Policies to Drive Innovation in India

Senapathy 'Kris' Gopalakrishnan and **Jibak Dasgupta,** Confederation of Indian Industry

India is a lower-middle-income economy in Central and Southern Asia with more than 1.2 billion people and an economy of $1.8 trillion GDP in absolute terms for 2014, and according to Global Innovation Index (GII) ranking for last four consecutive years, has been an outperformer in its peer group in terms of its innovation capacity. The other economies in India's peer group include Bhutan, Sri Lanka, Uzbekistan, and Pakistan.

The evolving policy landscape and research and development growth

In terms of the size of the economy and the volume and diversity of its population, India has an advantage over its peers, but its dominance in innovation capacity has not been mere coincidence. It is a result of the gradually increasing focus of its policy regime, a focus that has moved from science to technology and on to innovation and entrepreneurship, and has been supported by years of planning and implementation. After independence, policy makers in India targeted economic growth through industrialization and the development of science. Initially, industrial development was planned around setting up and empowering public-sector undertakings. The scientific policy focused on the acquisition, dissemination, and discovery of scientific knowledge, and stressed exclusively the cultivation of science and scientific research with a suboptimal focus on technology development.

The Industrial Policy Resolution of 1956 lay down policies that gave a state monopoly to all heavy industries. The Industrial Policy Statement of 1977 emphasized decentralization, and the Industrial Policy Statement of 1980 stressed the need to promote competition in the domestic market coupled with technological upgrading.[1] The Technology Policy Statement of 1983 stressed technology development in the country, shifting from the earlier focus on scientific development. The objective of the 1983 statement was to enable development of indigenous technology and the efficient absorption and adaptation of imported technology that could cater to national priorities. During the early 1980s, the private sector expanded gradually and the performance of Indian public-sector undertakings declined. With these policy measures in place, the GDP growth rate remained sluggish (at around 3.5%),[2] under an inward-looking and protectionist industrial policy regime.

During the 1990s, policy making in the science and technology sector started aligning with the country's overall economic policy framework, which favoured industrial research and development (R&D), the identification of technology needs, and technology development. Gradually the focus shifted towards collaboration between public and private institutions, identifying priority sectors and social needs, enhancing international collaborations, and strengthening human capital. In 1991 in a historic moment, with the help of a reformist budget, the Indian economy opened up by loosening its protectionist policies.

With a more open economy and the gradual shift in R&D and industrialization policy goals, scientific departments such as the Department of Science and Technology and the Department of Scientific and Industrial Research became proactive in collaborating with industry in public-private partnerships. This approach incentivized the private industry towards R&D by providing shared costs and rewards, and it provided a buffer against the high-risk basic research component of R&D. This collaboration was advantageous for industry. Research projects initiated at the institutes were now jointly funded by the government and industry; formerly, they would have been funded by industry alone.

According to the latest data (updated through 2009–10 and projected for two subsequent years) released by the Ministry of Science and Technology, gross expenditure on R&D (GERD) in the country has been consistently increasing over the years. From 24,117.24 crore Indian rupees (₹) in 2004–05, it has reached ₹53,041.30 crore in 2009–10, an increase of around 45%. The R&D

and GDP ratio increased significantly from 0.81% in 2004–05 to 0.87% in 2009–10. These data alluded to the strong growth in R&D in India that has occurred over the last decade compared with its closest peers, such as Pakistan (0.68% in 2007) and Sri Lanka (0.11% in 2008).[3] GERD as a percentage of GDP from 2011 to 2014 also ranks India consistently below 50, making Pakistan second in the peer group.

With this overview of India's growth in its innovation capacity, driven by its industrial and science and technology policy regime vis-à-vis its peers, the next section reviews India's innovation ranking in the GII. Subsequent sections will highlight what India has done to score higher than its peers in the lower-middle-income countries, the innovation policies that appear to have fostered innovation, and areas in policy that may need improvement. The chapter concludes with lessons to learn from India's experience and that of other countries, and, finally, a proposal for policy mixes that would enable India and similar countries improve in their innovation ranking.

Review of GII findings and pillars and their impact on India's ranking

As noted in the previous section, over the years the policy regime in India has evolved to become favourable in terms of innovation, but since the economic slowdown in 2008—specifically after 2010—the performance of the Indian economy has remained somewhat unstable. Over the last four years India has witnessed a reduction in its overall GII ranking, which dropped from 62th place in 2011 to 76th in 2014. This change in ranking can be primarily attributed to two major factors. The first concerns the changing dynamics of the country's political, educational, and business environment, and the second concerns the structural change GII has undergone to improve itself as an assessment tool over the years.

