

# POTENT RESEARCH

CSIR leads in patent filings from a developing nation. What does this mean for India?

## TOP 10 PATENTING INSTITUTIONS

Developing countries (2002)

INSTITUTION	COUNTRY	NO. OF PATENT APPLICATIONS
CSIR	India	184
Samsung Electronics	South Korea	184
Biowindow Gene Development	China	136
LG Electronics	South Korea	125
Huawei Technologies	China	84
Ranbaxy Laboratories	India	56
LG Chemicals	South Korea	47
SAE Magnetics	China	31
National University of Singapore	Singapore	28
Philips Electronics Singapore	Singapore	24

These are applications filed under the Patent Cooperation Treaty (PCT)

**A**SK anyone in Bangalore about the GE John F. Welch Technology Center and this is what they will tell you. It has one of the most impressive buildings in Whitefield near Bangalore. It is the largest research and development (R&D) centre in the country and Karnataka chief minister S.M. Krishna's prime exhibit to state visitors. It was conceived only three years ago, but has grown quickly to about 1,700 scientists on board now. But few know that the genesis of this centre can be traced to a single patent owned by the National Chemical Laboratory (NCL) in Pune.

In the early 1990s, the then director of NCL, R.A. Mashelkar, had given a lecture at GE's Schenectady (US) R&D centre. One of his slides had shown an NCL patent on polycondensation, a reaction that produces polycarbonates. Back then, polycarbonates was a pet project for GE; the company had a 40% share of this market. GE was attracted to NCL and, subsequently, to India. Yet it was not GE alone that gained from this.

NCL licensed the polycondensation family of patents to GE for a few million dollars, but that was just the beginning. When Mashelkar moved to Delhi in 1995 as director-general of the Council of Scientific and Industrial Research (CSIR), of which NCL is a part, he started urging the entire chain of 40 CSIR labs to vigorously pursue patents, particularly in the developed countries. That move is beginning to pay off.

About 10 days ago, the Geneva-based World Intellectual Property Organisation (WIPO) released a list of leading organisations in the developing world that have applied for patents in the year 2002; CSIR topped the list along with Samsung of Korea. CSIR has climbed the patent ladder rapidly in the last few years (See 'Top 10 Patenting Institutions'), and is now poised to reap some financial rewards.

Some Indian firms, too, are moving up. Included in the Top 50 were five Indian companies: Ranbaxy Laboratories, Dr. Reddy's Laboratories, Biocon, Orchid Chemicals and Pharmaceuticals, and Sun Pharmaceutical. But while the total number of organisations (six) in the Top 50 has not changed from 2001, the total number of patent applications has gone up from 154 to 293. Even if we exclude CSIR, which more than doubled its

number of applications, the applications has gone up from 65 to 109.

This list pertains to filings under the Patent Cooperation Treaty (PCT) of which India is a signatory. A PCT filing gives priority in all the 110-odd member nations, which include the US and other developed countries. The patents are examined and granted by patent offices of the member countries. About 60% of applications usually result in patents; the number of applications is, thus, a good indicator of patenting activity.

Patent statistics usually conceal a lot of information. The WIPO list includes only the developing countries, but it has to be seen in the overall perspective of R&D budgets. The R&D budget of Samsung is 12 times that of CSIR (Rs 1,100 crore). Samsung has three times the number of scientists and engineers who work for CSIR (5,400).

An analysis of the WIPO list reveals other interesting statistics. All the Indian companies that made it to the Top 100 (See 'Indians In The Top 100 Filings') were either pharmaceutical or biotechnology companies. This indicates that innovation is the highest in these sectors here. Patenting is strong among biotech and pharma companies the world over, but they are not among the top patenting companies.

The US patent office granted 13,500 patents to biotech firms in 2000 (of a total of 157,495 patents), but there were no biotech or pharma firms in the Top 10 (all were IT companies). IBM, with over 3,000 patents, topped the list for the tenth year in succession.

India has always had a poor track record of patenting. Even the best Indian scientists did not bother to patent their innovations. C.N.R. Rao, former director of the Indian Institute of Science (IISc) and one of the most prolific chemists in the world (over 1,000 research publications), did not believe in patenting his work. In contrast, leading chemists in the developed countries receive numerous patents. Ryoji Noyori and Barry Sharpless, chemistry Noble Prize winners in 2001, have 38 and 20 patents each. And it is not a recent trend. Albert Einstein had 39 patents to his name.

