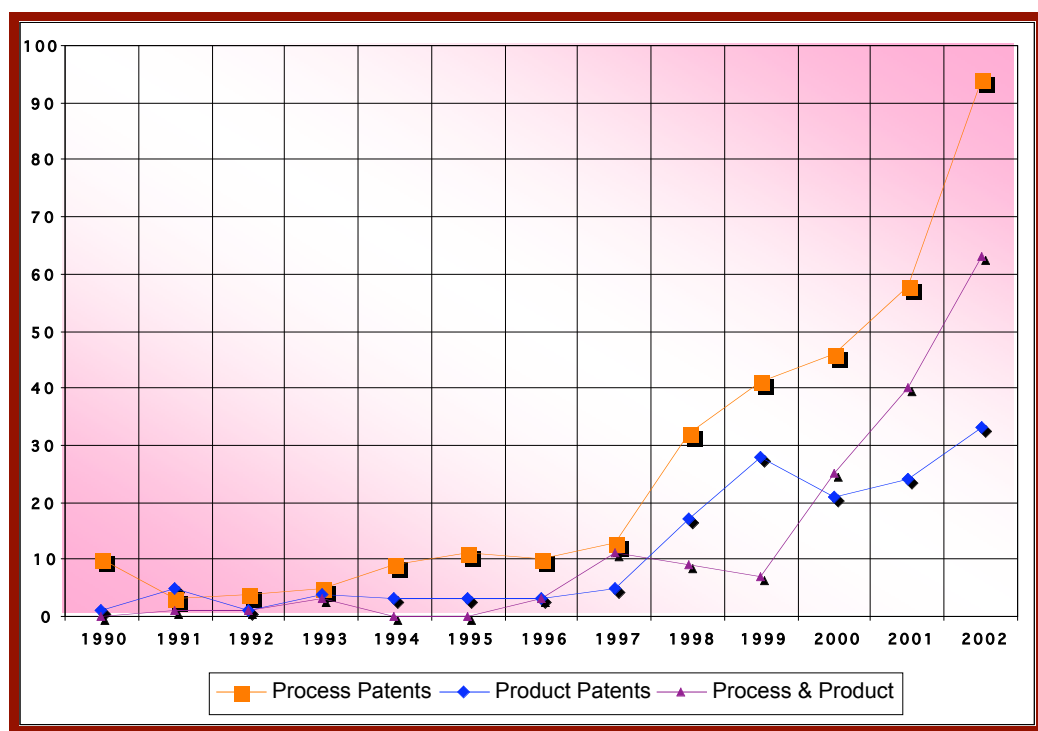
Table 1 indicates that 'country of priority application' in majority of the patents granted in USPTO were attributed to India or US. A substantial number of patents having 'country of priority application' in US make an important point. Apart from indicating attractiveness of that country's patenting process, it is also an indication of the technological merit the inventors (or the organization in which he/she is attached) perceives in his invention and is ready to undertake the necessary risks in this regard. Filing in U.S. requires much higher fees (US\$ 10,000 approx.) as well as going through a more elaborate process in documenting the invention, keeping detailed laboratory records of the experiments undertaken, and going through a more stringent process of satisfying the claims of the inventions. *To some extent a substantial number of patents having 'country of priority patent application' in US indicate that Indian organisations are gaining confidence in the technological merit of their invention and there is an expectation of return from protection in US (technological advantage, sales or license).*

C) Process/product Patent

A majority of patents granted to Indian organisations were process patents. There were 336 patents (50% of the total patents) that were only process patents, and 148 patents that were only product patents (22% of the patents). There were 174 patents (26 % of the patents) that claimed proprietary protection in both product and process. Patenting under all the three categories (process/product patents) exhibited an increasing trend, as shown by Figure 2. This can directly attributed to the

increase in patenting activity in the post and current period. Product patents are also contributing to the overall increase in patents in the later period. This is an encouraging trend.

