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Inventors' productivity in a publicly funded R&D agency—the case of CSIR in India

V.K. Gupta *

National Institute of Science, Technology and Development Studies, K.S. Krishnan Marg, Pusa, New Delhi 110012, India

Abstract

Intellectual property rights have become a significant component of R&D policy in India. The inventor's productivity is a major concern of the publicly funded R&D organizations like the Council of Scientific and Industrial Research (CSIR). The paper examines the patenting activity of inventors from CSIR in India and the US during 1976–2000. It observes that there is no uniform trend in patent output of inventors. The patent productivity is highly concentrated in a relatively small number of talented individuals. The first inventors have a role as scientific mentors. It defines the 'pioneer first inventors' as those who contribute more as first inventor and less as co-inventor. The 'patronising first inventors' are those who contribute less as first inventor but more as co-inventor. Though the former produce more patents in total in comparison to the latter yet the per inventor output of 'patronising first inventors' is twice that of 'pioneer first inventors'. The paper suggests that, within CSIR's policy of rewarding innovation and creativity, the role of leading inventors should be distinguished as pioneering first inventors and patronising first inventors and their contributions rewarded accordingly.

Keywords: Inventor productivity; Patent analysis; Patent information; Intellectual property rights; India; Pioneering inventors; Patronising inventors

1. Introduction

Several studies on patent information suggest its use for R&D and technology development, R&D policy and management, and for S&T information policy [1]. However, there are limited studies in the literature particularly devoted to the inventor's patent productivity. Ernst stresses the importance of patent information for storing relevant knowledge as a core element of knowledge management and as a tool for human resource management [2]. How can leading inventors in a specific technological field be found? How is it possible to ensure that leading inventors remain in the organization? Narin investigated productivity of inventors in four companies in the area of semiconductors [3]. Ernst reported a study of 2000 inventors in 43 companies that revealed that only 6.9% of all the inventors could be classified as key inventors [4]. The focus of these studies has been on the inventors' contributions in a specific technology field or firms in the industry. In India, Subbaram described the intellectual property system in the Council of Scientific and Industrial Research [5]. Rajeshwari examined the patent statistics and concluded that the patent output does not reflect the total manpower devoted to R&D in the country [6]. There is no specific study to look into the patent productivity of inventors from publicly funded R&D organizations.

The Science and Technology Policy of the Government of India announced in 2003 aimed at establishing an intellectual property rights regime, which maximised the incentives for the generation and protection of intellectual property by all types of inventors. The policy states that intellectual property rights have to be viewed as an effective policy instrument that will be relevant to wide ranging socio-economic, technological and political concepts [7]. There is a growing importance attached to the intellectual property rights in publicly funded R&D organizations like CSIR, which now operate in an environment of global technological trade and competition [8]. In order to compete, it is necessary for them to create and sustain the knowledge advantage over other R&D organizations as well as the clients [9]. In this process, the role of inventors is pivotal for protecting intellectual property rights, accumulating the

* Tel.: +91-11-2584-6669; fax: +91-11-2584-6640.
E-mail address: vkgupta@nistads.res.in (V.K. Gupta).

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proprietary knowledge, and effectively using patent information. The present paper examines the pattern of patent productivity of inventors in CSIR with a view to highlight the importance of the role of first inventors.

2. About CSIR

The CSIR is the premier agency in India that conducts R&D covering a wide canvas of scientific disciplines. With liberalization of the Indian economy in 1991, CSIR faced a challenge to become more market-responsive and customer-oriented. It reoriented its mission to provide 'scientific industrial R&D' that maximised the economic (industrial), environmental and societal benefits for the people of India. In recent years, the Government has encouraged it to generate resources from external clients by commercializing intellectual property and conducting contract research. Its IPR policy has emphasized the need to maximise the benefits from its intellectual capital by stimulating higher levels of innovation [10]. The goals of IP policy include stimulation and encouragement of increased creativity and innovation in order to gain economic advantage, and nurturing a strong innovation base through a balanced system of recognition and rewards ranging from according due weightage in promotions to monetary and other forms of rewards.

3. Data and methodology

The National Institute of Science Communication and Information Resources (NISCAIR) provides a CD-ROM database on Indian patents. The database is called INPAT. In this database, a search was made by using the key words '*CSIR*' or '*Council of Scientific and Industrial Research* ' or '*C.S.I.R*'. The search resulted in data on patents by CSIR in India for the period 1976–2000. The data included bibliometric information on patent numbers, title of patents, date of filing, date of grant, team of inventors, and international patent class. A set of 1978 Indian patents that had complete information was identified for the purpose of present analysis. Similarly, the data on patents obtained by inventors from CSIR was obtained from the USPTO patent database available on the Internet. In all, inventors from CSIR obtained 177 US patents during 1976–2000.

The data on names of inventors in a team of a patent were used to analyse the inventor's patent productivity, and productivity of inventors as first inventors and co-inventors. The total number of patents produced by an inventor was counted using the whole count methodology. In whole count methodology, each inventor whose name appeared in team of inventors was given credit for one patent regardless of number of co-inventors. The number of patents, in which an inventor was first inventor, was counted. The number of patents, in which the same inventor was a co-inventor, was also counted. The data were used to examine productivity of inventors as first inventors and as co-inventors. Two kinds of leaders among first inventors were identified. First, the role of 'pioneer first inventors' was defined as those inventors who contribute more as first inventor and less as co-inventor. Second, the role of 'patronising first inventors' was defined as those inventors who contribute less as first inventor but more as co-inventor. The pattern of productivity of pioneer and patronising first inventors was analysed.

