

Innovation chain and CSIR

The 'Innovation-Patent-Research paper-License-Product' chain has moved from the earlier mantra of 'publish or perish' to 'patent or perish'. Although the Council of Scientific and Industrial Research (CSIR) in its Diamond Jubilee Year has charted new ground in patenting, plenty remains to be done in the area of commercialization of patents and for a general heightened awareness among scientists in all institutions and universities. A national IPR policy is necessary for safeguarding Indian Intellectual Property (IP), to face the pressures posed by the year 2005 when new rules will become operational under international agreements.

Indian scientists have voiced mixed responses towards this development. In recent times, the most vocal supporters of a vigorous patenting policy have been Ragnath Ananth Mashelkar, Director General, CSIR and R. Saha, Patent Facilitating Cell, Technology Information, Forecasting Assessment Council. Some stalwarts in Indian science do not take to this trend, preferring output of research in the form of research publications. In any case, heeding the chant for patents, Indian researchers are increasingly adapting themselves to changed market economics. There is still a large fraction of scientists without the faintest clue of patent mechanics, leaving immense scope for more patent awareness programmes. There have been instances of researchers almost failing to convert their potentially valuable research results into a patent.

Patent stakes

Shielding proprietary knowledge or intellectual property determines the industrial and technological progress of a nation, and strengthens the economy. India has, in its recently unveiled Science and Technology Policy-2003, paid attention to this important aspect under the head 'Generation and Management of Intellectual Property' which will be 'handled differently from the present and with high priority'.

Data from the International Bureau of the World Intellectual Property Organization (WIPO), Geneva, indicating number of international applications filed via the Patent Cooperation Treaty (PCT) are

given in Table 1. WIPO is an UN agency. India stands Rank 22 among the listed class of 84 for the year 2002, while

China stands at Rank 15. The PCT helps inventors to protect their invention in each of a large number of countries by

Box 1. Patent information

If you are a scientist and have done some innovative research, here are some pointers and starters to help you protect your Intellectual Property. Some helpful contacts who could assist you further are the following:

Intellectual Property Management Division, CSIR, 14 Satsang Vihar Marg, Special Institutional Area, New Delhi 110 067. Tel: 011-26962560, Fax: 011-26968819, e-mail: ipmd@vsnl.net

Patent Facilitating Cell, Technology Information, Forecasting Assessment Council (TIFAC), Department of Science and Technology, New Mehrauli Road, New Delhi 110 016. It has a 'single-window facility' and plenty of useful booklets. Tel: 011-26859581, Fax: 011-26863877, e-mail: tifac@nda.vsnl.net.in. TIFAC has set-up patent information centres in Kolkata, Jaipur, Bhopal, Imphal, Hyderabad, Shimla, Chandigarh and Lucknow.

IPR Cell, Ministry of Information Technology, Government of India, Electronics Niketan, 6 CGO Complex, New Delhi 110 003. Tel: 011-24361464, Fax: 011-2436074, e-mail: rct@xm.doe.einet.in

IPR Cell, Indian Council of Agricultural Research, 204B Krishi Bhavan, New Delhi 110 001. Tel: 011-23382985, Fax: 011-23387293

Patent Facilitating Cell, Department of Biotechnology, Block 2, CGO Complex, Lodhi Road, New Delhi 110 003. Tel: 011-24364160, Fax: 011-24362884, e-mail: arora@dbt.delhi.nic.in

Patent Cell, Department of Atomic Energy, Technology Offer Centre, BARC, Anushakti Bhavan, Chatrapati Shivaji Marg, Mumbai 400 039. Tel: 022-22824354, Fax: 022-22048476.

