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India, a global space power

LEVERAGING ENGINEERING TALENT FOR DEVELOPMENT

Exclusive interview
with ISRO chairman
Mr. A S Kiran Kumar

Trade Fare
Patrice Perche, Senior Executive Vice President, Global Sales and Support, Fortinet

Building Blocks
Dr R A Mashelkar and Arvind Chinchure analyse India's R&D potential

Innoventors
Vision of Hope—3Nethra

Emergence of India as a global R&D hub

In March 1995, Dr RA Mashelkar delivered the Lala Karam Chand Thapar Centenary Memorial Lecture[1] , which was presided over by Dr. Manmohan Singh, the then Finance Minister. While delivering this lecture, titled 'India's emergence as a global R&D platform: Challenges and opportunities', he had said: "I have a strong belief that the vision of India as a global R&D platform would materialise and it would materialise sooner than we expect provided we move swiftly and with determination."
Hardly anyone in the audience believed that this could happen.

Raghunath Mashelkar
President, Global Research Alliance

Aravind Chinchure
Chair Professor of Innovation and Entrepreneurship, Symbiosis International University

Forward two decades–in June 2016, media carried the news 'Bengaluru Fifth Most Preferred Destination by MNCs for Technology and Innovation Centre.' This was based on a study by Capgemini, which reported that Bengaluru has now displaced Tokyo from the fifth spot on the list of most preferred destinations for innovation centres for global multinational companies.

Another headline read: 'India top destination for R&D investments; beats US, China.[3]' A study conducted by US-based HfS Research reported that India leads with 30% of the new global R&D centre announcements. As per this study, from April to December 2015, out of the 190 new R&D centre announcements, 57 of them chose India as a destination.

Where does India stand today? According to Zinnov report[4], by the end of 2015, there were 1,165 R&D centers in India established by 928 multinational companies (MNCs) with a total workforce of 323,000 scientists and engineers.

So the dream of India becoming a global R&D platform, which was articulated by Dr Mashelkar twenty one years ago has indeed come true!

EARLY STEPS: SOME PERSONAL REFLECTIONS

Let us look at the early beginnings of the evolution of India's emergence of global R&D hub from the lens of Dr Mashelkar, when he was the Director of National Chemical Laboratory (NCL) during 1989-95.

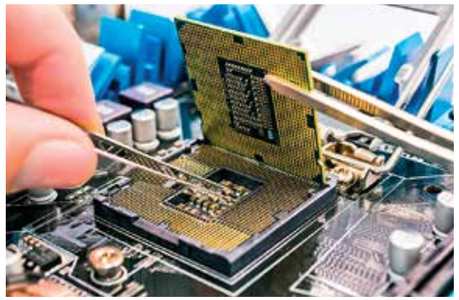
In his opening address to the NCL staff on June 1, 1989, he had said that National Chemical Laboratory should transform itself into an 'international chemical laboratory' by licensing its technology even to the leading multinational companies[5], and not limit itself to Indian companies. This looked like an audacious dream for a laboratory, which, from its inception in 1950, did not have a single US patent to its credit. Soon, under an efficient leadership the culture of NCL changed from 'publish or perish/ to 'patent, publish and prosper'. The results soon followed. NCL entered the global R&D market in 1990, even before the advent of the new industrial policy that was announced in July 1991. NCL licensed its patent on hydrodewaxing catalyst technology to a multinational company from the Netherlands.

A turning point came, when NCL's US patents on solid state polycondensation of an engineering plastic polycarbonate were licensed to General Electric in 1990. Interestingly, GE was a global market leader in polycarbonate. This was the first-ever instance of 'reverse transfer of technology' from any Indian laboratory to a global market leader from the US.

Indeed the GE-NCL partnership grew so well that over 25 US patents in the broad area of polycondensation chemistry emerged[6]. Over 15 million US dollars of income accrued to NCL through patent licensing fee, royalties, and research and consultancy fee between 1994 and 2002.

