Patenting trends among the SAARC nations: comparing the local and international patenting intensity

Tarakanta Jana, Siddhartha Dulakakhoria, Nupur Wadia, Deepak Bindal and Ankit Tripathi*

An attempt has been made in this study to present an overview of the patenting intensity of South Asian Association for Regional Cooperation (SAARC) countries. Patent data originating from SAARC countries from 1995 to 2011, filed through World Intellectual Property Organization (WIPO), European Patent Office and United States Patent and Trademark Office were collected and analysed. Annual intellectual property (IP) reports of India, Pakistan, Sri Lanka and Bangladesh patent offices and WIPO annual IP reports were used to congregate patents filed/granted in the respective patent offices. During the study period, inventors from India have been highly active in filling international patents, whereas a modest international patenting activity was observed in case of the remaining SAARC nations. At the country level, a comparison based on the domestic patenting intensity and relative quality indicators shows that Sri Lanka is the strongest scientific country among the SAARC nations.

Keywords: Innovation, intellectual property, patents, SAARC.

In the present age, regional organizations like South Asian Association for Regional Cooperation (SAARC) are becoming an important and effective new scene for political and economic interaction in the world[1]. SAARC is an organization comprising eight South Asian nations: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. It was established in 1985 by Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka[2]. Afghanistan joined SAARC in 2007. Covering approximately 1.5 billion people, SAARC is the largest regional cooperation in the world[3].

Academic publications have become the trademark of science and technology (S&T) information at the advanced level of national development. Till date various studies have been undertaken which use scholarly publications to measure the technical and scientific output of SAARC countries. Gupta *et al.*[4] studied the outputs of S&T collaborations among South Asian countries by analysing authored research papers published during the period 1992–1999 in the journals covered by *Science Citation Index*. They found that India had stronger collaborative linkage with all the other SAARC nations, but the collaborations were restricted to a few subject areas. Mahbuba and Rousseau[5] presented a comparative analysis between Bangladesh, Pakistan and Sri Lanka with India, by analysing the *Web of Science* (*WoS*) and *Scopus* data. They observed that India has got the maximum number of *WoS* publications followed by Pakistan, Bangladesh and Sri Lanka. But based on the comparative analysis of the relative quality indicator, they found that Sri Lanka is the best performer among the four countries. Many recent articles have also used patent as an indicator to measure the S&T output, but most of those studies compared India with China or other developing Asian countries[6–8]. But till date no study has been done to measure and compare the technical and research output of the SAARC countries based on patenting intensity of these countries. Patents are the primary source of unique and state-of-the-art technical information. The number of patents originating from a country indicates the technological performance of a country; hence patents can be used as indicators to measure the technological competitiveness of a country. To attain the objectives of the study we will be analysing the patents filed by inventors/ innovators from SAARC countries through World Intellectual Property Organization (WIPO), European Patent Office (EPO) and United States Patent and Trademark Office (USPTO) and their respective patent offices.

Methodology

For the present study data have been collected from Thomson Innovation Index database, which covers published

The authors are in the Patent Informatics Division, National Institute of Science Communication and Information Resource, 14, SV Marg, New Delhi 110 067, India.
*For correspondence. (e-mail: tkj@niscair.res.in)

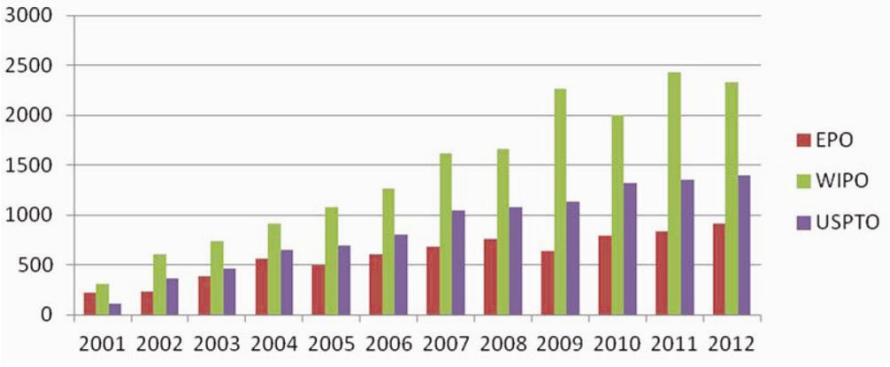

Figure 1. Annual patent trend (by Indian inventors).