Technology Transfer and Industry Cooperation, ISRO Headquarters, Antariksh Complex, New BEL Road, Bangalore 560 094. Tel: 080-3416273, Fax: 080-3418981

National Research and Development Corporation, Anusandhan Vikas, 20-22 Zamroodpur, Kailash Colony Extension, New Delhi 110 048. Tel: 011-26417821, Fax: 011-26460506, e-mail: nrdc@nda.vsnl.net.in

Most patent search services can be availed of on charge basis. Some other useful addresses are:

Patent Information System, Third Floor, C Block, CGO Complex, Seminary Hills, Nagpur 440 006. Tel: 0712-510670, Fax: 0712-510186, e-mail: pisinagp@nag.mah.nic.in

National Informatics Centre, Intellectual Property and Knowhow Informatics Division, A Block, CGO Complex, Lodhi Road, New Delhi 110 003. Tel: 011-4363239, e-mail: bali@pkid.delhi.nic.in

Useful websites

Patent Office, India: <http://www.ipindia.nic.in>

US Patent Office: <http://www.uspto.gov>

UK Patent Office: <http://www.patent.gov.uk>

European Patent Office: <http://www.epo.org>

World Intellectual Property Organization: <http://www.wipo.int>

Japan Patent Office: <http://www.jpo.go.jp>

World Trade Organization: <http://www.wto.org>

filing one international patent through the national Patent Office. India is a signatory to the PCT along with about 100 member countries.

Among the major PCT applicants from developing countries, the most notable performer is CSIR, India. In fact, CSIR shares the first rank with Samsung Electronics Co. Ltd, Republic of Korea for 2002 (see Table 2) from WIPO statistics. Data for the year 2001 showed CSIR at Rank 2 with 89 applications, Biowindow Gene Development Inc. at Rank 1 with 921 applications and Samsung Electronics Co. Ltd. at Rank 3 with 86 applications. Ranking of some of the other major Indian players is shown in Table 3.

The Prime Minister Atal Bihari Vajpayee, on 10 April 2003, during a meeting of the CSIR Society praised the role of CSIR in the area of Intellectual Property and urged CSIR to move to the undisputed number one position by 2003 according to the PCT data from WIPO.

US patents granted to Indians in a decade and the percentage share of CSIR are shown in Table 4.

'The Big Five': CSIR laboratories contributing to IPR success

The 'Big Five' performers for patents filed abroad ranked in order are shown in Table 5.

Patents filed abroad during 2002–03 for the top five CSIR laboratories are: IICT (135), CFTRI (98), CIMAP (63), RRL (JM) (45) and NCL (42).

Patents filed in India during 2002–2003 for the top three CSIR laboratories are: CFTRI (122), IICT (43), NCL (27).

The poor performers among the CSIR laboratories from 1999 to 2002 are shown in Table 6. These include those who filed patents, but were granted none or just one patent.

Genesis and content of CSIR-IP Policy of 1996

The history of CSIR's recent patent successes has origins in the patent filed on 5 May 1992 by S. Sivaram *et al.* of National Chemical Laboratory (NCL), Pune (US Pat. No. 5,266,659 30 November 1993) on 'Solid state process for the preparation of high molecular weight poly (arylcyanates) from amorphous

Table 1. International applications filed based on record copies by country of residence of the applicant, under the Patent Cooperation Treaty, World Intellectual Property Organization, Geneva (Source: WIPO, Geneva). Selected data, including India in ranking order for the year 2002 are indicated. Data for 2001 are also given