The initial success in licensing NCL patents to US firms in the early nineties did several things. First, NCL scientists, who were so far used to doing import substitution or 'reverse engineering' got the confidence that they can do 'forward engineering'. Second, major multinational companies, such as GE got confidence about the quality of world-class research that Indian scientists were able to do. In fact, Jean Heuschen, the senior Vice-President in charge of GE's external R&D, once told Dr Mashelkar that after looking at NCL's performance, Jack Welch, the then CEO of GE said, "if they are so good, why are we not there?" That was one of the initial triggers for GE setting up John F Welch Technology Centre (JFWTC) in Bengaluru.

Jack Welch was in India during the inauguration of the GE R&D Centre in Bengaluru. When a press reporter asked him as to why he was here, he said "India is a developing country. But it is a developed country



Photos: Shutterstock

with regards to its superb scientific infrastructure. It is for this reason that we wish to shift a part of GE's development effort to India." NCL's early success with GE laid the foundation of other major companies, from Du Pont to Procter and Gamble, becoming NCL's partners in R&D and NCL gaining the reputation of an 'international chemical laboratory'.

GLOBALISATION OF R&D

From a specific snapshot of the early journey from a personal lens to the big picture now.

At a macro level, one must understand the phenomenon of globalisation of R&D before analysing the phenomenon of India's emergence as a global R&D hub.

What are the driving forces for globalisation of industrial R&D? Dr Mashelkar had spoken about this[7] in his Thapar Memorial Lecture in 1995. After two decades, the fundamentals that he articulated still remain valid. So here they are:

'The chain of concept to commercialisation necessarily crosses transnational boundaries today. The idea is to develop synergies and to make one and one equal to eleven and not just two! Many companies across the world today consider it to be rather unwise to attempt for self-sufficiency in technology development, particularly in an era, where the R&D costs are increasing rapidly. With trade barriers among the countries disappearing fast, companies have to provide the best technology globally to their customers. The concept that technology could be acquired rather than re-invented is gaining momentum. As a part of the global innovation strategy, several companies world over are scouting for new ideas and patents.These companies believe that the surest way of becoming technically strong is through networking with premier organisations in those regions.

There is another interesting and subtle aspect of the whole game. The globalisation of R&D is closely linked to the globalisation of business and consequently to the global competition of skills. The competitive advantage in a high-technology business increasingly depends on underlying technical skills of the business rather than on particular products. As product life cycles keep on becoming shorter, skill life cycles become longer. The product then is merely an intermediary between a company's skills and the market it serves. Rather than being the focus of corporate activity, products are actually transient mechanisms by which the market derives value from a company's skill base, and the company derives value from the market. High-technology companies are therefore asking as to what skills, capabilities, and technologies should they build up, rather than asking a stereotype question as to which markets should they enter, and with which products."

BUT WHY INDIA?

Firstly, India is home to a rich talent pool. For instance, 400,000 plus engineers graduate from Indian institutions every year. This means a company like Cisco can set up a centre with 20,000 engineers fairly easily. Where else could they do it?

Secondly, the high-quality science base prevalent in India in certain select areas is a big attraction, especially when one recognises that industrial R&D is becoming increasingly high science-based.

Thirdly, companies perceive that R&D alliances with India provide specific mutants of an existing technology or create a new technology that is fully adaptable to the distinctive conditions prevailing in India.

Table 1: Percentage contribution of US-granted patents from Indian MNC R&D centres to their global entity

Companies	Share of US-granted patents from Indian R&D centre to the overall global contribution in % 2003	Share of US granted patents contribution from Indian R&D centre to the overall global contribution in % 2013
Novell	≈ 4%	28%
Symantec	Negligible	24%
Adobe	Negligible	15%
Honeywell	Negligible	11%
Oracle	Negligible	10%
Texas Instruments	≈ 3%	9%
Cisco	Negligible	5%