Table 1. IPC-wise segregation of patents filed by Sri Lankan inventors

IPC category	WIPO (%)	EPO (%)
Human necessities	39	68
Performing operation, transporting	17	–
Chemistry metallurgy	16	12
Fixed construction	5	10
Mechanical engineering	5	5
Physics	12	–
Electricity	6	5

patent documents originating from the majority of leading industrialized countries and patent offices/organizations, for example, WIPO and EPO. Patents originating from SAARC countries (i.e. patents filed by inventors based in SAARC countries) for the period 1995–2011 have been collected and data selected for the analysis are for the period 2001–2010. Country codes (India – 'IN'; Pakistan – 'PK'; Sri Lanka – 'LK'; Bangladesh – 'BD'; Nepal – 'NP'; Bhutan – 'BT'; Maldives – 'MV'; Afghanistan – 'AF') were used to collect the data. It should be noted that since by convention patents are usually classified and published 18 months after filing, the patent record set covering 1995–2011 may not be complete. This should be borne in mind when considering recent patent trends (within the last 18 months). We could not retrieve patents originating/filed in Nepal, Bhutan, Maldives and Afghanistan; hence they were excluded from the study. On-line patent database, WIPO patent reports and annual intellectual property (IP) reports of India, Pakistan, Sri Lanka and Bangladesh patent offices were used to congregate patents filed/granted in the respective patent offices.

Results

Annual filing trends of SAARC inventors in EPO, USPTO and WIPO

The analysis presented in this study is primarily based on publication year to give the earliest indication of inventive activity. Annual filing trend highlights recent trends and patenting patterns of SAARC inventors with respect to publication date of patent filed through EPO, WIPO and USPTO. From Figure 1 it can be observed that there is a steady growth in the number of patents filed by Indian inventors. It has increased significantly from 219 to 914 in EPO, 312 to 2331 in WIPO and 115 to 1395 in USPTO. This corresponds to a cumulative annual growth rate (CAGR) of 8.25% in case of EPO, 18.1% in case of WIPO and 23% in case of USPTO. Since 2001, in EPO, publication of patents filed by Indian inventors has increased at an average of 65 patents per year. In case of WIPO, patent publication has increased at a rate of 132 patents per year. Similarly, in case of USPTO, since 2001, patent publication has increased at a rate of 116 patents per year (Figure 1).

We recorded a total of 70 patents filed by inventors from Sri Lanka through USPTO, WIPO and EPO. Fifty-four patents were filed through WIPO, 14 through EPO and only 2 patents (US20110074318A1 and US20100320773A1) were filed through USPTO. Table 1 presents the number of patents filed by Sri Lankan inventors through WIPO and EPO in each International Patent Classification (IPC) area. From Table 1, it can be interpreted that maximum number of patents filed by Sri Lankan inventors falls under the technological sphere of 'human necessities', followed by 'performing operation, transporting', 'chemistry metallurgy' and 'mechanical engineering' in WIPO and 'chemistry metallurgy' and 'fixed construction' in EPO. Though maximum number of patents was filed under the IPC area 'human necessities', there is significant difference in the distribution of the remaining patents in both databases.

We recorded a total of 18 patent publications filed by inventors from Pakistan in the three patent offices, 7 in USPTO, 6 in EPO and 5 in WIPO. Pakistan inventors who have filed patents through EPO are Muhammad Siddique, Mujeeb Ur Rehman Alvi and Zafar Iqbal. Mujeeb Ur Rehman and Zafar Iqbal were the only Pakistan inventors who filed patents through both EPO and USPTO. A. Khan, H. Afzaal, A. Mustafa, Hamid Abdel Zaki, A. Ashfaq, A. Choudhary, S. Robina, O. Saeedand and A. D. Hussain were the Pakistani inventors who filed patents through WIPO.