Country	Number of applications in 2002	Number of applications in 2001	Percentage of total applications in 2002	Percentage of total applications in 2001
USA	44609	40003	39.1	38.5
Germany	15269	13616	13.4	13.1
Japan	13531	11846	11.9	11.4
UK	6274	6233	5.5	6.0
France	4877	4619	4.3	4.4
The Netherlands	4019	3187	3.5	3.1
Sweden	2988	3502	2.6	3.4
Republic of Korea	2552	2318	2.2	2.2
Switzerland and Liechtenstein	2469	2011	2.2	1.9
Canada	2210	2030	1.9	1.9
Italy	2041	1574	1.8	1.5
Australia	1775	1754	1.6	1.7
Finland	1762	1623	1.5	1.6
Israel	1199	1248	1.0	1.2
China	1124	1670	1.0	1.6
Denmark	989	929	0.9	0.9
Spain	729	575	0.6	0.6
Belgium	697	681	0.6	0.7
Russian Federation	616	551	0.5	0.5
Austria	563	630	0.5	0.6
Norway	525	525	0.5	0.5
India	480	316	0.4	0.3
South Africa	407	418	0.4	0.4
Singapore	322	271	0.3	0.3
New Zealand	301	279	0.3	0.3
Ireland	257	212	0.2	0.2
Brazil	204	193	0.2	0.2
Hungary	148	130	0.1	0.1
Total (from 84 countries)	114048	103947	100.0	100.0

Table 2. Top five major PCT applicants from developing countries in 2002 (Source: WIPO, Geneva)

Rank	Applicant	Country of residence	Number of applications (based on record copies)
1	CSIR	India	184
2	Samsung Electronics Co Ltd	Republic of Korea	184
3	Biowindow Gene Development Inc.	China	136
4	LG Electronics Inc.	Republic of Korea	125
5	Huawei Technologies Co Ltd	China	84

Table 3. Ranking of top five Indian players among the PCT applicants from developing countries for 2002 (Source: WIPO, Geneva)

Rank	Indian applicant	Number of applications (based on record copies)
1	CSIR	184
6	Ranbaxy Laboratories Ltd	56
12	Dr Reddy's Laboratories Ltd	19
17	Orchid Chemical and Pharmaceuticals Ltd	16
27	Biocon India Ltd	10

oligomer' with the assignee as CSIR. This was followed by what was to be a milestone in Indian patenting history, when General Electric Company showed immense interest in the work pertaining to the NCL patent and Sivaram *et al.* obtained US Pat. No. 5,710,238 20 January 1998, whose assignee was the General Electric Company, Schenectady, New York for 'process for preparing branched polycarbonates by solid state polymerization'.

Mashelkar, on taking over as leader of 'Team CSIR', moved these successes even further by concretizing a sound IP Policy in 1996, laying the ground for professional management of IP and strengthening the teeth of the Intellectual Property Management Division (IPMD) of CSIR, a national resource and an international reference centre on IP matters. The present data show that the policy appears to be bearing fruit, with IPMD coordinating the efforts. The vision 2001 envisaged that 'CSIR would hold a valuable portfolio of at least 1000 Indian patents and 500 foreign patents'. According to CSIR sources, 'CSIR stands well',

having achieved this target. Also, 95% of patents filed and subjected to international examination are accepted. The stage, says CSIR, is set for achieving in the near future 'strategic alliances with global technological leaders, generating at least 5% of CSIRs R&D budget from IP licensing and alliances'. But, by present estimates, it could take well over six years for reaching this target, as the exercise has only just begun and presents the greatest challenge – commercialization of granted patents. The FY 2003–04 is one for focus on commercialization and licensing of granted CSIR patents, 'showing the way' for the rest of India, with the past year witnessing speeding up of more product applications, according to the CSIR source. Provisional figures from CSIR indicate that in the last five years, 4% of patents in force have been licensed and scientists at CSIR are 'not only obtaining patents, they are now thinking differently'. The IPMD assists and guides farmers and individual students; in fact, anyone who might feel his/her research or innovation requires patent protection. The IPMD, CSIR

also houses the 'IP Manager's Association of India', launched in April 2003, on WIPO Day, for furthering the professional and ethical practices of IP management.