In more general terms, there is no In-

## IISc: Slow and steady...

IISc lost out on an opportunity for a valuable patent, but it may have been a blessing in disguise

**T**HREE months after publishing a landmark paper in US journal *Science*, Ajay Sood and his colleagues at the department of physics in the Indian Institute of Science (IISc) are suddenly less inclined to talk about their work. There is good reason. Sood missed filing a valuable patent because he had presented his work at a conference earlier. And he does not want to repeat the error.

Sood and his colleague Shankar Ghosh, along with N. Kumar of the Raman Research Institute, made an important discovery at the end of last year. They found that carbon nanotubes, miniature tubes made of neatly arranged carbon molecules, generate a voltage when a fluid flows over it. It was a significant discovery, which *Science* accepted without hesitation. Sood presented this finding at a meeting of the Third World Academy of Sciences in Delhi last October. Communicating a research finding at a conference is common practice, but Sood had not realised the full commercial potential of his work then.

That began to dawn on him soon after several discussions with his colleagues. The work has an immediate utility in a flow sensor, a device that measures the flow of liquids. But the journal *Science* thought of a more fancy application: carbon nanotubes generating electricity. Once Sood and his colleagues realised the full potential of their work, they wanted to patent it.

Patent Cooperation Treaty (PCT) rules specify that an innovation can be made public only after filing a patent application. The US patent office allows for filing one year after publication. The IISc scientists clearly lost an opportunity to file a patent application in countries other than the US. If they had the patent worldwide, IISc may have received huge royalties from future power generation equipment sales.

Yet all is not lost. IISc filed a patent application in the US. Sood and his team continued their work. They found some new applications and are now busy trying to file patent applications before publishing. Says Govardhan Mehta, IISc director: "We are now trying to change our culture of publishing all our innovations immediately." The work of the physicists has thrown open many interesting applications already. It could use energy from blood flow and power a pacemaker. It could detect the amount of blood flow in arteries and do away with the need for painful angiograms. It could, as everybody has now realised, generate electricity from flowing water. And, of course, there are the applications that Sood is not revealing.

In terms of patents, IISc is at a place CSIR was six years ago. The United Nations ranks IISc 17th in the world among educational institutions. Its research output is of the highest quality. Yet it filed only two PCT applications last year. In contrast, top universities in the US like Massachusetts Institute of Technology, Stanford University and Caltech have obtained thousands of patents since they were set up, with the number varying from a few to over 100 each year. It is difficult to get a Ph.D. from a US university in any applied science without obtaining a patent or two.

IISc has the resources to become a patenting powerhouse. It has over 450 research scientists. Each year it generates 150 Ph.D. theses and 150 Masters degree theses. Its students are involved in over 400 projects a year. So, IISc can generate 100 patents every year, provided the faculty shows a genuine interest in patenting. •

A carbon nanotube generates electricity when a fluid like water flows over it. This principle may power future generators



dian academic institution in the WIPO list. IISc filed only two PCT applications last year and thus did not make it to the Top 100 (See 'IISc: Slow and steady...'). In contrast, academic institutions in China, Singapore and South Korea have been prolific innovators. Biowindow Gene Development of China had filed as many as 136 applications in 2002. In fact, this organisation topped the list in 2001, and not without reason. China had invested \$17 billion in R&D in 2000 (India's R&D spending is about \$3.8 billion).

PCT applications do not tell the full story. Companies file separately in each country if only a few countries need to be covered. But US patent statistics have an equally interesting tale. In 2001 (the 2002 break-up is not yet available), CSIR was granted the maximum number of patents (58) in India (See 'US Patents Granted To Indians'). Texas Instruments and GE figured in the Top 10 Indian list with nine and six patents each.

The Indian patenting landscape is expected to change in the next few years as MNCs increase their patenting activity in India. That may improve India's overall position in patents. In 2001, India (with 177 patents) was ahead of South Africa (120) and Brazil (110), but behind China (195) and South Korea (3,538), the other critical nations in the WIPO list.

CSIR has patents for a broad spectrum: drugs, food processing technologies, medicinal plants, traditional medicine, chemical engineering, aerospace and so on. Medicinal plants is a thrust area at CSIR. It has created a traditional knowledge digital library, which has been accepted by all member nations of the WIPO. The idea is to avoid wrong patents due to the absence of information, like in the case of turmeric.

The Mysore-based Central Food Technology Research Institute, which is part of the CSIR network, has a patent in many countries on high protein biscuits.