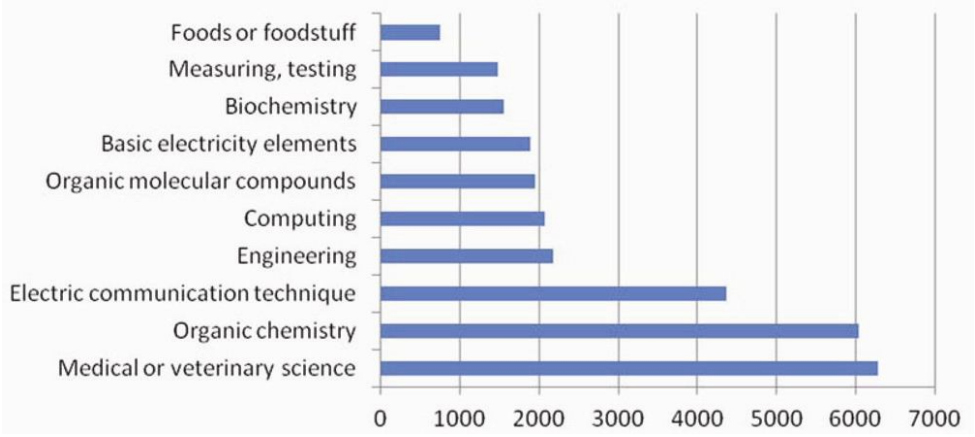

Figure 2. Top technical fields based on IPC analysis (India).

We did not record a single patent filed by Bangladeshi inventors in EPO, WIPO and USPTO.

Annual filing trends of SAARC inventors in their respective patent offices

A total of 251,421 patents have been filed in the Indian patent office from 2001 to 2010, out of which 49,304 were filed by domestic applicants and 202,117 were filed by foreign applicants. The number of patents granted during this period amounts to 64,208, out of which 14,872 patents were assigned to Indian inventors and 49,336 were assigned to foreign inventors. Out of every 10 patents filed by foreign applicants, 2.4 patents get granted, whereas in case of patents filed by Indian inventors, out of every 10 patents filed, 3 get granted. The number of patents filed has increased from 10,592 in 2001 to 39,400 in 2010. This increase corresponds to a CAGR of 14%. The number of patents granted has increased from 1591 in 2001 to 7509 in 2010, which corresponds to a CAGR of 16.7%. Domestic patent filing has increased from 2371 in 2001 to 8312 in 2010. Similarly, domestic patent granted has increased from 654 in 2001 to 1273 in 2010.

In Pakistan, 14,734 patents have been filed during the study period, out of which 1019 were filed by domestic inventors and 13,715 were filed by foreign inventors. The number of patents filed has decreased from 1461 in 2001 to 953 in 2010. This corresponds to a CAGR of –4.71%. During this period a total of 3236 patents have been granted by the Pakistan patent office. The number of patents granted has decreased from 322 in 2001 to 237 in 2010, with a CAGR of –3.01%.

In Sri Lanka from 2001 to 2010, a total of 3805 patents have been filed, out of which 1547 have been filed by domestic inventors and 2258 by foreign inventors. The number of patents filed has increased from 356 in 2001 to 460 in 2010, corresponding to a CAGR of 2.59%. From 2001 to 2010, a total of 1932 patents have been granted, out of which 802 were filed by domestic inventors and 1130 by foreign inventors. The number of patents filed by domestic inventors has increased from 120 in 2001 to 225 in 2010.

In Bangladesh a total of 3142 patents have been filed during the study period, out of which 456 were filed by domestic inventors and 2686 by foreign inventors. The number of patents granted has increased from 295 to 306, corresponding to a CAGR of 0.36%. A total of 2202 patents were granted by the Bangladesh patent office from 2001 to 2009.