Some recent money earners in commercialization of patents have been the following: NCL, Pune has licensed patents in the areas of polymers and engineering to multinational companies, whose value is more than eight lakh US dollars. It has obtained research funds in US dollars for doing further contract research. IICT, Hyderabad has licensed technology for pretreatment of vegetable oil for physical refining worth over 900 lakh rupees. There is an on-going project worth Rs 5 crores for anti-TB drug evaluation in joint partnership with industry. The recent anti-malarial drug from CDRI, Lucknow has been licensed for nearly 60 lakh rupees and the drug 'Asmon', for treatment of asthma is reported to be 'making a dent in the foreign markets', according to CSIR. CFTRI, Mysore has licensed several food technology-related patents.

Table 4. Total US patents granted to India from 1992 to 2003 and percentage share of CSIR (Source: IPMD, CSIR)

Year	India	CSIR	Percentage
1992–93	42	4	9.5
1993–94	42	7	16.7
1994–95	55	8	14.5
1995–96	59	8	13.6
1996–97	61	10	16.4
1997–98	84	19	22.6
1998–99	141	29	20.6
1999–2000	160	34	21.3
2000–01	185	34	18.4
2001–02	245	68	27.8
2002–03	367	145	39.5

Table 5. 'The Big Five'. CSIR laboratories based on performance during 2001–02 for patents filed and granted abroad (Source: IPMD, CSIR)

CSIR laboratories	Filed 1999–2000	Granted 1999–2000	Filed 2000–01	Granted 2000–01	Filed 2001–02	Granted 2001–02
CIMAP	68	1	38	7	31	25
IICT	32	6	72	4	92	17
NCL	18	12	63	16	43	16
CDRI	16	0	8	6	27	6
IICB	3	1	18	0	9	5
Total-CSIR	199	35	452	56	580	86

CDRI: Central Drug Research Institute, Lucknow; CIMAP: Central Institute of Medicinal and Aromatic Plants, Lucknow; IICB: Indian Institute of Chemical Biology, Kolkata; IICT: Indian Institute of Chemical Technology, Hyderabad; NCL: National Chemical Laboratory, Pune.

Savvy Patent Office, New Delhi

The Patent Office, New Delhi, and meeting the people who administer patent law, has been recently modernized, an action which auger well for the task of protecting IP for the country. With its Headquarters in Kolkata, and branch offices at Chennai, Delhi and Mumbai, the Office of the Controller General of Patents, Designs and Trade Marks functions under the Department of Industrial Policy and Promotion, Ministry of Commerce and Industry, New Delhi. The new Patent Act 2002 with Patent Rules 2003 came into force on 20 May 2003. With the new law, the nearly 45,000 pending cases would become zero as in the earlier system all patents filed were automatically examined. Now, there is a deferred examination system and the innovator has to file a request for examination. A significant change under the new Act is that Patent Agents and Attorneys would have to have a science background. A complaint by the scientists has been that while drafting a patent application, the poor comprehension of science by the Patent drafters had led to frustration and time delay. Also, due to apprehensions of losing secrets, many innovators fail to make appropriate dis-

Box 2. Patent information

Intellectual Property (IP) is any creative work or invention, a non-tangible possession that can be protected by an IPR. The legal protection for IP prevents others from exploiting it without the owner's permission for a defined time. Examples of IP include patents, designs, trademarks, copyright, databases and geographical indications. See Table 7 for a short history of Indian patent regulations.

What is a Patent? A patent is the grant of exclusive right for limited period by the Government to the patentee (owner of the patent), in exchange of full disclosure of the invention, for making, using, selling the patent or authorizing others to do so. It is a form of IP that protects innovations that are scientific or technical.

There are three types of patents (Source: US Patent Office):

Utility patents to anyone who invents or discovers any new and useful process, machine, article of manufacture, or compositions of matters, or any useful improvement thereof.

Design patents may be granted to anyone who invents a new, original and ornamental design for an article of manufacture.

Plant patents may be granted to anyone who invents or discovers and asexually reproduces any distinct and new variety of plants.

