The globalization of India's national system of innovation

Balaji Parthasarathy

V Ranganathnan

International Institute of Information Technology
Bangalore, India

A country of contrasts - I

- the second most populous country, with the 4th largest economy in PPP terms in 2008, that is growing rapidly, and a potentially vast market. A large number of engineers, makes the country a choice site for production and innovation.

- nearly 30% of respondents to a survey by the World Investment Report (WIR) 2005 identified India as the third most attractive R&D location, after China and the US.

A country of contrasts - II

- Yet, the country is poor and illiterate.
- The WIR 2005 ranked India 66 out of 117 on its Technological Activity Index (computed on the basis of R&D manpower, patents in the US, and articles in scientific journals). India's position expected to only improve to 56 in the period 2007-12.
- In the Global Competitive Index computed by the World Economic Forum, even as India moved up two spots, from 46 to 44, between 2005-06 and 2009-10, among 114 countries, its rank slipped from 26 to 30 in the component that evaluates the potential to generate endogenous innovation

Sectoral contrasts

- A green revolution since the 1970s has allowed India to feed itself.
- For a country once dismissed as a mere exporter of “communicable disease”, by 2008, it had the world’s third largest pharmaceutical industry in volume terms and was the largest exporter of software services.
- But pockets of productivity, especially in services, co-exist with an informal sector, which employed 89% of the workforce (2000).
- While 99% of employment in agriculture (which employed 61% of the workforce) was informal, it was 80% in manufacturing and 31% in services. As a result, total factor productivity (TFP) in South Asia in 2005 barely 6% of what it was in the US

Explaining the contrasts – the changing policy environment

- After independence in 1947, India adopted an autarkic public sector enterprise (PSE) led import substitution led industrialization (ISI) developmental model.

- The policy environment created capabilities and competencies in a few sectors, especially strategic ones such as atomic energy and space. But internal and external barriers to the flow of ideas and resources ensured that the country was relatively poor, illiterate and isolated.

Suspicious of the world

- ISI in India meant producing with local inputs that were obsolete or relying on imported inputs. But, until 1991, since royalty payments were tightly regulated and patent enforcement was weak, foreign sources transferred as little technology as they could get away with.

- ISI not only discouraged innovation but also prevented India from exploiting its comparative advantage in labor-intensive sectors such as electronics assembly.

- A highlight of that period was asking IBM and Coca Cola to leave the country after the parent firms refused to dilute their 100% equity in the subsidiaries.

Embracing the world

- Policy changes since the 1980s have emphasized private initiative, trade and foreign investment, and innovation has driven economic growth.

- Changes made it easier access to technologies, royalty payments were eased and foreign trademarks and brands could be used freely in the domestic market.

- After accession to the World Trade Organization (WTO), and signing of the Trade-Related Aspects of Intellectual Property Rights (TRIPS), Patents Act of 1970 amended thrice – in 1999, 2002 and 2005 - to make it TRIPS-compliant

- Emblematic of the 1980s were policies to ensure that India became to the software industry what East Asia had become to the hardware industry. Software was the first industry where ISI and the ideology of self-reliance was explicitly rejected.

Growth in GDP and trade

- The Indian economy by a factor of 1.7 between 1980 and 1990, by 1.7 between 1990 and 2000, and by 1.8 between 2000 and 2008 (but growth in GDP per person and the GDP per person employed was lower)

- India's economic ties to the world grew faster than growth in GDP. Imports went up by a factor of 1.8 between 1980 and 1990, by 3.4 between 1990 and 2000, and by 3.6 between 2000 and 2008. Imports as a share of GDP grew from 9% in 1980 to 28% in 2008.

- Exports went up by a factor of 1.7 between 1980 and 1990, by 3.2 between 1990 and 2000, and by 2.9 between 2000 and 2008. Exports as a share of GDP grew from 6% in 1980 to 23% in 2008.

Trade, investment and human capital flows

- Inward FDI flows grew from 0.15% of the world total to 0.26% in 2000, but shot up to nearly 2.5% in 2008. Leading investors: US, Germany, UK. The period also witnessed investment by many MNCs, including the return of IBM.

