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Innovation needs an ecosystem

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When inaugurating the 99th Indian Science Congress last month, Prime Minister Manmohan Singh urged a doubling of R&D spending, with greater private sector contributions. He also called for inclusive innovation to focus on India's food, energy and water security. Too often, however, innovation is conflated with levels of spending. Needed, instead, is a dynamic ecosystem for R&D and innovation with several crucial ingredients: financial investment of course, but also human, physical and natural capital, knowledge acquisition and transmission, laws and regulations, and institutions. Why are they important and how do these interact?

India's record is not only poor on each count, but there is also no integrated approach that links R&D activities across different institutions with the aim of increasing competitiveness. As Dr Singh recognised, the share of the private sector is very small. In industrialised countries, governments and universities account for at most 20-30 per cent of R&D investment. The rest comes from the private sector. In India these ratios are reversed. In other emerging economies, while government shares are significant (just over 50 per cent in Brazil; over 30 per cent from universities and research institutions in China), they are still much lower than India's and the shares are declining.

If the source of R&D spending is important, so is the destination. For industry to benefit from R&D activities, applied research has to have priority. Moreover, the financial resources, research infrastructure and gestation periods needed to support fundamental research are not available in developing countries. Compared to the experience of other countries, India's record is counterintuitive. More than a quarter of R&D investment goes towards basic research, against 5 per cent in China and 17 per cent in the United States. Thus, India, with one of the lowest R&D/GDP ratios, is also expending the resources in areas without a direct connection to industry. This is another consequence of low private sector involvement in research.

Worse, R&D activities in India are not as productive as compared to other large economies. For one, despite a large tertiary student population, India has not been able to increase the number of PhDs in science and engineering significantly (from 54 per 10 million in 1983 to 70 in 2004). China, which lagged India until a decade ago, now has 174 science and engineering PhDs per 10 million population.

For research to increase economic competitiveness there must be efforts to commercialise some portion of it; knowledge acquired must be transmitted. One step towards commercialising R&D is patenting new technologies. India's patent filings have grown rapidly since the mid-1990s (with a compounded growth rate of 10 per cent per annum); China had an annual rate of 25 per cent during 1995-2007. Moreover, patent filings per million people have remained low in India, touching a maximum of six. By contrast, China witnessed an exponential increase from eight to 116. Even controlling for rises in income, China's upward swing began at a lower level of per capita income than India's trajectory suggests.

For an integrated R&D and innovation sys-

tem to evolve in India, there has to be a move away from State domination towards promoting more innovation-based networks. At least four reforms should be encouraged.

First, diversify R&D funding sources and uses. The share of private sector funding in R&D must increase by at least 10 percentage points over the next five years. By doing so, the aim should also be to increase the share of applied research by five percentage points. If achieved, these outcomes would still be far less than in other countries, but they would signal a strategic shift in giving prominence to the productive sectors of the economy.

Second, convert R&D into commercial opportunities. Indian universities should be permitted to develop for-profit enterprises. Such an approach would correct the imbalance between basic and applied research, create a direct link between universities and other industry partners, connect research bodies with financial institutions outside government grant channels, and protect intellectual property rights accruing to research institutions.

Third, secure India's intellectual property. Simply increasing R&D spending will not guarantee innovation. Patent filings per billion dollars of R&D spending in India remain consistently lower (less than a third) than in China, not to mention technology leaders like Japan. The Indian government should consider setting up a Research IP Facilitation Agency, an institution that would help with patent filings for research institutions. A dedicated institution could advise universities on procedural matters and also subsidise the costs (say, against a share of future royalty payments). This would also encourage industry investments in R&D, whereby some of the research could be outsourced to universities without fear of IP theft.

Fourth, build a country-wide innovation network. There is no large funding agency that can step up R&D investments. Nor is the model of in-house research in vertically integrated firms flexible enough to tap into multiple sources of innovation. A networked model involving academic and industry institutions can match India's record of bottom-up entrepreneurship. This approach would allow India to leapfrog from state-led research initiatives to more collaborative approaches without waiting for large companies to pick up the R&D slack.

The convergence of trends that have been running in parallel so far — demands for energy security, need for materials and resource efficiency, the imperative of environmental sustainability, scientific breakthroughs in the biosciences, and the indispensable role of information technology — now offers both the opportunity for progress in the 21st century and also lays down the challenge for India. If these technologies and capabilities are not harnessed, India's economic competitiveness will gradually erode while simultaneously widening the technological gap between India and other great and emerging powers. Indian ingenuity might currently derive from the constraints that its entrepreneurs and innovators face but it cannot be the basis of long-term technological leadership. Cash is not enough; an innovation ecosystem is desperately needed.

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