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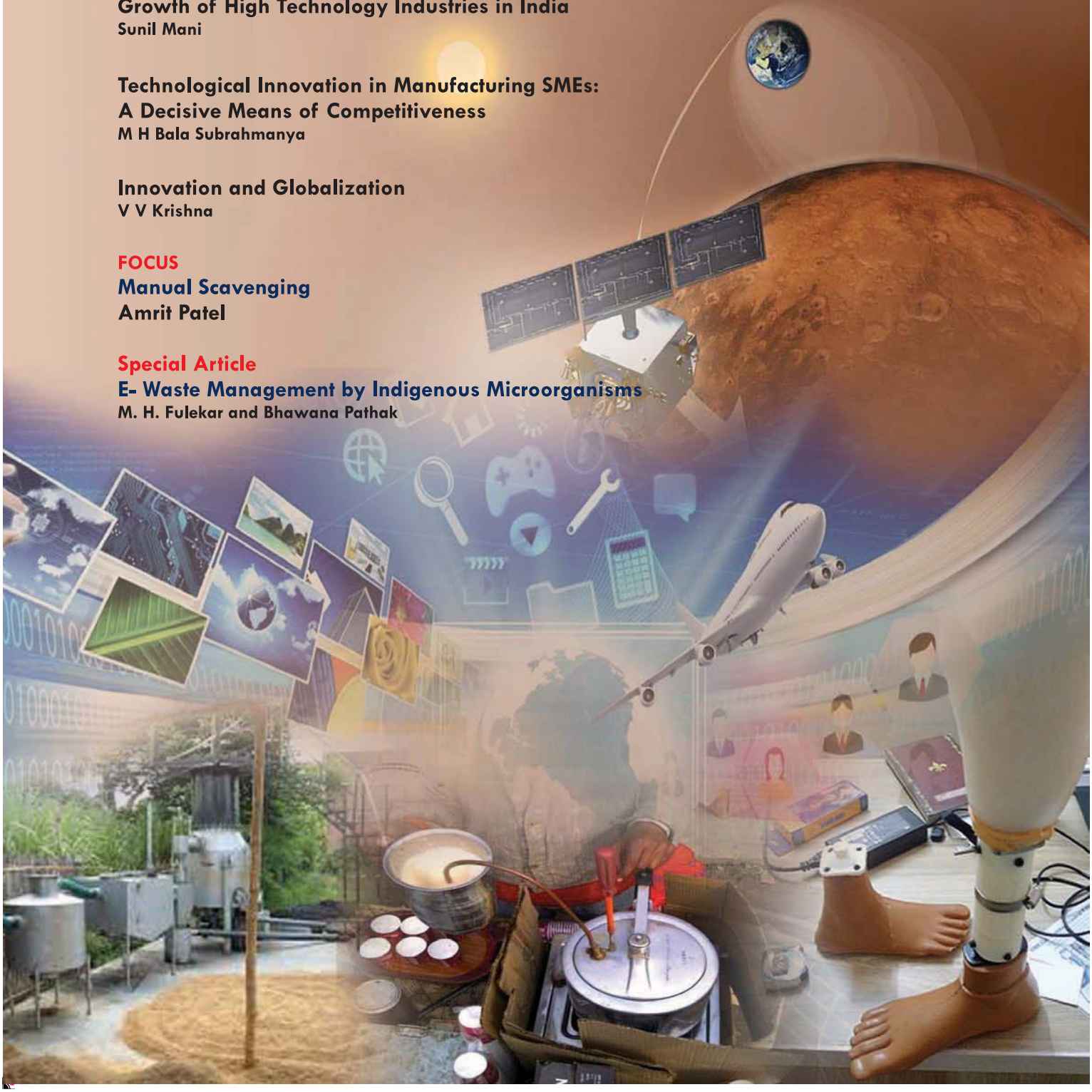

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Let noble thoughts come to us from all sides
Rig Veda

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Positioning India as an Innovation-Driven Economy

Rajnish Tiwari

The added emphasis on innovations is a direct result of consumer aspirations as people increasingly demand innovative products and services from a competitive market. This demand is fulfilled on one hand by leveraging the technological prowess of India's own scientific pool, and access to global knowledge on the other. While this is still an ongoing process with promising prospects, there is also a need for greater assertiveness and less risk-aversion in firms, if the true potential is to be realized

EVEN THOUGH some experts continue to see India as a factor-driven economy, in the recent years the country has progressively moved towards being an economy driven by knowledge and innovation. The added emphasis on innovations is a direct result of consumer aspirations as people increasingly demand innovative products and services from a competitive market. This demand is fulfilled on one hand by leveraging the technological prowess of India's own scientific pool, and access to global knowledge on the other. While this is still an ongoing process with promising prospects, there is also a need for greater assertiveness and less risk-aversion in firms, if the true potential is to be realized.

The Global Competitiveness Report (GCR), published annually by the World Economic Forum (WEF), classifies national economies in three broad categories: (a) factor-driven, (b) efficiency-driven, and (c) innovation-driven. Many economies are considered to be in a transitional phase between any two given broad groups. These categories are seen as indicators of a development ladder.