According to GII data, the input parameters in which India has consistently performed poorly during the last four years are political stability, ease of starting a business, tertiary inbound mobility, and environmental performance. These findings also resonate with the general public's perception that the government has been relatively inactive during this period in terms of making policy decisions. Among the reasons for this inactivity is the slowdown experienced in the overall economy, the country's high inflation, and clamour over severe corruption charges against the incumbent government. Weaknesses that are underscored in the GII occur in the area of ease of starting a business—a persistent matter of contention in India, which presents regulatory hurdles to entrepreneurs through a highly complex compliance regime and heavy bureaucratic interference. Such government interference discourages entrepreneurs from effectively starting and running businesses. The tertiary inbound mobility indicator concerns the number of foreign students studying in Indian institutions. Although India's higher education sector ranks better than many other developed economies in terms of the quality of its students, because of a lack of adequate infrastructure and student support system it loses out on the opportunity to attract foreign students. Finally, as a developing nation, India still holds a debate between the procurement of expensive, eco-friendly technology and the use of traditional, low-cost technologies that have a high carbon footprint. India's dismal ranking (155th out of 176) in the 2014 Environmental Performance Index is evidence of the fact that the country has lacked efficient policy measures to tackle this issue.[4]

Also influencing the decline in India's GII ranking are the structural changes of the index. The GII model is continually updated to reflect the improved availability of statistics and a better understanding of the meaning and implications of innovation. *Updates to indicators* have prompted India's drop in ranking in six of the indicators that have changed. Over the years the GII has used *new indicators* to better capture the different elements of the model. For example, adding indicators on global entertainment and media output and using patent applications instead of patent registrations were a feature of the 2014 GII. *Changes in absolute data values* have been another factor. These include the decrease in variables such as total value of stocks traded, market capitalization, and market access for *non-agricultural exports* over the 2011–14 period. Also affecting India's ranking is *low data availability* in instances where some indicators for India were not available for a more recent year, revised at the source, or simply not reported. Finally, a *variation in relative performance* (i.e., better performance by other economies in specific indicators) has also been responsible for India's overall change in ranking.

Because India's rank in the GII has gradually declined over years, it may be misconstrued by many that India has performed poorly in terms of its innovation capacity building, but this would probably be a wrong analysis. The GII states that there are certain areas where data could not be captured because of the non-availability of standard international indicators, and even if some of these areas have produced good innovation advantage for a country like India, it

does not translate into ranking. The following section illustrates some of the key areas driven by its evolving policy landscape that have worked well for India, and other areas that need further improvement.

Areas that have worked well and areas that need further improvement

The GII for the last seven years has been consistently publishing the ranking of countries on their innovation capacity and analysing the innovation input and output parameters that affect the relative strengths and weaknesses of nations. In this process, the GII has identified several key factors that have been responsible for better performance for some nations compared with their peers in a specific economic and geographical category. India has been identified as one such innovation achiever in its peer group of lower-middle-income economies in the Central and Southern Asia region. Following are some of the key areas identified by the GII as responsible for relative strengths and weaknesses of India's innovation prowess vis-à-vis its peers.

Areas of strength

This section presents some key areas where India has outperformed its peers in terms of building its innovation capacity guided by an effective policy regime. Some of these—such as information technology and mobile penetration—have been a great success; in these areas, India has performed on par with the best in the world.

Top Indian universities

Over the years, India has developed a stable foundation for scientific, technological, and business education by setting up centres of excellence such as the Indian Institutes of Science (IISC), the Indian Institutes of Technology (IITs), and the Indian Institutes of Management (IIMs). These premier institutions have prospered over time and produced some of the most brilliant minds on the world stage. Admission to these premier Indian institutions has, consistently, been competitive with a '1 out of 50' student admission ratio for IITs,[5] and a '1 out of 150' student success ratio for IIMs; this trend has grown over years. This competition for admission is even fiercer than the competition for admission in the top US schools such as the Massachusetts Institute of Technology (MIT), where the ratio stands at around 1 out of 10 who apply.[6] This competitive landscape and the influx of meritorious students have provided a natural advantage for India, which positions its top institutions as some of the best in the world. Despite many challenges, average scores at top universities in India has been a strong point for its superior innovation ranking, not only among its peers but also among all nations.