Some basic requirements for filing an application for patent:

- Application form in triplicate
- Fee form
- Application datasheet
- Provisional or complete specification which includes: Title of the invention, Abstract of the disclosure, Field of invention, Background of invention, Object of invention, Summary of invention, Brief description of the accompanying drawing, Detailed description of the invention, Claim or claims, Sequence listing (if any)
- Drawing in triplicate
- Declaration

India hopes for an unbroken chain from innovation to product, finished in its entirety, making it exquisite wherever possible. It is just a matter of inculcating a patent culture while pursuing science, attitude reorientation on how to conduct research and making a visit to the neighbouring Patent Office or Cell which looks forward to innovators walking through its doors, benefiting the preservation of IP, for the scientist and for the country.

Box 3. Choice between research paper and patent – a dilemma

In spite of belonging to the prestigious Indian Institute of Science, Bangalore, Ajay Sood and co-workers rushed to publish potentially patentable work in the journal *Science* (see *Current Science*, 2003, **84**, 269–270 for a report on this work developing carbon nanotubes as 'flow sensors'). Then, in an afterthought, the scientists just managed, with huge efforts from the Patent Facilitating Cell of TIFAC, to file for a US Patent that just managed to beat the time deadline. This protected the use of the innovation in the US. Patent protection in other countries is not possible because Sood had reported his findings at the conference of the Third World Academy of Sciences in October 2002, resulting in a news item appearing in the newspapers.

There is a lesson to be learnt. There is a need for more patent awareness on which research results need patenting. Institutions and universities need to be alert and have functioning Patent Cells before India loses more of her IP.

Table 6. Poor CSIR performers from 1999 to 2002, for patents granted abroad (Source: IPMD, CSIR)

CSIR laboratories	Granted		
	1999–2000	2000–01	2001–02
CBRI	0	0	0
CCMB	0	1	0
CEERI	0	0	1
CFRI	0	0	0
CMRI	0	1	0
CSIO	0	0	0
CSMCRI	0	0	0
IMT	0	1	0
NAL	0	0	0
NBRI	0	0	1
NGRI	0	0	0
NIO	0	0	0
NML	0	0	0
RRL (BHU)	0	0	0
RRL (BHO)	0	0	0
RRL (JM)	0	0	0

CBRI: Central Building Research Institute, Roorkee; CCMB: Centre for Cellular and Molecular Biology, Hyderabad; CEERI: Central Electronics Engineering Research Institute, Pilani; CFRI: Central Fuel Research Institute, Dhanbad; CMRI: Central Mining Research Institute, Dhanbad; CSIO: Central Scientific Instruments Organization, Chandigarh; CSMCRI: Central Salt and Marine Chemicals Research Institute, Bhavnagar; IMT: Institute of Microbial Technology, Chandigarh; NAL: National Aerospace Laboratories, Bangalore; NBRI: National Botanical Research Institute, Lucknow; NGRI: National Geophysical Research Institute, Hyderabad; NIO: National Institute of Oceanography, Goa; NML: National Metallurgical Laboratory, Jamshedpur; RRL (BHO): Regional Research Laboratory, Bhopal; RRL (BHU): Regional Research Laboratory, Bhubaneswar; RRL (JM): Regional Research Laboratory, Jammu.

closures while drafting their patents. The Patent Office 'vouches for complete secrecy'. Also, patent administrators say that data on subsequent commercialization by innovators are not furnished to the Patent Office. The argument could be that really few patents granted actually see the light of commercialization, a trend that has to be reversed. The other point strongly put by patent administrators was that although the Patent Office was going all out for increasing patent awareness – more than 50 workshops in the last year alone – many institutions even refuse to respond. One recent case is the newly opened Patent Cell at the All India Institute of Medical Sciences, New

Table 7. History of Indian patent regulations
(Source: Patent Office, Government of India)

Year	History of Indian patent regulations
1856	The Act VI of 1856 protecting inventions. Framework used the British Patent Law of 1852
1859	Modified Act XV
1872	The Patents and Designs Protection Act
1883	The Protection of Inventions Act
1888	The Inventions and Designs Act
1911	The Indian Patents and Designs Act
1972	The Patents Act (Act 39 of 1970)
1972	The Patent Rules of 1972
1999	The Patents (Amendment) Act of 1999
2002	The Patents (Amendment) Act of 2002

Delhi that in spite of correspondence regarding patent workshops for sensitizing the medical fraternity has 'not responded'. Scientists need to learn about patents for remaining competitive.