Technical field

In this section the distribution pattern of domestic patents in technical fields, filed in the SAARC countries is presented. As we could not find data on technical fields of patents filed in Sri Lanka and Bangladesh, the analysis will be limited to India and Pakistan. From 2005 to 2010, Indian inventors have filed the maximum number of patents in the IPC class A61, covering technologies related to medical or veterinary science (Figure 2). Similarly, in Pakistan, A61 covers the maximum number of patents (Figure 3). Patents filed in Pakistan were mostly focused on medical, agriculture and chemical sciences, while in India technical fields covering pharmaceutical or industrial inorganic chemicals rank first followed by electric communication system, engineering and computing.

Number of patent applications per million population

Figure 4 shows the number of resident patent applications per million inhabitants. Sri Lanka and India had the highest rate of domestic patent applications per million population (pmp) at 77.3 and 39 respectively. They were followed by Pakistan and Bangladesh with 5.5 and 3

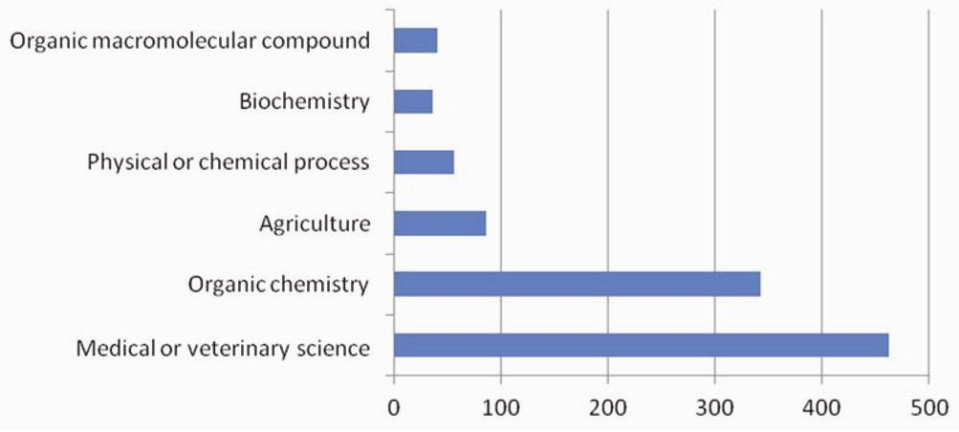

Figure 3. Top technical fields based on IPC analysis (Pakistan).

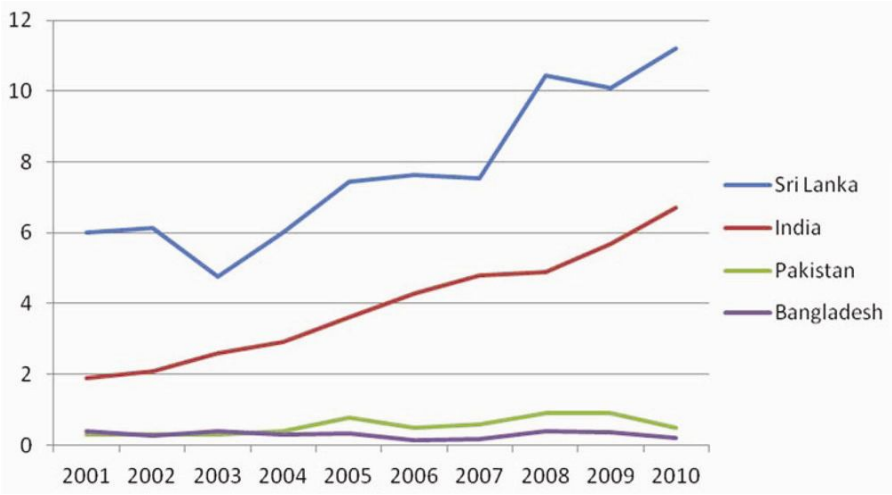

Figure 4. Patent applications per million population.

patent applications pmp respectively. The number of patents granted during this period to Indian inventors amounts to 12 patents pmp compared to 40.1 patents pmp in case of Sri Lanka. During the study period the rate of domestic patent filing has changed in India from 1.9 in 2001 to 6.7 patents pmp in 2010; in Sri Lanka, from 6 to 11.5 patents pmp; in Pakistan from 7.5 to 5.1 patents pmp and in Bangladesh from 0.38 to 0.21 patents pmp.