Citation of publications

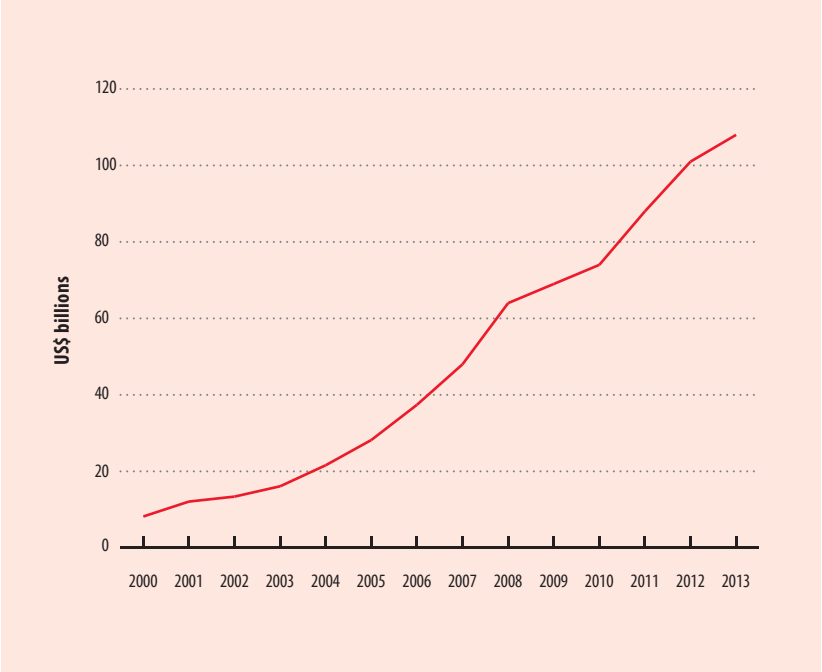
Allied to higher education, the strength of scholarly publications from India has been a key proponent for driving innovation capacity. The higher education sector in India has contributed to the 66% average growth rate in the output of scientific publications as assessed over a five-year period (2006–10). Among all disciplines, engineering research has made the most significant progress, and Indian scientific papers have nearly quadrupled their presence in the top-ranked 1% of journals worldwide. In addition, the improvement of the citation rate (and therefore their impact) in engineering disciplines has been significant, and this level of impact has grown steadily since the 1993–97 period. A government study also indicates that the citation impact of Indian publications has increased from 0.35 in 1981–85 to about 0.68 in 2006–10,[7] which helped India to lead the citation index among its peers.

Mobile networks, information technology, and broadband

The other important segment in which India has leapfrogged, leaving others in its category behind, is its mobile networks, information technology, and broadband. When the first National Telecom Policy was launched in 1994, the telephone density in India was about 0.8 per hundred persons; the world average was 10.0 per hundred persons. This density was even lower than that of other developing countries such as China (1.7 per hundred persons), Pakistan (2.0), and Malaysia (13.0).[8] By 1999 India had achieved some of the targets laid down in the 1994 policy, such as the penetration of one public call office per 522 urban population against the target of one public call office per 500,[9] and establishing 8.7 million telephone lines—even more than the planned target of 7.5 million. In addition, targets were set to achieve a teledensity of 7% and 15% by 2005 and 2010, respectively, and to increase rural teledensity from 0.4% to 4% by 2010. Online electronic commerce was encouraged to pass on information seamlessly with the addition of 10 gigabytes of bandwidth on national routes (expandable up to terabytes in some special cases).[10]

With a penetration of broadband and Internet in the country standing at around 0.02% and 0.40%, respectively, in 2004, the government announced an exclusive policy on broadband.[11] With all these policies in place, the growth of telecommunications connectivity through mobile telephones rapidly expanded

Figure 1: Yearly revenue growth in IT, US$ billions (2000–13)



Sources: Authors' calculations, based on IBEF, 2014; NASSCOM, 2008; and OECD, 2010.

in the next decade. The number of telephone connections surged from 41 million in December 2001 to a staggering 943 million by February 2012, out of which 911 million alone were added via the cellular segment (mobile phones). The increasing teledensity and sharply declining tariffs in a competitive market made India the fastest-growing telecommunications market in the world and placed it far ahead of its peers in the Central and Southern Asian regions. The sector was responsible for almost 3% of country's GDP. The National Telecom Policy 2012 was conceived in this context, with the aim of transforming India into an empowered and inclusive knowledge-based society.[12]

Information technology (IT) in India was a fledgling industry during the 1970s, and few players were active in the market. Over the years the pace of growth in this sector remained faster than in other segments because it did not require much capital to set up a business, and it also provided relatively short lead times to generate revenue. The development of new Indian organizations in this space has grown exponentially in the last two decades, with revenue growth from US$5 billion in 1997 to around US$64 billion in 2007,[13] and to US$108 billion in 2013.[14] The yearly growth in IT revenue from 2000 to 2013 is illustrated in Figure 1.

Recognizing the growing potential of the IT sector in the 1980s, the government opened the sector up to external competition. In the 1990s policies were directed towards developing required infrastructure in telecommunications to support IT growth. As a result, during the period 2000–13, the IT-business process management sector expanded at a compound annual growth rate (CAGR) of 25%, which is three to four times higher than the global average. The IT policy of 2012, by looking at this trend, has put forth the ambitious target of increasing revenue to US$300 billion by 2020. It is also envisaged that this policy will help to scale up innovation and R&D in cutting-edge technologies, provide benefits to small- and medium-sized enterprises (SMEs) and start-ups, create a pool of 10 million skilled workers, and make at least one individual in every household e-literate.[15] With the growth of IT, coupled with the advancement of broadband technologies, access to the Internet grew multifold from 2000 to 2013, at a CAGR of around 32.5%. Annual Internet penetration in India is illustrated in Figure 2.

