

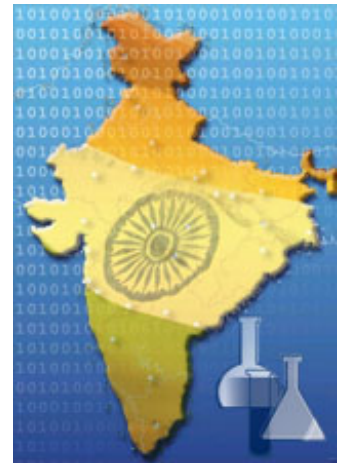


R&D in India: The Curtain Rises, The Play Has Begun...

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Motorola's two research and development facilities in India helped produce a sub-\$40 cellular phone for emerging markets. Microsoft in January launched its third international research center in India. Intel has 800 India-based engineers working on software and hardware designs for its communication and semiconductor product lines. Other U.S. companies are designing everything from auto parts to consumer electronics in India through outsourcing or setting up their own facilities in areas such as Bangalore, India's Silicon Valley.

All these efforts and more represent just the beginning of advanced research and development in India. If R&D in India were a three-act play, advanced development for products would be in the first act. Basic research, the software engineering and development to support other labs, is probably in the second act, according to experts. "More than 150 international companies are doing R&D in India," noted Arun Shourie, a former minister for privatization in the Indian government at a conference of Indian Institute of Technology alumni held in Washington, D.C., in May. As the number of companies from the U.S. and Europe moving R&D operations to India rises, hopes are high that the third act will be a grand finale that potentially could turn the country into an R&D powerhouse.



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"All the leading pharmaceutical companies have set up research operations in India," notes [Harbir Singh](#), a management professor at Wharton. "These companies have realized that India is not just a location where you conduct clinical trials; you can also do basic research. R&D in India isn't just about low-end work." Singh believes that the movement of global R&D into India is still in its early stages, but will expand over time. "Indian firms are starting to realize that they must become innovators," he says. "Their capital outlays are lower than those of their counterparts in the U.S., but that also makes them more selective about choosing projects."

Indeed, experts say that much of the R&D in India is geared toward smaller projects that complement other innovation centers in Silicon Valley and elsewhere. According to Arindam Bhattacharya, a director for the Boston Consulting Group, R&D centers in India focus on what he calls "competencies," or things like two- and three-dimension modeling, computer-aided drafting and add-ons to existing products.

For the year ending March 31, revenues from product development and R&D services in India stood at \$3 billion, up from \$2.3 billion a year earlier, according to the National Association of Software and Service Companies (NASSCOM), India's information technology services trade association. (Although that \$3 billion figure on the surface is impressive, it is \$1.8 billion less than what Intel spends on R&D in a year.)

While it's still relatively early in the movement of R&D to India, experts predict gains ahead. The upshot: The next big technological innovations could emerge from India, China or Russia, far away from Silicon Valley. Rafiq Dossani, a senior research scholar for the Stanford University Institute for International Studies, says R&D is simply following the movement of information technology work to India. "You can see it happening as the U.S. information technology giants come to India," says Dossani. "Big consulting

firms such as Accenture and IBM seem to be building every other building."

Opportunity or Threat?

The fact that U.S. multinationals are moving information technology and now R&D to India raises a few issues. To some industry veterans such as Bhattacharya, developing products in emerging markets makes sense. Why? The future growth markets for global companies are likely to be in China and India, both of which have different consumer markets than the U.S. By hiring local engineers and researchers, companies can better tailor products to those emerging markets. "Some things are inevitable," says Bhattacharya. "Growth will come from emerging markets, and in poor countries the products, price and value will continue to be different than in the U.S. A designer in Virginia will have limited knowledge of the emerging market. But an Indian designer will make the same design choices that the market wants because he comes from the same background as they do." That vision of the future means that products will be created everywhere and marketed globally. "Different cultures look at innovation through different lenses," says Ashok Deo Bardhan, a researcher at the Haas School of Business at the University of California in Berkeley.

In theory, those globally created markets will fuel the profit and sales results for U.S. companies. For Cadence Design Systems, a San Jose-based company that makes software and hardware to design semiconductors, building R&D outposts in India, China and Russia was primarily a matter of being close to its customers -- chipmakers that have manufacturing operations in those countries. By putting development operations near chipmakers' fabrication plants, Cadence can offer better support. "We're following our customers," says Jaswinder Ahuja, corporate vice president and managing director of Cadence's India operations. "It's easier to collaborate with them if we're local."

Ahuja adds that Cadence's 17-year-old operations in India were built largely to mimic its U.S. counterpart, creating redundancy for development work. For other companies, taking R&D to countries like India can cut costs and bring products to market faster. By playing time zones between, say India, the U.S., Russia and Singapore, the well choreographed company can develop new products and plug them into the U.S.'s infrastructure of lawyers, venture capitalists, accountants and financial markets to create economic value.