Number of patent applications per gross domestic product

Figure 5 shows the number of domestic patent applications per 100 million USD of GDP, where the average GDP from 2001 to 2010 was measured in USD. India and Sri Lanka with 2.63 and 2.61 patents respectively, had the same rate of patent applications per 100 million USD. Similarly, Pakistan and Bangladesh with 0.48 and 0.40 patents respectively, had the same rate of patent applications per 100 million USD.

Number of patent applications per 1 million USD of R&D expenditure

Figure 6 shows the number of domestic patent applications per 1 million USD of R&D expenditure. Sri Lanka with 9.43 patents has an overwhelming lead over India with 1.36 patents and Pakistan with 0.37 patents per million USD of R&D expenditure.

Discussion and conclusion

The objective of this study was to analyse the patenting behaviour and measure the technical output of the SAARC countries. To achieve the aforementioned objectives we analysed patent publications, filed by inventors from SAARC countries, through WIPO, EPO, USPTO and their respective patent offices.

Indian inventors maintain an overwhelming lead over their SAARC counterparts when it comes to international filing of patents. In case of Sri Lanka, Pakistan and Bangladesh, more than 98% of all patents is solely applied at

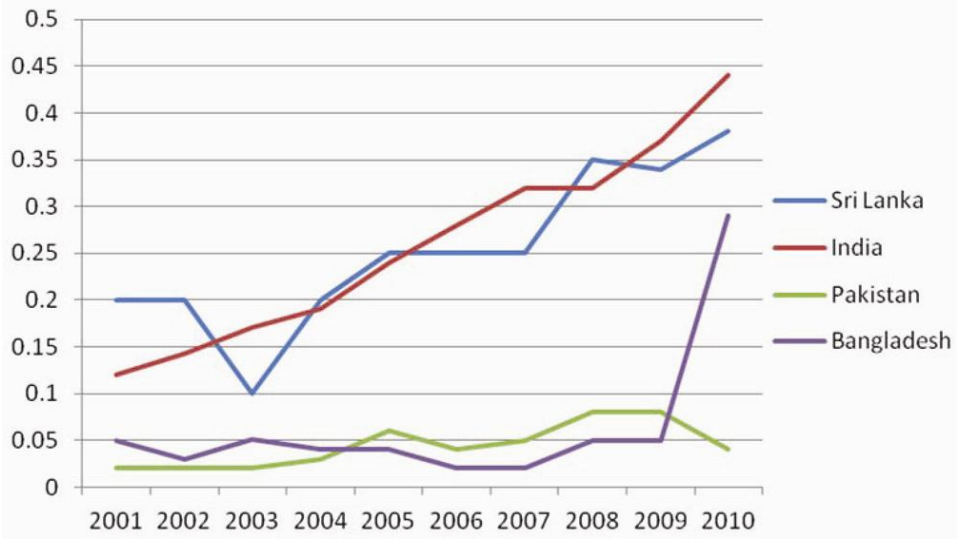

Figure 5. Patent applications per 100 million USD of GDP.

Table 2. SAARC countries ranking from Global Competitive Index

Indicators	India	Sri Lanka	Pakistan	Bangladesh
Intellectual property protection	71	63	109	130
Quality of education	33	28	84	98
Intensity of local competition	24	20	79	74
Availability of latest technologies	58	72	79	101
Capacity of innovation	41	44	49	120
Quality of research	37	53	75	130
Company spending on R&D	39	52	75	134

the respective patent office. An increasing trend towards international patenting in future cannot be identified so far, as the average number of patents applied at WIPO and USPTO remains negligible compared to Indian inventors. Reasons for this lack of international filing may be less interest in international patent protection of their inventions, since they possibly do not generally focus on a worldwide commercialization of their research results. Another argument could be that international patent applications are too cost-intensive, due to high costs from patent drafting, filing, prosecution, maintenance, etc. Despite reducing fees and improving procedures for patent filings, EPO, USPTO and WIPO have received very little patents from SAARC countries like Pakistan, Sri Lanka and Bangladesh. This is due to factors internal to those nations (their policies and environment). However, to the extent that these countries depend on access to foreign markets in Europe and USA for their development, their lack of involvement in international patenting activities becomes an important issue.