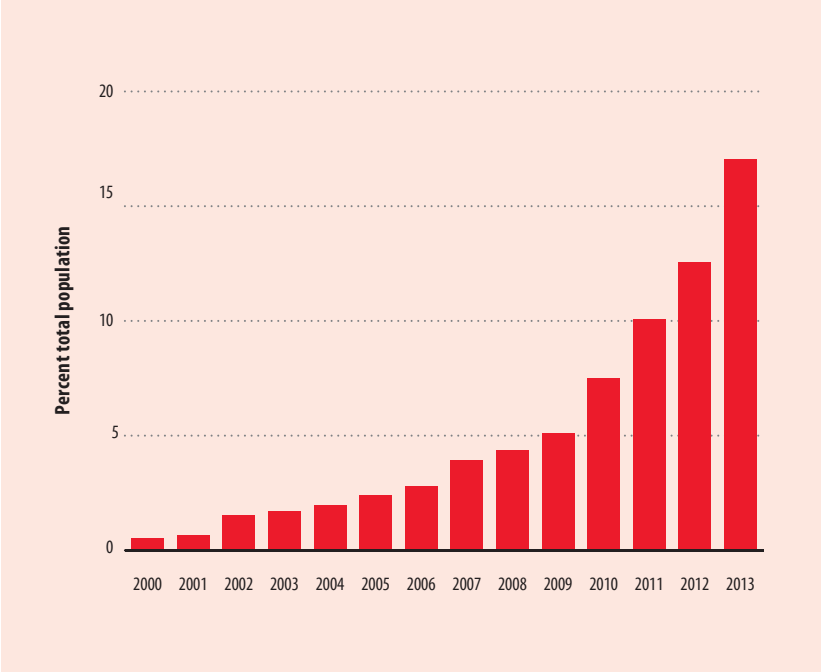
This revolution in communications has affected a pace of knowledge creation and dissemination in the economy that is unprecedented in Indian history. It has helped to transform innovation-driven entrepreneurship from the point of aspiration to the point of reality for the people of India.

Gross capital formation and market capitalization

India, as one of the fastest-growing economies in the world, has demonstrated strengths in factors such as gross capital formation, market capitalization, and total value of stocks traded. India's high GDP growth rate has complemented a strong gross capital formation that consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. After the country's economic liberalization in 1991, Indian industry also posted a high growth trajectory with more and more firms getting listed in the Bombay Stock Exchange (BSE) and National Stock Exchange (NSE),[16] which in turn increased the country's market capitalization over the years. As the volume of the stock

market grew, so did the total value of traded stock. The BSE Sensex, also known as 'BSE 30', is the most commonly used term for referring to the trading volume in India. When compared with the NSE, the BSC has statistics that are similar in terms of total market capitalization, but in terms of share volume, the NSE is almost twice as large as the BSE.[17] The equity market capitalization for BSE from 2011–12 to 2014–15 has risen from US$1,235.05 billion to US$1,626.68 billion, respectively.[18] The other factor that has played a major role in this success is the clear policy guidelines laid down by the Securities and Exchange Board of India for regulating the financial market.

Figure 2: Annual penetration: Percent of population with access to the Internet



Source: Authors' calculations, based on data available in http://www.internetlivestats.com, accessed 30 April 2015.

Areas of weakness

Although India exhibits areas in which it has performed very well and areas that have allowed it to be a successful outperformer in its peer group per the GII classification, the country also has many areas of weaknesses. In this section we will consider three of these weak areas: SMEs, intellectual property rights, and higher education. In all of these areas a much better innovation policy will be indispensable.

Small- and medium-sized enterprises

In India, the SME sector is responsible for 45% of total manufacturing output and employs around 70 million people. The potential of this sector makes it important for realizing the policy target of achieving manufacturing output equal to a 25% share of GDP, an increase from its current level of 16%. Although the SME sector has a high growth potential, its sub-optimal development could be attributed to a lack of adequate cash flow caused by low credit availability in the form of equity as well as debt.[19] This concern is amplified because SMEs have a large number of unregistered units under their purview for which credit is much harder to come.[20] Cluster development in India has traditionally been spearheaded by the Ministry of Micro, Small & Medium Enterprises. The ministry runs an initiative—the Micro & Small Enterprises Cluster Development Programme (MSE-CDP)—that looks at the development of industrial clusters encompassing marketing, exports, skill development, and the setting up of common facility centres; the initiative includes upgrading the technology of enterprises.[21] According to a study released by UNIDO in 2003, around 388 SME clusters across India have been affected by this initiative.[22] Although this has provided a good platform from which Indian SME clusters could grow, it has not been enough to bring a rapid improvement in the sector in terms of fostering R&D-driven innovation. Recognizing this lack of competitiveness in the SME sector as a major impediment, in 2005–06 the government announced the formulation of a National Manufacturing Competitiveness Programme (NMCP) to address firm-level competitiveness. Since this development, the yearly growth of the SMEs has improved marginally. Also in 2011 the National Innovation Council of the Government of India launched a flagship initiative on innovation clusters, at a pilot stage. The innovation cluster programme has thus far successfully piloted only five clusters across India.[23] The overall situation of SME cluster growth in India has remained sub-optimal.