But there may be side effects to taking R&D to emerging markets such as India and China. Critics argue that the moves could impact high-paying jobs in the U.S. According to Ron Hira, a professor at the Rochester Institute of Technology and author of *Outsourcing America*, the big risk is that the U.S. could lose its capacity to innovate. "This is an area where U.S. policymakers and offshoring advocates have been asleep at the wheel," he says. "Many people inside the Beltway say, 'We'll just innovate our way out of this.' They haven't recognized that our normal policy mechanisms for innovation, such as increasing R&D funding and subsidizing universities, are more geographically leaky than they were before."

At the moment, though, much of the R&D in India isn't seen as an immediate threat. And Cadence's Ahuja notes that its R&D work abroad also happens or originates in the U.S. Cadence has 450 R&D employees in its India facility, roughly a third of the number the company employs in the U.S. Its relatively new centers in Russia and China have 110 and 70 R&D employees, respectively. Bottom line: It's too early to assess the impact as R&D goes global. "Is it a threat?" asks Bardhan. "It could be a threat and an opportunity; probably a bit of both."

Bardhan doubts that all R&D will suddenly flee the U.S. to go to low-cost countries. After all, the U.S. is still the second most popular destination for new R&D funding, second only to China, according to a white paper by the Economist Intelligence Unit. India is third. Nevertheless, if R&D fails to create a major technological advance in the next decade -- a prospect that appears unlikely -- companies will view it as a big cost without much of a payoff in additional sales, new products and number of patents. That situation would result in more R&D to low-cost areas just to save money. "If R&D isn't effective, it will be viewed as a cost center that will increasingly go to low-cost areas," says Bardhan.

Going Quietly

U.S. companies are reticent to discuss how much research and development work resides in India. For instance, General Electric, identified by experts as an R&D frontrunner in India, declines to comment, though media reports have pointed out that GE's facility in Bangalore is working on projects in fields ranging from nanotechnology to photonics. When Jeff Immelt, GE's CEO, visited India in 2002, he noted that the company employed 18,000 people in India, including more than 1,000 scientists. "We make some of the most sophisticated medical products here," said Immelt, according to newspaper reports published at the time.

However, companies that have long been established in India don't see a problem disclosing that R&D resides in India -- along with numerous other locations around the globe. These companies cite a comfort level because they have worked in India for several years, attracted primarily by the country's large talent pool of engineers, designers and scientists.

Take Intel, which spent \$4.8 billion on R&D globally in 2005 and as of Dec. 31, 2004, had 25,000 workers devoted to it. The company established an R&D center in India in 1999 to design everything from hardware to the software that is used to make its semiconductors work with other programs. Today, Intel has 800 workers in India working on R&D out of 2,500 total employees in the country, says Agnes Kwan, a spokeswoman. "We conduct research around the world. We're in China, Russia, Israel and Spain too." According to Kwan, the development team in India primarily works on communications products that are used worldwide. Teams in India are responsible for their products from inception to launch.

Motorola has had facilities in India since 1991, says Mary V. Lamb, director of corporate communications and public affairs for Motorola Asia Pacific. The company has two R&D facilities in Bangalore and Hyderabad that focus on software development for new and existing Motorola products. "India has emerged as an R&D hub for the company, a position that is being strengthened constantly," says Lamb, adding that Motorola has 2,000 employees in India, of whom 1,700 are involved in software engineering.

Motorola recently announced it will open a lab in India that will cooperate with other research facilities to advance the technology behind its so-called seamless mobility initiative, which aims to provide corporate voice and data communication wherever a worker goes. Lamb says the company has leveraged its presence in India to become the leading telecommunications supplier to the country's army, paramilitary forces/police, and civil authorities. The creation of a sub-\$40 phone is aimed at expanding Motorola's foothold in India's consumer market as well as other emerging markets and "connecting the unconnected," she adds.

Microsoft, which opened its research laboratory in Bangalore in January -- the third outside the U.S., after Cambridge, England, and Beijing -- is another company that views India as a microcosm of the developing world. Considering India's diversity in terms of religion, culture, geography, climate and language, Microsoft believes the country offers opportunities to develop technology that can rapidly be deployed elsewhere. "Solutions that work in India are more likely to transfer to other locations because they will have been tested across these barriers," says a company spokesperson.