Figure 2: Product/Process Patents in the India Owned Patents



Source: Indian Patenting Activity in International and domestic patent system. Report by NISTADS for the Office of the Principal scientific Advisor, Govt. of India (2005)

D) Joint Assignment

Joint patents that reflect linkages/collaborations among organizations were very less. Out of 669 Indian granted patents, only 62 patents were collaborative patents, constituting 9% of the total patents. However, of the 62 joint patents, 24 patents were co-assigned to entities belonging to same organization. Reddy's Research Foundation had 23 patents with Reddy-Chemical Inc. USA, its own subsidiary. Grindwell Norton Ltd. had 1 joint patent with its parent organization Norton Company. Linkages were mostly of the industry-industry type and a few were research-industry type. Most of the linkages were in the current period (1999-2002). Table 2 illustrates organisations that had been granted patents involving another firm/research organisation.

Table 2: Collaborative Patents 1990-2002

Organization	No. of patents (Collaborative patents)	Collaboration with
Council of Scientific & Industrial Research	378 (14)	Department of Science and Technology (3)
		Indian Oil Corporation Ltd (3)

		General Electric Company (3)
		Department of Biotechnology (2)
		University of California (1)
		Laboratoire des Materiaux Organiques a Proprietes Specifiques (1)
		National Institute of Cholera & Enteric Diseases and Department of Biotechnology (1)
Dr. Reddy' s Research Foundation	35 (29)	Reddy-Cheminor, Inc. (23)
		Novo-Nordisk A/S (6)
Dabur Research Foundation	15 (2)	Delhi University (1)
		National Institute of Immunology (1)
Indian Petrochemicals Corporation Limited	9 (2)	Korea Institute of Energy Research (2)
Indian Herbs Research & Supply Company Ltd.	5 (5)	Natreon Inc. (5)
Vittal Mallya Scientific Research Foundation	5 (2)	The University of Leicester (1)
		Renaissance Herbs, Inc. (1)
Indian Institute of Science	2 (2)	Nagarjuna Holding Private Limited (2)

Note: Organisations that had only a single patent as joint assignment is not shown in this table.

Source: Indian Patenting Activity in International and domestic patent system. Report by NISTADS for the Office of the Principal scientific Advisor, Govt. of India (2005)

E) Impact Based on Patent Citation Analysis

The cited activity of Indian patents showed that out of 669 Indian owned patents, 262 patents (40%) were cited one or more times. Table 3 exhibits the citation details.

Table 3: Cited Details of Indian Owned Patents

Year	Total Patents	No. of Patents Cited	No. of Times Cited	Citation Per patent	Uncited Patents
1990- 1994	50	36 (72%)	175	3.5	14
1995- 1998	127	77 (61%)	317	2.5	50
1999- 2002	492	149 (30%)	328	0.7	343
1990- 2002	669	262 (40%)	820	0.8	407

Source: Indian Patenting Activity in International and domestic patent system. Report by NISTADS for the Office of the Principal scientific Advisor, Govt. of India (2005)

Table 4 shows that maximum numbers of citations were received during the current period (1999-2002). However, citation per patent was less then the earlier periods. Table 4 further distinguishes the citations received in different periods.