Intellectual property rights

Intellectual property is one of the key indicators of the innovation output of an economy. In India, a persistent contradiction exists between protecting intellectual rights for

commercialization and profitmaking and catering to the social needs and obligations to the poor. Owing to this contradiction, policy and patent laws have been crafted to strike a balance between these two considerations. This has resulted in a relatively weaker intellectual property rights (IPR) regime than those of other developed nations. Figure 3a compares patents filed against patents granted (for Indian, foreign, and total) over a 10-year period. Figure 3b concerns the percentage of patents granted by the Indian patent office and indicates that this percentage has significantly declined over the years, particularly since 2008–09. Figure 3c compares the rate of foreign and Indian patent grants and indicates that, over years, the foreign patent grant percentage is significantly higher than the patent grant percentage in India. Figure 3d contrasts international and domestic patent filings by Indians and shows that the share of international patents filed by Indians is minuscule compared with patents filed in India. This is a worrying situation for an economy like India's, which is striving to grow multifold in the near future and aspiring to become a knowledge-driven economy.

Higher education

Although India's top educational institutions have done relatively well over the years, India is still grappling with some pressing issues in higher education that need immediate attention. With a population of more than 1.2 billion, and with 50% of that population under the age of 25, there is a huge demand for higher education in India. This has resulted in an enormous supply-demand gap, with an enrolment rate of only an 18% in higher education institutions, leaving a large section of the population deprived of educational opportunities after high school. The government is aiming to increase the enrolment rate to 30% by 2020. Other issues that the higher education sector is currently confronted by are poor teacher quality, constraints in research capacity and innovation (owing to low enrolment in PhD programmes, few opportunities for interdisciplinary working, a weak innovation ecosystem in academia, and low industry-university collaboration), and a large socioeconomic disparity.

Conclusions and the way forward

The preceding sections have outlined how India's economic growth has been influenced by its policy regime over a period of time. This section reiterates some of the stronger as well as weaker areas in the economy where India and other nations can learn and benefit from each other. The section also lists key areas that need immediate and sustained policy interventions, and notes some of the recent initiatives undertaken by the government and other stakeholders to improve the country's innovation capacity.

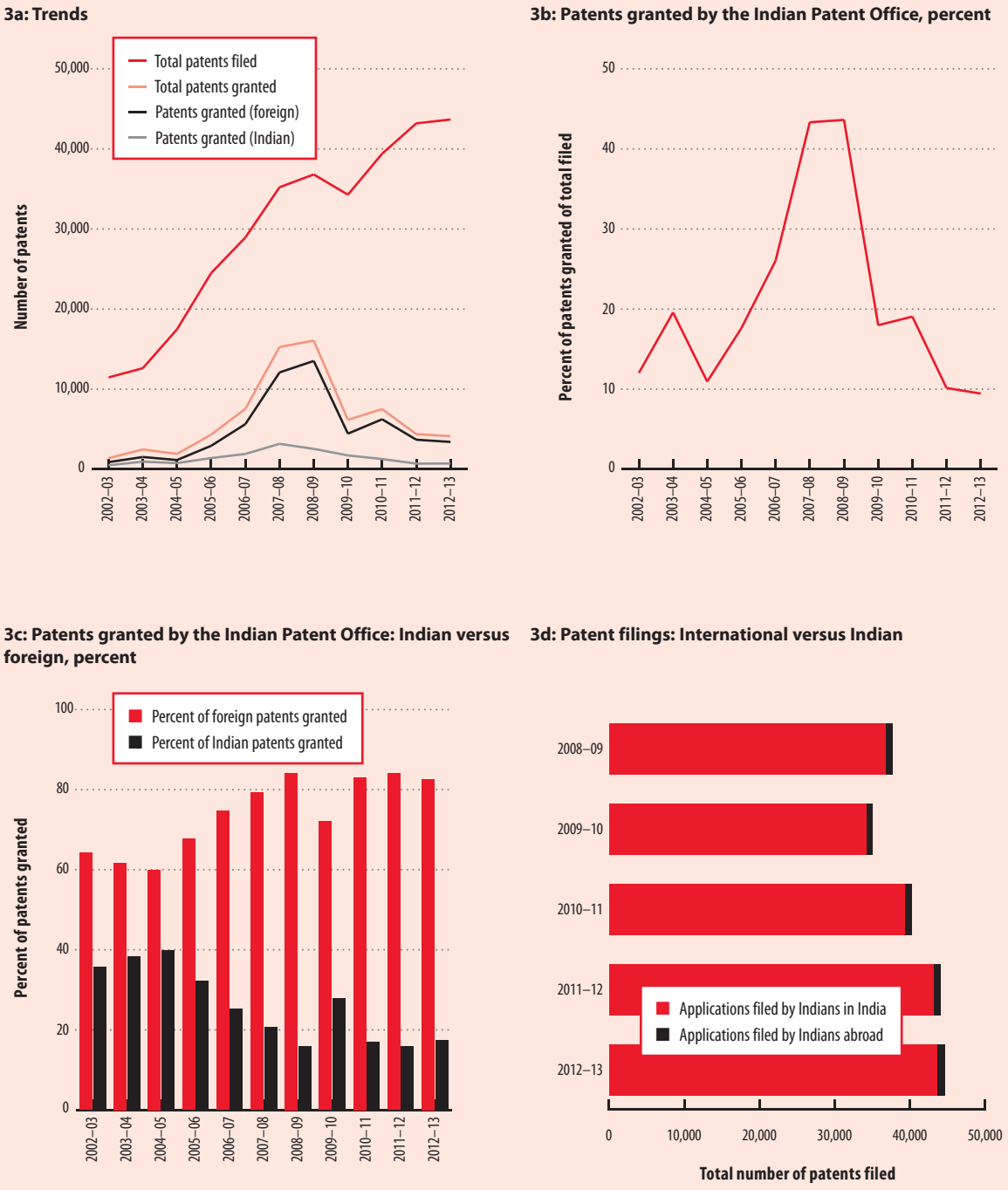
The main areas where India provides an example for rest of the world are in the growth of its ICT regime (mostly mobile penetration) and in its IT and IT-enabled services (ITeS) sector. Previous sections have discussed how, with the implementation of progressive policy measures, these two sectors have emerged to be trendsetters in a span of just two decades. For countries with similar economic and demographic conditions, the India story could be a very useful case study to consider. Many of the lessons India has learned can be adopted to emulate a similar growth experience in a short span of time.