In case of patents filed in domestic patent offices, a comparative analysis based on the absolute number of patents filed in these offices will be incoherent. Hence we used three patent indicators for reference in our study to achieve more cross-country comparisons by weighting the number of patent applications by a measure of the regional size and economic activity. These three patent intensity indicators were introduced by WIPO, that compare patent filing with population, gross domestic product (GDP) and R&D expenditure[9]. The scenario changes when the local patenting intensity is compared based on the population, GDP, R&D expenditure and R&D personnel of these countries.

Analysis based on these three indicators shows that Sri Lanka, which has the lowest population, GDP, R&D expenditure and R&D personnel among the SAARC countries is the best performer, followed by India, Pakistan and Bangladesh. It can be argued that the better performance of Sri Lanka is due to its small population size; then what about Pakistan and Bangladesh. If we go by the aforementioned argument, then both Bangladesh and Pakistan should have done far better than India. But based on the three indicators, Pakistan and Bangladesh patenting intensity is way behind India. It is true that India is ahead of Sri Lanka in certain technology sectors and even competes with highly developed industrial nations, but in matters of providing a favourable ecosystem for innovation, Sri Lanka is better than India. According

Table 3. Ranking of SAARC countries from Knowledge Economy Index (KEI)

	KEI		Knowledge index		Economic incentive regime		Innovation		Education		Information and Communi-cation Technology		Rank	
Country	2008	2012	2008	2012	2008	2012	2008	2012	2008	2012	2008	2012	2008	2012
Sri Lanka	4.61	3.63	4.07	3.49	4.44	4.04	4.44	3.06	4.91	4.61	2.85	2.80	82	101
India	3.12	2.06	2.94	2.89	3.67	3.57	3.97	4.5	2.26	2.26	2.59	1.9	100	110
Pakistan	2.48	2.45	2.18	2.63	2.43	1.93	2.75	2.84	1.07	1.44	2.72	3.60	115	117
Bangladesh	1.49	1.49	1.63	1.48	1.10	1.51	1.71	1.69	1.52	1.75	1.66	1.01	128	137

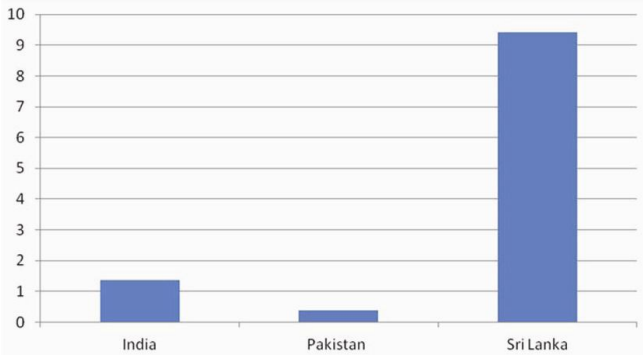

Figure 6. Patent applications per million USD of R&D expenditure.

to the Global Competitive Index (GCI), Sri Lanka has by far the highest IP protection ranking among the SAARC countries (Table 2). Similarly, Sri Lanka maintains a healthy lead over its SAARC counterparts in the quality of the education system, intensity of local competition and Knowledge Economy Index (KEI; Table 3). Not much difference exists in the capacity for innovation among India, Sri Lanka and Pakistan. But considering quality of research institutions and company spending on R&D, India outranks its SAARC counterparts. This indicates why India can compete in certain technology sectors with highly developed industrial nations, but lacks in uniform development in every sector.

In summary, based on patent intensity and the general indicators taken from GCI, KEI and Human Development Index, Sri Lanka is the strongest scientific country among the SAARC nations. It is also a matter of concern that each year SAARC nations are moving down the ranking in almost every global technology and innovation index. Further qualitative studies are required to analyse in detail why this is happening and how to prevent the same.

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