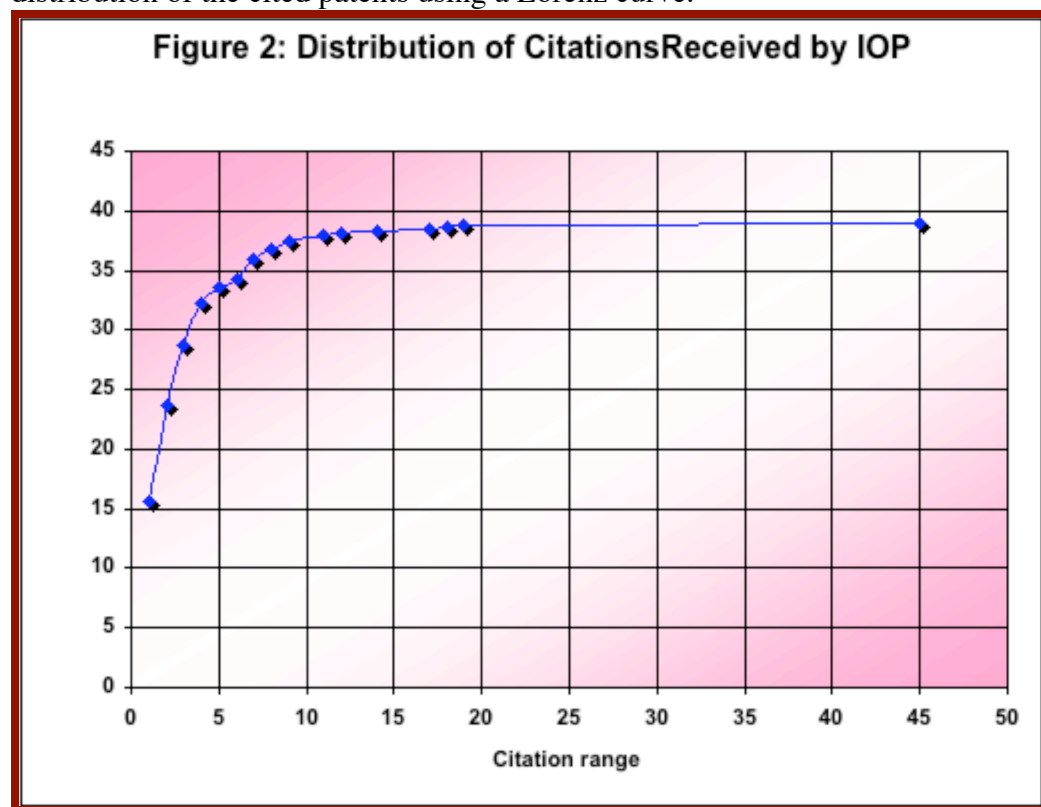
Table 4: Citation Received in Each Block Period

Patents granted: No. of Patnets	Times Cited (1990-94)	Times Cited (1995-98)	Times Cited (1999-02)
1990-94: 50	12	70	93
1995-98: 127	-	24	293
1999-2002: 492	-	-	312

Source: Indian Patenting Activity in International and domestic patent system. Report by NISTADS for the Office of the Principal scientific Advisor, Govt. of India (2005)

Table 4 corroborates the fact that it takes time for the patents to attract citations, i.e. to get noticed (*this is similar to the research paper, i.e. on an average there is some time gap before a research paper is noticed*).

The cited activity of patents has been depicted for the overall study period as well as for the breakup of periods i.e., pre/post-WTO and current Period. Figure 2 exhibits the citation distribution of the cited patents using a Lorenz curve.



From Figure 2, it can be interpreted that 15% of the patents have received one citation. Similarly 35% of patents had received six or less then six citations. The other correspondences can be interpreted similarly from the Figure. The above lorentz curve helps to visualise in what manner citations are being attracted by the IOP. For example, high degree of concentration between the citation range five to eight implies that maximum number of patents attracted citations below this range.

e) Indian Patents Cited in Journals

Generally references by articles in scientific journals are to journal articles and other non-patent references. Citations to patents are not very much noticed in journal articles. Thus patents that are cited by journal articles point out the scientific significance of the invention that the said patent protects. 95 patents (14%) of the total granted patents (669 patents) were cited by journals. In all 167 journal articles had cited 95 patents. The major field and subfield analysis of the citing journals were also undertaken. Journals in chemistry had cited maximum number of patents, i.e., 67 patents.

Within chemistry, the sub-field 'Physical chemistry' cited maximum number of patents followed by 'Organic chemistry,' and 'General chemistry.' This provides indirect evidence that there are some fields and subfields where IOP have scientific significance.

Conclusions

The above study has highlighted some of the information that can be extracted from a patent document. There has been a long tradition of constructing indicators from patent statistics. As Grupp and Schmoch [8] has pointed out that patent analysis is difficult and we must treat the data with care. The main problem emerges in understanding the different features and characteristics of a patent document. The present study attempts to contribute in this direction by drawing attention to some of the rich source of information in a patent document.

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