Although ICTs and IT have together comprised a vital differentiating component that increases the pace of the innovation and knowledge development in the economy, their benefit can truly be realized when areas such as higher education, IPR, the regulatory and business environment (which affect the ease of doing business), physical infrastructure (such as railways, roadways, freight transport, etc.), and institutional reforms get appropriate attention and sufficient support from the government. In these key areas India can learn from developed economies about how policy can play a major role for improvement and provide a long-term dividend. The other most important step would be to create entrepreneurship policy at the national and state levels to leverage existing resources effectively.

In light of the above observations, the following are suggested as the primary areas in which government needs to carefully and deliberately formulate robust policy measures to achieve economic growth driven by innovation:

- **Higher education.** As noted earlier, India lacks an adequate number of higher education institutions to cater to its growing number of aspiring students. The level of university-industry collaboration in India is also minuscule compared with that of other developed nations, and there is dearth of high-quality teachers in the education system. The government needs to look into all these aspects carefully while devising a suitable policy for the higher education sector.
- **Industrial innovation.** SMEs are the future growth engines of any economy; an economy is as innovative as its SMEs. In order

Figure 3: Trends in Indian patents



Sources: Authors' calculations based on the Ministry of Commerce & Industry (India), 2013; Statistical Country Profile: India, WIPO database, http://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=IN.

to infuse a culture of innovation and R&D into Indian SMEs, proper fiscal and tax guidelines must be set by the government so that more and more SMEs see benefit in R&D and adopt this as their future business strategy.

- **Entrepreneurship.** As the world economy becomes more volatile and India faces the adverse effects of this economic instability, it is essential for the government to stimulate job creation in the economy far more than usual by devising new methods. This goal can be achieved through building a strong entrepreneurial ecosystem and incentivizing innovation-driven start-ups. Policy concerning entrepreneurship at the national and provincial level needs to be formulated to stimulate this process, which is currently nonexistent.
- **Easing the business environment.** India ranks poorly in terms of its ease of doing business parameters. This will remain a major obstacle that India must address if it is to hasten its economic growth (in terms of its GDP) from its current level of 5–7% to 10% and above. Providing simple regulatory guidelines, moving all processes online, and ensuring less paperwork and less bureaucratic interference will be the key. This can be achieved only through policy-level amendments.
- **Infrastructure development.** Although IT infrastructure in the country has improved by leaps and bounds over the years, the scenario in the physical infrastructure development remains grim. Unless India gears up its infrastructure development—that is, unless it builds good roads and efficient railways (passenger and freight corridors) and modernizes its ports—it will be hard to develop industrial corridors and attract foreign investments. Clear policy guidelines and investment in these sectors will boost the economy and trigger new innovative solutions for existing bottlenecks.
- **Intellectual property rights.** The existing IPR regime in India has traditionally been weak when compared with that of developed economies in terms of protecting new technologies and innovations. The merit of strong, enforced IPR in certain sectors, such as pharmaceutical and biotechology, may be largely debatable when weighing the needs of the business community to protect intellectual property for commercialization and to make a profit with the obligations and needs of the country's large poor population. But India (including its poor) cannot afford to allow a weak IPR regime to remain a long-term barrier for its new entrepreneurs if it intends to fulfil its aspirations of becoming an innovation-driven economy. The government must find ways to study and address this important driver of innovation while restructuring its existing laws and its enforcements.

In 2014 the newly elected Indian government, as one of its first moves, established an aligned Ministry for Skill Development and Entrepreneurship. This is a step forward. With the intervention of the government and the private sector, the level of innovation in Indian industry is also growing and more and more Indian SMEs are coming forward to invest in collaborative R&D. For example, public-private partnership platforms such as the Global Innovation and Technology Alliance, a not–for–profit organization, are opening up opportunities for Indian companies to join with their foreign counterparts and develop products and technology through joint R&D programmes.