**INDIANS IN THE TOP 100 FILINGS**

INSTITUTION		
CSIR	184	1
Ranbaxy Laboratories	56	6
Dr. Reddy's Laboratories	19	12
Sun Pharmaceutical Industries	8	38
Avestha Gengraine	6	56
Kumar, Bakulesh, Mafatlal	6	56
Aurobindo Pharma	5	74
J.B. Chemical & Pharmaceuticals	5	74
Lupin Laboratories	5	74
Shahajanand Biotech	5	74

**US PATENTS GRANTED TO INDIANS**

COMPANY	NO. OF PATENTS (1997-2001)	PATENTS IN 2001
CSIR	174	58
Texas Instruments	28	9
Ranbaxy Laboratories	23	8
Dr. Reddy's Research Foundation	20	3
GE	17	6
Indian Oil Corporation	12	4
Panacea Biotec	11	3
Dabur Research Foundation	9	5
Lupin Laboratories	9	0
National Institute of Immunology	9	3

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Source: US Patent and Trademark Office

Another CSIR lab, the Bangalore-based National Aerospace Laboratories, is expecting a US patent on a glider modified into a helicopter. And so on.

Filing and obtaining patents is one thing, getting commercial returns from patents quite another. The NCL patent family on polycondensation may have brought it a few million dollars, but such licensing deals do not occur frequently. Overseas private companies that have a large portfolio often license their patents to other companies for a fee. Indian firms, on the other hand, still file patents for the classical reason: to obtain market exclusivity for their products.

Companies like Dr. Reddy's may have licensed their new molecules to other companies, but this is a temporary compromise due to lack of resources. No Indian company is looking at patent licensing as a source of revenue in the near future. However, CSIR, with no production facilities of its own, has to depend on technology licensing to make up for its investments in intellectual property (IP) creation. The story so far is not good, but it could change soon.

Last year, CSIR spent Rs 20 crore on patenting expenses. It gets about Rs 10 crore every year from patent licensing. So the licence revenues do not even cover the patenting costs, let alone the cost of research. But licensing revenue is not an indicator of the organisation's value. CSIR's R&D budget is Rs 1,100 crore now, which is about 6% of the

**CSIR & US PATENTS TO INDIANS**

YEAR	NO. OF INDIAN PATENTS	NO. OF CSIR PATENTS	% OF CSIR PATENTS
1992-93	42	4	9.5
2000-01	185	34	18.4
2001-02	245	68	27.8
2002-03	367	145	39.5

Source: US Patent and Trademark Office

country's total R&D budget. About 10% of the country's industrial production uses technology from CSIR.

The organisation is actively pursuing methods of increasing revenues from licensing. Till now, each laboratory individually tried to commercialise its IP. Now CSIR is trying to license the IP of its labs as a whole. CSIR recently tied up with six companies — Evalueserve, VenturEast and Opportunia in India, and M-com DOORS, Baker BOTTS and Schwegman-Lundberg-Woessmer-Kluth in the US—to find buyers for its IP. CSIR has a target of Rs 150 crore in licensing revenues in five years.

Selling public-funded research abroad may seem anathema to many Indians. Even in the US, public-funded institutions had several debates before finally accepting the free flow of technology to private companies. The cornerstone was the Bayh-Dole Act of 1980, which laid down rules for commercialising federally-funded inventions.

In the 30 years till 1980, the US government had about 30,000 patents. Only about 5% of this was licensed and a smaller percentage commercialised. But in 2000, US universities spun off 364 companies, filed 8,500 patents and executed 3,600 licences. Things are not different in the developing world. Of the Top 30 PCT applications from developing countries, eight were from public-funded institutes. About 13% of applications from China were

from government-funded labs. But CSIR was the lone representative from India.

In terms of resources, India does very well. The slightly outdated World Science Report (1996) ranked 46 innovative nations (including developed nations) on several parameters. India ranked first in the number of qualified engineers, seventh in R&D personnel, 39th in IP development and 38th in exploitation of patents from abroad. No such study was done recently, but the drift is clear.

The world is seeing a dramatic increase in the number of patents being filed and granted. The US patent office received about 164,558 utility patent applications in 1990 and granted 90,365. In 2001, it received 326,508 applications and granted about 166,039. The intangible assets of US firms have increased from about 39% in 1982 to about 70%. But only 177 US patents were granted to Indians in India. The intangible assets of Indian firms, too, are negligible.

Is change in the air?