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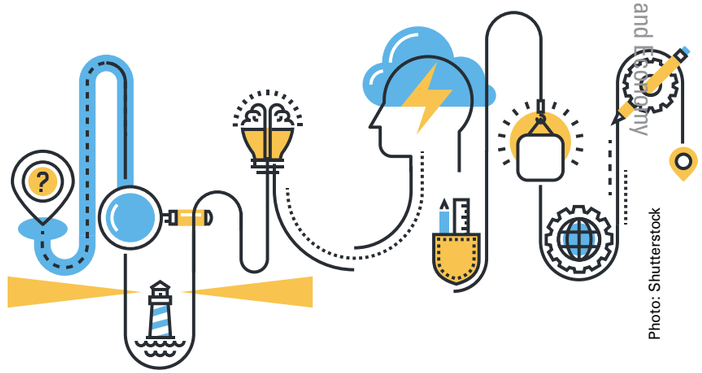


Photo: Shutterstock

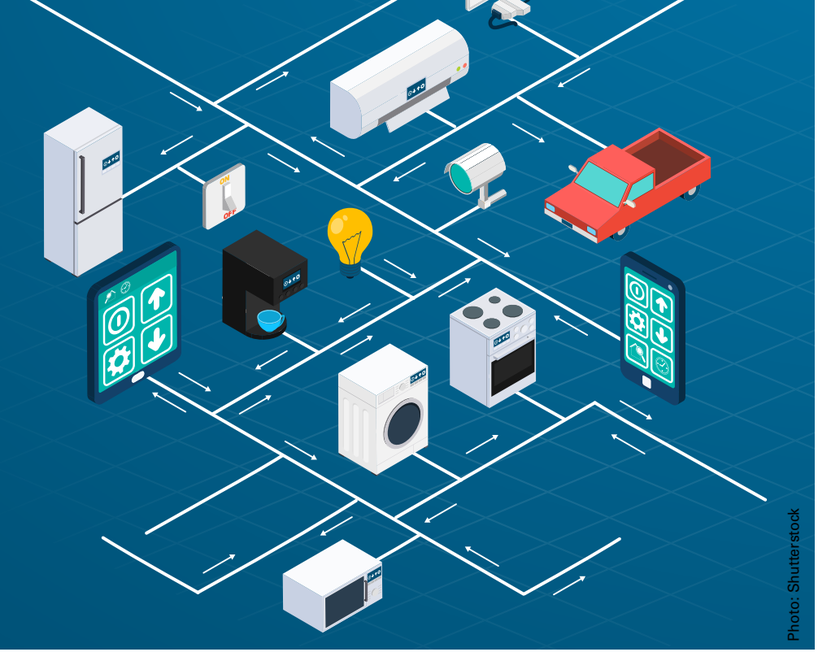
Fourthly, the obvious one, the lower costs of doing research in India. While it is indeed a key factor, it is important to note that India offers not just 'cost arbitrage' but a 'value arbitrage' as well.

Take, for example, GE's John F Welch R&D Centre in Bengaluru which houses more than 4,000 engineers and scientists and has filed over 1,000 patent applications. The patent share of this centre in Bengaluru as a percentage of GE's overall US granted patents increased twelve folds in ten years. It went from 1% (2003) to 12% (2013). In addition, during the early years, GE India's research was mainly focused on traditional technology areas such as polycarbonates and circuit breakers. Today, scientists in GE-India are creating IP in cutting edge technology areas such as imaging techniques, microfluidic devices, fuel cells, photovoltaic devices, etc. Aravind Chinchure, one of the authors, has worked in GE's R&D Centre in India on cutting-edge fuel cells technology. We find similar results for other companies with their R&D Centres in India as shown in Table 1.

Multinational R&D centres in India are moving their R&D outfits in India from periphery to the core. We present just two examples to illustrate the point.