Some states in India have fared better in terms of applications for patents filed

in the year 2000–01. A part of the break-up is as follows: Delhi, 663; Maharashtra, 545; Tamil Nadu, 174; Gujarat, 147; West Bengal, 143; Karnataka, 112; Andhra Pradesh, 100; Uttar Pradesh, 90; Kerala, 77; Bihar, 31; Madhya Pradesh, 30; Har- yana, 20; Punjab, 15 and the rest in single

digits (Source: Patent Office, Government of India).

Nirupa Sen, 1333 Poorvanchal Complex, JNU New Campus, New Delhi 110 067. e-mail: nirupasen@vsnl.net

Marine debris in Great Nicobar

Andaman and Nicobar Islands are situated off the eastern coast of India in the Bay of Bengal and are also called Bay Islands. They are located between 6°45'–13°45'N lat. and 92°15'–94°00'E long., about 1200 km from the mainland. The islands, which have proximity to some of the South East Asian countries like Myanmar, Thailand, Malaysia, Singapore and Indonesia, comprise 572 islands, islets and exposed rocks. The Island coast extends to 1912 km, which is almost one-fourth of the Indian coastline.

The National Institute of Ocean Technology (Department of Ocean Development, Government of India) is carrying out a national programme entitled 'Coastal Ocean Monitoring and Prediction System' (COMAPS) throughout the Andaman and Nicobar Islands. A detailed survey throughout the Andaman and Nicobar group of islands was carried out during April–May 2003, to assess the magnitude of coastal ocean pollution and its impact on the coastal waters.

During this survey, occurrence of substantial quantity of marine debris all

along the shore and coastal regions of Great Nicobar and Nancowry (Figure 1) has been observed. The quantity of debris was large, as seen in Figure 2, although the population in these islands is around 6800 islanders and 1000 tribals, respectively (according to 1992 census). The debris is not of local origin.

Marine debris is defined as any man-made solid material that enters the ocean directly (e.g. by dumping) or indirectly (e.g. washed out to sea via rivers, streams, storm drains, etc.). Of all marine debris materials, plastic debris is one of the most alarming of today's environmental hazards along shorelines, coastal waters and oceans throughout the world. Most plastics are non-biodegradable, as no naturally-occurring organisms can break down these polymers. The process of photo-degradation takes longer duration in the ocean than on land because of the cooling capacity of the ocean.

Unexpected quantities of marine plastic debris in this region may be due to improper handling of the solid waste in adjacent foreign countries, since plastics

could be carried by currents and circulated continuously in the open sea and coastal areas, and are subsequently washed ashore.

Marine plastic debris can harm fish species and other aquatic organisms that use the coral reef, and kill coral reefs by continually rubbing against them or

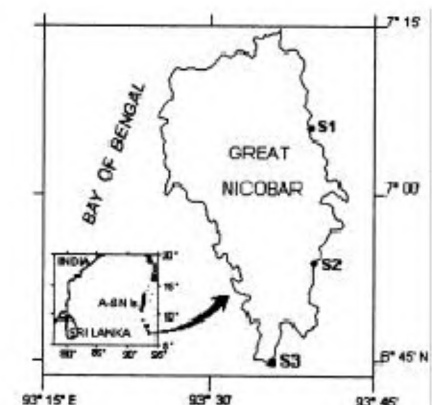


Figure 1. Site map of the Great Nicobar Island. S1, S2 and S3 indicate sampling locations.