Microsoft plans to focus on at least four key areas at its India laboratory. These include multilingual systems, in which researchers will work on areas such as speech recognition and user interfaces in several languages; India, with its 22 languages, is considered a good location for such research. Other areas include the development of technologies for emerging markets; geographical information systems; and sensors and sensor network applications. Daniel T. Ling, vice president of research at Microsoft, told the IIT alumni conference in Washington D.C. that one of Microsoft's major goals in setting up the Bangalore lab is to access India's talent pool through collaborative projects with institutions such as IIT. "Our lab doesn't do any product development, just basic research," he said. "There's a drop in students in computer science in the U.S., so a worldwide pool [of researchers] is very important to us."

India: R&D Exporter

Most U.S. companies use R&D in India to create products that are largely exported to the world. A communications chip designed in India can wind up anywhere. In contrast, R&D in China is primarily designed to create products to sell locally. For instance, Intel's R&D centers in China are focused on speech recognition software and designing hardware that can recognize the characters in the Chinese language.

Intel's Kwan says the speech recognition software could be exported in products elsewhere, but the first target is the market in China. Bardhan says companies are conducting R&D in China to gain market expertise. R&D in India is created for global use. "Much of that R&D is imported into the U.S.," says Bardhan.

Still, India faces major challenges as it attempts to grow into an R&D powerhouse. According to Singh, the first is managing the transition from product development to research. "India has a pool of scientific talent that traditionally has been under-funded," he notes. "India is now trying to release its untapped potential as a result of linkages between global firms and Indian educational institutions." Singh believes it will take time and effort for Indian firms to learn how to operate in the global context. "They have to grasp the dimensions of scale -- and recognize that they are competing on a global stage. Many firms will measure up, but many others will not. The barrier is to understand what it means to be world class. Indian companies are being invited to play on the world stage; they now have to learn what it means to play to win."

[Saikat Chaudhuri](#), a management professor at Wharton, believes India faces three crucial challenges as it strives to become a global R&D player. "The first impediment, which is steadily improving, is the intellectual property regime, or perhaps its perception," he says. "If this is perceived as solid, then more mass-scale investments by global multinational firms in India will blossom (for instance, pharmaceutical majors simultaneously developing future blockbuster drugs in India along with the U.S.), producing cutting-edge technologies and products, and thereby creating strong agglomeration effects."

The second challenge, according to Chaudhuri, is the brain drain. "Even though this has come down substantially (only 30% of IIT graduates now leave India, vs. 70% earlier) and we see many reverse brain-drain cases, the fact remains that the very best people often choose to stay abroad, because they perceive opportunities in India at the highest levels of research not to be on par with the West (for example, being a professor at IIT is still not the same as being one at MIT). Luckily, the overall brain drain trend has reversed, so I see the trajectory as positive and it will only be a matter of time where we see more high-profile moves." By way of an example, Chaudhuri mentions Rono Dutta, former president of United Airlines between 1999 and 2002, who moved from the U.S. to India to become the CEO of Air Sahara.

Chaudhuri notes that India can accelerate this positive development, as well as the growth in indigenous R&D by aiming to remove the third obstacle -- lower levels of basic research. "This can be achieved by investing in R&D facilities and improving the research atmosphere at Indian universities," he says. "While there is a set of top universities that teach and research well, it is not sufficient for a country of India's size; many other universities teach well, but are not sufficiently motivated to pursue top research. Even the Indian Institutes of Management suffer from this problem today. Funding and policy changes would be required to effect a change here. High standards and levels of basic research will feed directly into top-notch applied research and product development, both in content and mindset. On all these fronts, I believe India is making good progress and the momentum is in a positive direction. Some policy changes, perhaps through public-private partnerships where possible, could quicken the pace of this evolution."

While the movement of R&D to India is likely to continue, experts say growth is likely to be gradual. Why? Companies have to overcome internal resistance to moving work offshore and become better managers. "There is huge internal resistance within organizations," says BCG's Bhattacharya. "A lot of

designers in India for GM have to work with engineers in Flint, Michigan. That can be difficult with different cultures and weak project management. Companies are grappling with a lot of internal issues."

The major questions companies must answer include:

Build or outsource? Bhattacharya says one of the biggest decisions revolves around creating a R&D center or outsourcing to a services company such as Wipro. Bhattacharya adds that it may be more structured to create R&D centers and hire the workers directly.

What returns are expected? According to Bhattacharya, R&D isn't something that will deliver an immediate return even if companies save on costs. "R&D takes time and you need to build knowledge over a series of projects," he says. "The projects have to then be linked with training."

How will work be managed? R&D teams need to be integrated no matter where they are located across the globe. Sophisticated project management and processes to handle changes are required to nip problems in the bud before they become thorny. "You have to create a community," says Bhattacharya. "Engineers need to talk and throw ideas around."

While these issues will take time to resolve, it's clear that U.S. companies will increasingly be managing R&D operations all over the globe, and that India will be a key outpost. That could well be the third act in India's R&D drama. Until then, please hold the applause and the brickbats.

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