Emerson, the US-based global manufacturing and technology company, has a world-class innovation centre in Pune. Established as an experiment in 2003 as Emerson Design and Engineering Center, it has grown from a handful of engineers to over a thousand in ten years. The centre transformed itself from doing task-based engineering work to executing end-to-end new product programmes and thus earned the new name 'Emerson Innovation Center–Pune' in 2010. The innovation centre's engineers work on a variety of innovative products and technology domains under one roof, contributing to the success of over 20 Emerson businesses worldwide. The centre, with high-quality talent, infrastructure, capabilities and culture has become a closely integrated and critical part of Emerson businesses' global growth strategy.

Samsung has a number of R&D centres strategically spread across the globe. India is among the hotspots for its innovation strategy. The three R&D centres based in Bengaluru, Delhi, and Noida develop cutting-edge technologies across almost all areas of Samsung's business, for global as well as for local markets. Samsung R&D Bangalore (SRI-B) is the largest overseas R&D centre of Samsung Electronics. It is a key player in the breakthrough innovation and success story of Samsung Electronics; their engineers



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THE IMPROVED ECONOMIC CONDITIONS and availability of exciting and intellectually stimulating challenges in India have created a great impetus towards 'brain gain' from 'brain drain'.

conceptualise and commercialise novel features, designs, products and services that differentiate Samsung as a market leader and deliver world-class products [8].

INDIA CAN BECOME THE LABORATORY FOR THE WORLD

India is slowly but surely becoming the laboratory of the world. India, with its large potential market, staggering diversity, enormous challenges and inventive and entrepreneurial spirit, has many of the conditions suited for innovation. Once innovative offerings have succeeded in India, companies find that there is a good reason for expecting success elsewhere. Succeeding in India becomes important because it is a catalyst for development of powerful new capabilities that are critical for competing worldwide[9] .

GE and John Deere pioneered design and development of innovative and affordable products in India to serve local markets and later these products were launched globally. Some of the other examples include [10]:

- Samsung India's research and development laboratory in Chennai developed a new top-loading washing machine, which is now a bestseller in South Korea.
- LG developed a few innovative products in India such as Mosquito Away Technology ACs, smart refrigerator 2.0 and a top-load washing machine, which are being sold in South East Asia, the Middle-East and the African region.
- Renault has introduced a new car Kwid, which was conceived and built from scratch by its Indian R&D unit. Kwid is expected to be launched in other markets globally over time.
- Coca-Cola India developed a visi-cooler for the Indian market, which was later introduced in other parts of the world.
- Hindustan Unilever's Pureit water purifier is an Indian innovation that was later made available in several markets such as Indonesia, China, Africa and Brazil.

India is also one of the fastest growing startup hubs in the world and companies like Microsoft and IBM have successfully launched programs for engaging startups. And others will too. The recent NASSCOM report puts India in the third place for technology-driven product startups, after the US and UK. The Indian government is fully supporting to build a robust ecosystem for nurturing innovation-led startups. More and more startups in India are now focusing on developing products and solutions based on innovative technology. A number of startup incubation centres set up in academic institutions like IITs and startup accelerators based in tier-1 and tier-2 cities can be a source for developing disruptive technologies and acquiring entrepreneurial talent. India offers a great opportunity for companies and their R&D centres to partner, invest, or acquire talent and disruptive technologies that are being developed by these startups.

New policy initiatives from the Government of India such as Make in India, Smart Cities, Digital India, and new IPR Policy offer significant opportunities for global companies to develop new products and solutions that lead to business growth. India is becoming one of the biggest and fastest growing emerging markets especially in sectors such as electronic systems, electrical machinery, and automobiles.

WHAT DOES THIS MEAN FOR INDIA?

One might argues that if Indian IQ creates IP for multinationals, then what is the gain for India?

Dr Mashelkar's experience in the early nineties is revealing. The very name 'National Chemical Laboratory' implies that for NCL, it is 'nation first'. So in the lecture in 1995, he had said, "NCL does recognize that its charter is to serve the nation and make the Indian industry competitive. It, therefore, maintains a balanced portfolio, where two thirds of the work undertaken is still with the Indian firms."