To enhance PhD education in the country, in 2013 the prime minister's office launched the Prime Minister's Fellowship Scheme for Doctoral Research, which is unique in its promotion of industrial research. According to this scheme, the government provides 50% of the total cost of a fellowship to students for performing research in a real-time industry environment. Industry provides the rest, and any IPR once created is owned jointly by the student and the industry concerned.[24]

In India's most recent Union (central) budget presented in February 2015,[25] the government placed considerable emphasis on rapid development in the SME sector by addressing the funding issue. It has created a fund of ₹20,000 crore with a credit guarantee of ₹3,000 crore for entrepreneurs in this sector.[26] In addition, it set aside ₹1,000 crore for a Techno-Financial, Incubation and Facilitation Programme to support all aspects of start-up businesses, and other self-employment activities, particularly in technology-driven areas.[27] The Ministry of Micro, Small & Medium Enterprises has launched Intellectual Property Facilitation Centres in different parts of the country with the aim of creating an intellectual property culture within SMEs by looking at protection, capacity building, information services, and counselling and advisory services regarding IPR.

The government is also looking to boost the development of sectors such as infrastructure, transport, smart cities, manufacturing, and

IT to supplement growth. Recently launched schemes such as Make in India and Digital India are steps in this direction. Furthermore, reforms in India's credit delivery mechanism to its poor have been addressed by credit transfer schemes such as Pradhan Mantri Jan-Dhan Yojana, which aims to increase disposable income for India's poor.

Given the unique challenges that India faces, achieving even 40 to 50% of their targets by some of these initiatives will amount to an economic revolution. The momentum is building positively and the time is favourable for India to change gears and get its innovation journey onto the fast track.

Notes

1 The Press Information Bureau, Government of India, released a series of press notes concerning Industrial Policy Highlights. These can be found online at http://eaindustry.nic.in/handbk/chap001.pdf; subsequent versions can be found by adjusting the chapter number in the link.

2 Mohan, 2008.

3 For growth in Pakistan, see Kahn and Khattak, 2014; for growth in Sri Lanka, see Weerasinghe, 2013.

4 EPI, 2014.

5 Basu, 2014.

6 PwC, 2012.

7 Department of Science and Technology, Government of India, 2012.

8 Ministry of Communications & Information Technology, Department of Telecommunications (India), 1994.

9 A public call office (PCO) is a telephone facility located in a public place in India.

10 Ministry of Communications & Information Technology, Department of Telecommunications (India), 1999.

11 Ministry of Communications & Information Technology, Department of Telecommunications (India), 2004.

12 Ministry of Communications & IT, Department of Telecommunications (India), 2012.

13 Gupta, 2010.

14 IBEF, 2014.

15 Ministry of Communications & IT, Department of Electronics & Information Technology (DeitY), 2012.

16 The Bombay Stock Exchange is available at http://www.bseindia.com/; the National Stock Exchange is available at http://www.nse-india.com/.

17 See S&P BSE Equity Market Capitalisation, available at http://www.bseindia.com/markets/keystatics/Keystat_maktcap.aspx?expandable=0'.

18 See http://www.bseindia.com/markets/keystatics/Keystat_maktcap.aspx?expandable=0, accessed 30 April 2015.

19 In India the availability and access to equity and debt for micro business is relatively low compared with that of other developed nations. The entrepreneurial sector is slowly building and gradually policies are being framed that allow creation and access to more such funds by micro businesses and start-ups. See 'Private sector investment for MSME' under 'Financial Resources' Working Group for the Twelfth Five Year Plan (2012–2017) of India's Planning Commission, available at http://planningcommission.gov.in/aboutus/committee/index.php?about=12strindx.htm.

20 For the purpose of collecting data relating to manufacturing activities through a sample survey, all manufacturing units in the country are classified into two broad sectors: registered and unregistered sectors or organized and unorganized sectors (the terms are often used interchangeably). Although the registered manufacturing sector covers the manufacturing units registered under sections 2m (i) and 2m (ii) of the Factories Act of 1948 or under the Bidi & Cigar Workers (Condition of Employment) Act of 1966—that is, the units employing 10 or more workers and using power or 20 or more workers but not using power—the unregistered manufacturing sector covers all +residual manufacturing units. See Section 5, 'Industrial Statistics', from the Ministry of Statistics, available at http://mospi.nic.in/nscr/is.htm.

21 Ittyerah, 2009.

22 UNIDO, 2003; data are taken from http://www.dcmsme.gov.in/clusters/clus/smelist.htm#clus.

23 National Innovation Council, 2013, pp. 19–20.

24 CII, 2014 and 2015.

25 Jaitley, 2015.

26 For details about MUDRA, see http://www.mudra.org.in/faq.php.

27 Ministry of Finance (India), Press Information Bureau, 2015.

References

Basu, S. D. 2014. 'Race to IITs Just Got Tougher; Number of Candidates Who Qualified in JEE Advanced 6,360 More than Last Year'. *The Economic Times,* 20 June. Available at http://articles.economictimes.indiatimes.com/2014-06-20/news/50739176_1_1-26-lakh-students-joint-entrance-exam-iit-seat.