4. Pattern of patenting

The inventors in CSIR obtained 1978 patents in India during the period 1976–2000, an average of 79 patents per year (Table 1). The patenting activity is above the annual average during 1976–1978, 1984, 1987, 1995–1999 while it is below the annual average during 1979–1983, 1985–1986, 1988–1994, and 2000. The analysis indicates that the patenting activity has not been uniform over the years. The CSIR announced its formal IPR policy in 1996 that lead to a more focused approach

Table 1
Annual growth in CSIR patenting activity

Year	Patents in India (in numbers)	Patents in US (in numbers)
1976	97	1
1977	144	1
1978	130	–
1979	48	–
1980	41	–
1981	36	–
1982	56	1
1983	36	–
1984	103	1
1985	49	1
1986	63	1
1987	121	–
1988	63	2
1989	49	1
1990	77	6
1991	63	3
1992	35	4
1993	30	7
1994	58	7
1995	116	10
1996	95	10
1997	190	19
1998	95	27
1999	123	38
2000	60	37
Total	1978	177

to patenting and its growth. The shift is also reflected in the pattern of patenting by CSIR scientists in USA.

5. Productivity of inventors

The propensity to patent differs among R&D organizations and inventors. The whole count data of Indian patent output of CSIR inventors indicates that there are 2880 inventors who produced 6877 patents in India. Of these, 62 (2%) inventors produced 1225 (18%) patents, 691 (24%) inventors produced 4166 (61%) patents, and 2189 (76%) inventors produced only 2711 (39%) patents.

The patenting in US by inventors from CSIR also reflects a similar pattern. There are 461 inventors who produced 755 patents in US. The analysis indicates that 19 inventors (4%) produced 155 patents (20%), a highly concentrated pattern of inventor productivity. There are 48 (10%) inventors who produced 227 (30%) patents while 413 (90%) inventors produced 528 (70%) patents.

A small number of inventors in CSIR account for a large fraction of patents in India as well as in US.

6. Productivity of first inventors

The analysis indicates that, of the 2880 inventors, 1010 inventors are first inventors who produced 3309 patents (average 3.3 patents per inventor). There are 443 first inventors who contribute single inventor patents. The remaining 567 first inventors contribute both as first inventors as well as co-inventors.

The role of scientific mentors as a component of one's scientific career is one of those things that most will agree to be positive and need to be addressed as a conscious R&D policy. Scientific mentors motivate colleagues to excel in science and patent productivity. The role of first inventors as scientific mentors in patenting has been examined below.

6.1. Pioneer first inventors

The 'pioneer first inventors' contribute more as first inventors and less as co-inventors. The analysis of raw data indicates that there are 468 pioneer first inventors who contribute 1176 patents as first inventors and 753 patents as co-inventors. The patent output of pioneer first inventors is 4.12 patents per inventor (2.5 patents per inventor as first inventor and 1.6 patents per inventor as co-inventor).

6.2. Patronising first inventors

The 'patronising first inventors' contribute less as first inventors but more as co-inventors. There are 99 patronising first inventors who contribute 374 patents as first inventors and 563 patents as co-inventors. The patent output of patronising first inventors is 9.5 patents per inventor (3.8 patents per inventor as first inventor and 5.7 patents per inventor as co-inventor).

The pioneer first inventors produce more patents in comparison to the patronising first inventors. However, per inventor productivity of patronising first inventors is twice that of pioneer first inventors. It highlights the significance of the role of patronising first inventors as scientific mentors in the patenting process.

7. Productivity of co-inventors

There are 1870 co-inventors who have never been first inventors. These co-inventors do not take lead as first inventors. They only contribute their skills to the inventive features of the invention as directed by first inventors. The co-inventors produce 3568 patents (average 1.9 patents per co-inventor). The average number of patents produced by such co-inventors is almost half the average number of patents produced by the first inventors.

8. Conclusions

There is no uniform trend in patent output of inventors in CSIR during 1976–2000. However, a more focused approach to patenting emerged after publication of its formal IPR policy in 1996. The patent productivity is highly concentrated in relatively small number of talented individuals. The examination of the role of first inventors as scientific mentors indicates that the 'pioneer first inventors' produce more patents in comparison to the 'patronising first inventors'. However, per inventor output of 'patronising first inventors' is twice that of 'pioneer first inventors'. The patronising first inventors play a significant role as scientific mentors. The co-inventors, who have never been first inventors, produce almost half the average patents produced by the first inventors. These co-inventors play a supportive role to the first inventors and contribute their skills to the inventive features of the invention as directed by the first inventors.

The implication of the above findings is that, within CSIR's policy of rewarding innovation and creativity, the role of leading inventors as pioneering first inventors and patronising first inventors should be distinguished and their contributions rewarded accordingly. The CSIR should encourage interactions among the first inventors and the co-inventors so as to enhance the role of patronising first inventors and the overall patent productivity.

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V. K. Gupta is a senior scientist presently researching the issues of intellectual property rights, WTO, and S&T policy reforms in the context of Indian R&D policy and management. His main areas of specialization include international affairs in science and technology, S&T policy and management, dual use technology and export controls, transfer of technology, and human resource management. He has more than 30 years of experience in these fields and has written several publications and technical reports.