- Cumulatively, between January 2000 and March 2009, the top three sectoral recipients of FDI were Services (21%), Computer Software and Hardware (10%), and Telecommunications (7%)

- Outward investment flows grew from a negligible share of the world total in 1980 and in 2000, to nearly 1% by 2008

- Increased flows of human capital. One indicator of the phenomenon: Indians the largest beneficiaries of H1B and L1 visas to the US due to the demand for Indian software professionals and the services of Indian software firms. But these flows have not been one-way, a phenomenon referred to as “brain circulation”.

Impacts on R&D and innovation

- India's R&D investment grew 2.6 times in real terms between 1995-96 and 2006-07.

- A notable feature - the growing R&D spending by the private sector. As a share of total sales in all industries, R&D spending grew from approximately 0.5% in 2002-03 to 0.7% in 2005-06..

- The leading sector (on a spending per firm and in aggregate terms) is drugs and pharmaceuticals. Other sectors are ICTs, transport equipment, and defense.

Patents and intellectual property

- Eleven times more patents were granted to Indian inventors or assignees in the period 1995-2008 than in 1976-1994.

- MNCs accounted for more than half the patents in both periods, although 71% of MNC patents in the earlier period were in Chemistry-related areas (mostly pharmaceuticals) whereas in the latter period it was in ICTs.

- The share of Indian firms increased from less than 8% to 16%, with 82% of patents being Chemistry-related in the latter period. Indeed, of the top twenty Indian patenting firms, sixteen were in the pharmaceuticals industry.

Limits to innovation

- Despite the increase in patenting, a study on innovation, based on patents granted by European and Japanese and the US patent offices, ranks India 58 out of 82 countries for the period 2002-05.

- Although India s viewed as an attractive location for R&D, investments under that category were only 3.5% of the total FDI in services.

- Likewise, amidst the growing acknowledgement of the importance of the R&D and innovation, R&D spending as a share of GDP grew from approximately 0.7% to 0.9% between 1995-96 and 2006-07.

Barriers to innovation

- In a 2007 survey of 137 firms by the National Knowledge Commission, more than half of all firms mentioned the lack of collaboration with universities and R&D labs.

- biggest barrier to innovation for all firms was “skill shortages due to lack of emphasis on industrial Innovation, problem solving, design, experimentation”

Limited higher education

- Although spending on education grew from 1.5% of GDP to 3.5% in 2005-06, only 7% of population of relevant age groups goes for higher education.

- But there too, in 2007-08, annual public spending per student in higher education in India was US$400, compared with US$3986 (Brazil), US$2728 (China) and Russia (US$1024).

- Higher education characterized by islands of excellence: 30 institutions award 65% of PhDs in science, while 20 institutions award 80% of PhDs in engineering

The overwhelming problem

- although India is “rushing headlong toward economic success….India’s colleges and universities, with just a few exceptions, have become large, under-funded, ungovernable institutions. At many of them, politics has intruded into campus life, influencing academic appointments and decisions across levels. Under-investment in libraries, information technology, laboratories, and classrooms makes it very difficult to provide top-quality instruction or engage in cutting-edge research.”

Need for inclusive innovation

- Discussion thus far ignores innovation in the informal sector due to challenges such as high transactions costs for scouting and documentation, the need for value-addition and finance, and ambiguous IPR.

- But, ignoring such innovation is to ignore the activities of a majority of the population that has long relied on its own ingenuity to solve local problems because it has no one else to turn to.

Acknowledging inclusive innovation

- Acknowledging the value of grassroots innovation, the Indian government established the National Innovation Foundation in 2000 to build a multilingual, online National Register of Innovations. It also organizes a biennial competition for grassroots innovation and tradition knowledge.

- Interest in learning from the informal sector has also extended to the formal sector, including MNCs.

- With markets in industrial economies maturing, the estimated 4 billion plus consumers with the lowest incomes at the ‘bottom-of-the-pyramid’ (BoP), are becoming attractive as a potentially vast and yet largely untapped market, since the majority owns few products.

Gaining insights into the BoP market

- But there are challenges when entering this unfamiliar market as infrastructural inadequacies, socio-cultural diversity, and affordability, mean that existing metrics for ‘lead’ users do not work.

- MNCs find in India all these characteristics; in addition, they also find an abundance of partners who can provide insights into grassroot innovation i.e., NGOs.

- Partnerships with NGOs help MNCs understand how products/services are designed for the BoP market and how that can be used in other locations.