CII (Confederation of Indian Industry). 2014 and 2015. 'Prime Minister's Fellowship Scheme for Doctoral Research'. Available at http://primeministerfellowshipscheme.in/Home.aspx.

Department of Science and Technology, Government of India. 2012. *Bibliometric Study of India's Scientific Publication Outputs During 2001–10: Evidence for Changing Trends.* New Delhi: Government of India. Available at http://dst.gov.in/whats_new/whats_new12/report.pdf.

EPI (Environmental Performance Index). 2014. 'India Ranks 155th on the 2014 Environmental Performance Index'. Press release. Available at http://epi.yale.edu/files/2014_epi_press_release_-_india_.pdf.

Gupta, D. 2010. 'Information Technology Industry in India Growth Structure and Performance'. In *Human Resource Development Practices in Information Technology Industry in India.* PhD thesis, Punjab School of Economics. 138–56.

IBEF (India Brand Equity Foundation). 2014. Indian IT and ITeS Industry Analysis, 31 August. Available at http://www.ibef.org/pages/36252.

Ittyerah, A. C. 2009. *Evaluation Study of Micro & Small Enterprises Cluster Development Programme.* New Delhi: IIPA (Indian Institute of Public Administration). Available at http://www.dcmsme.gov.in/schemes/evaluation_study(MSME)_cluster.pdf.

Jaitley, A. 2015. Budget 2015–2016, speech of Arun Jaitley, Minister of Finance. Available at http://indiabudget.nic.in/bspeecha.asp.

Kahn, J. and N. U. R. Kattak. 2014. 'The Significance of Research and Development for Economic Growth: The Case of Pakistan'. *MPRA Paper* No. 56006, posted 21 May. Available at http://mpra.ub.uni-muenchen.de/56005/1/MPRA_paper_56005.pdf.

Ministry of Commerce & Industry, Department of Industrial Policy and Promotion (India). 2013. *Intellectual Property India: Annual Report 2012–2013.* Office of the Controller General of Patents, Designs, Trade Marks and Geographical Indication. Available at http://ipindia.gov.in/cgpdtm/AnnualReport_English_2012_2013.pdf.

Ministry of Communications & IT, Department of Electronics & Information Technology (DeitY). 2012. *National Information Technology Policy 2012.* Available at http://deity.gov.in/content/national-information-technology-policy-2012.

Ministry of Communications & IT, Department of Telecommunications (India). 1994. *National Telecom Policy, 1994.* Available at http://www.dot.gov.in/telecom-polices/national-telecom-policy-1994.

———. 1999. *National Telecom Policy, 1999.* Available at http://www.dot.gov.in/telecom-polices/new-telecom-policy-1999.

———. 2004. *Broadband Policy, 2004.* Available at http://www.dot.gov.in/telecom-polices/broadband-policy-2004.

———. 2012. *National Telecom Policy, 2012.* Available at http://www.dot.gov.in/sites/default/files/NTP-06.06.2012-final.pdf.

Ministry of Finance (India), Press Information Bureau. 2015. 'Self-Employment and Talent Utilisation (SETU) to be Established'. Press release, 28 February. Available at http://pib.nic.in/newsite/PrintRelease.aspx?relid=116187.

Mohan, R. 2008. 'The Growth Record of the Indian Economy, 1950–2008: A Story of Sustained Savings and Investment'. *RBI Bulletin* March: 373–97.

NASSCOM. 2008. Indian IT-BPO Industry: NASSCOM Analysis Factsheet. Available at http://www.almamate.in/pdf/IT_Industry_Factsheet_2008.pdf.

National Innovation Council (India). 2013. *Report to the People: Third Year.* New Delhi: National Innovation Council. Available at http://innovationcouncilarchive.nic.in/images/stories/report/rtp2013/Report%20to%20the%20People%202013%20-%20National%20Innovation%20Council%20(English).pdf.

OECD (Organisation for Economic Co-operation and Development). 2010. *The Information and Communication Technology Sector in India: Performance, Growth and Key Challenges.* Unclassified Document JT03286352. Available at http://www.oecd.org/sti/ieconomy/45576760.pdf.

PwC (PricewaterhouseCoopers). 2012. *India - Higher Education Sector: Opportunities for Private Participation.* Available at https://www.pwc.in/en_IN/in/assets/pdfs/industries/education-services.pdf.

UNIDO (United Nations Industrial Development Organization). 2003. 'Methodology and the Action Plan for Updation on SME Industrial Clusters.' Compiled by UNIDO Focal Point, CDP UNIDO, 14 November. Available at http://www.dcmsme.gov.in/clusters/unido/methcludata.htm#basic.

Weerasinhghe, M. C. 2013. 'R&D Country Profile: Sri Lanka'. Presentation for the Consultative Expert Working Group on Research and Development: Financing and Coordination. Bangkok, Thailand, 25–26 July 2013. Available at http://www.searo.who.int/entity/intellectual_property/about/strategy/23bDrManujandDrAnton.pdf?ua=1.