National interest is guarded in many ways. For instance, the contractual terms that were set for collaborative research with GE were such that the product arising out of a novel process developed by NCL was manufactured in India. This continues to be so even today. So it was 'Make in India' based on science-led innovation done in India, which was funded by a US company! And, of course, jobs were created in India. Taxes were paid in India.

Secondly, holding hands with leading US companies raised the quality of NCL's research. GE trained over 20 NCL scientists in Six Sigma, and the benefits of these enhanced skills were finally accrued to Indian industry. NCL learnt the art of writing 'strong and impenetrable' patents, which again benefitted Indian industry in the end–since the scientists with such special skills were serving them. NCL's senior leadership got exposure to the way strategic planning and linking research and business was done by some of their Fortune 500 company partners. This helped NCL become a supplier of world class leadership in India.

The improved economic conditions and availability of exciting and intellectually stimulating challenges in India have created a great impetus towards 'brain gain' from 'brain drain'. Along with the reversal of brain drain, the migration of professionals to Indian companies after working in multinational companies has helped Indian companies to drive a next-level of growth through research and innovation.

For example, Aravind Chinchure returned to India from the Netherlands to join GE R&D Centre in India. Before receiving an offer from GE R&D Centre, Bengaluru, he was in the process of relocating to Germany from the Netherlands to work at the Max Plank Institute for Chemical Physics of Solids, Dresden, Germany. The opportunity to work in the GE R&D Centre attracted him to return to India instead of moving to Germany. After working in GE and Honeywell in India, he joined an Indian company– Reliance Industries to be part of a team that drives innovation-led growth across existing and new businesses of Reliance. His experience of working in multinational companies helped him to contribute significantly to an Indian company.

Today, there are several examples of professionals who worked in multinational companies in India and are now contributing to the next level of growth of Indian companies. Another great example is former Chairman and Managing Director of GE India Technology Centre, Dr. Gopichand Katragadda, who returned from the US to join GE-India and is now the Group Chief Technology Officer (CTO) of Tata Sons. He is now responsible for driving technology and innovation for the Tata group of companies. This is yet another classical case of brain drain to brain gain to brain circulation.

Just as we began by quoting from Dr Mashelkar's 1995 Thapar lecture, let us end in the same way. While concluding the lecture, Mashelkar had said, "I believe that this is an important point in our history, where we must look at the present, not just as a mundane extension of the past but as an exciting launching pad for a great future." I believe, a time has come, when India does not just develop technologies that are 'first to India', but 'first to the world'. The quality of Indian talent (whether it makes Mars Orbiter Mission (MOM) at US$ 74 million as against US$ 676 million for the US, or whether it produces 12% of GE's global patents in cutting edge technologies) is the best in the world. It is this Indian talent, I am sure, that will make the ultimate dream of India as 'the world's number one R&D hub' come true. ■

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[1]http://www.mashelkar.com/index.php/keynote-addresses/147-india-s-emergence-as-a-global-r-d-platform-the-new-challenges-and-opportunities

[2]http://economictimes.indiatimes.com/tech/ites/bengaluru-fifth-most-preferred-destination-by-mncs-for-tech-and-innovation-centres/articleshow/52562572.cms

[3]http://www.thehindubusinessline.com/info-tech/india-top-destination-for-rd-investments-beats-us-china/article8780331.ece

[4]http://zinnov.com/executive-summary-talent-report/

[5]Reinventing India, R.A. Mashelkar, Sahyadri Prakashan, 2011, p. 213.

[6]Current Science, 85, p.571, 10 September 2003.

[7]Reinventing India, R.A. Mashelkar, Sahyadri Prakashan, 2011, p. 163.

[8]http://www.samsung.com/in/aboutsamsung/samsungelectronics/india/rnd.html

[9]http://www.industryweek.com/expansion-management/win-india-win-everywhere

[10]http://timesofindia.indiatimes.com/business/india-business/Reverse-innovation-2-0-More-MNCs-take-Indias-frugal-engineering-global/articleshow/48166102.cms

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