A factor-driven economy is defined by GCR as one that competes based on its factor endowment, which mainly comprises of unskilled labour and natural resources. As countries make economic development, they are seen to be progressing "into the efficiency-driven stage of development, when they must begin to develop more efficient production processes and increase product quality". Factors such as higher education and training, financial market development, and technological readiness influence a country's efficiency. At the top of the development pyramid, we find industrialized countries with high wages. These can sustain their "standard of living only if their businesses are able to compete with new and unique products". Companies in such economies "must compete by producing new and different goods using the most sophisticated production processes and by innovating new ones". It is the business sophistication and capability to innovate that determines this status. (cf. Schwab, 2014).

While, as a rule of thumb, developed nations like the United States or Germany are classified as innovation-driven economies, Brazil and Russia are seen to be on the transitional path to join that group. India's giant neighbour, China, is categorized as an efficiency-driven economy, whereas India – along with 36 other countries such as Rwanda, Ethiopia and Pakistan – still

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qualifies for GCR as a factor-driven economy. The reasons for India's classification in this group can be found in its relatively low rankings on factors such as technological readiness (121 out of 144 ranked nations). India is reported as being "one of the world's least digitally connected countries".

This article examines the proposition, whether India actually remains a factor-driven economy or whether it, at least partially, has already begun its transcendence up the value chain, and if so, what are its achievements, what are the challenges associated with such a transformation and, finally, what are the prospects for its progress into being an innovation-driven economy. To seek an answer, we will look into the scene of research & development, higher education and innovation in India. Furthermore, we will examine the trends in foreign trade and analyse the challenges and prospects for India.

Research and Development (R&D) in India

According to official statistics (cf. GOI, 2013), the government sector and companies spent an amount of Rs. 3,974 crores on R&D in fiscal year (FY) 1990-91, which had increased over 18-folds to an estimated Rs. 72,620 crores by FY 2011-12.Even though in terms of its ratio to gross domestic product (GDP), R&D's share increased only marginally from 0.75 per cent to 0.88 per cent, it must be noted that India's GDP itself registered a massive increase in this period catapulting India into the league of top-10 global economies at market prices, so that the increase in the absolute numbers is not without its impact. Moreover, an increase by 0.13 per cent of GDP in a trillion dollar economy is not without substance.

Most importantly, this growth was not carried out by the government sector alone. It was the private sector that increased its R&D expenditure almost 40-folds, from Rs. 550 crores in FY 1990-91 to Rs. 21,965 crores in FY 2011-12. This increasing emphasis on R&D by private sector firms must be attributed to an increased need for better technology and higher quality of their products and processes that form a core part of the technological readiness in the GCR. Also, multinational corporations (MNCs) in India were contributing to push the R&D envelope. A survey of 681 MNCs by the Reserve Bank of India revealed that they had spent Rs. 283 crores ($598 million) on conducting R&D in India in FY 2009-10. Average expenditure per company had risen from $ 0.11 million a year in FY 2000-01 to $0.88 million a year by then (Tiwari and Herstatt, 2012).

Another interesting aspect of the growth in R&D expenditure is the focus on "Industrial Production and Technology" (IPT). Total R&D expenditure on IPT in FY 2005-06 was Rs. 3,841 crores. By FY 2009-10, the last year for which this data was available at the time of writing this report, this amount had increased to Rs. 5,858 crores, growing by more than 50 per cent within a time-span of four years.

The fruitful outcome of such efforts can be seen in the patent statistics of the Organisation for Economic Co-Operation and Development (OECD). As per OECD (2014)data, Indian patent seekers filed 267 patent applications under the Patent Cooperation Treaty (PCT) in 1999. By 2011, this number had already increased to 2,195.At domestic level, the trend is not less impressive. While there were 8,503 patent applications filed with the Indian Patents Office in FY 2000-01, FY 2010-11 saw 39,400 patent applications being filed (GOI, 2013).

Access to Intellectual Property

A further indicator of India's increasing appetite for knowledge and innovation can be derived from the payments for royalty, license and copyright fees that India-based firms and organizations make to their international counterparts in lieu of using their intellectual property. On the other hand, receipts for these items indicate India-generated knowledge which is sought from entities overseas. As evident from Figure 1, on both these accounts there has been a considerable progress; especially sourcing of intellectual property has increased phenomenally in the past decade.

According to World Bank (2014) data, India's payments for the use of intellectual property stood at $1.86 billion in calendar year 2009, and increased to $3.99 billion four years later in 2012. In this same period, India's receipts for the use of intellectual property registered a growth from $191.9 million to $321.5 million.

Higher Education in India

Higher education, also an indicator of the capability for creation and dissemination of knowledge in a society, has seen continuous increase in the number of institutions as well as in the number of enrolments in the past three decades.

Figure 1: Payments and receipts of royalty, license and copyright fees in million USD, source: (Tiwari and Herstatt, 2012)

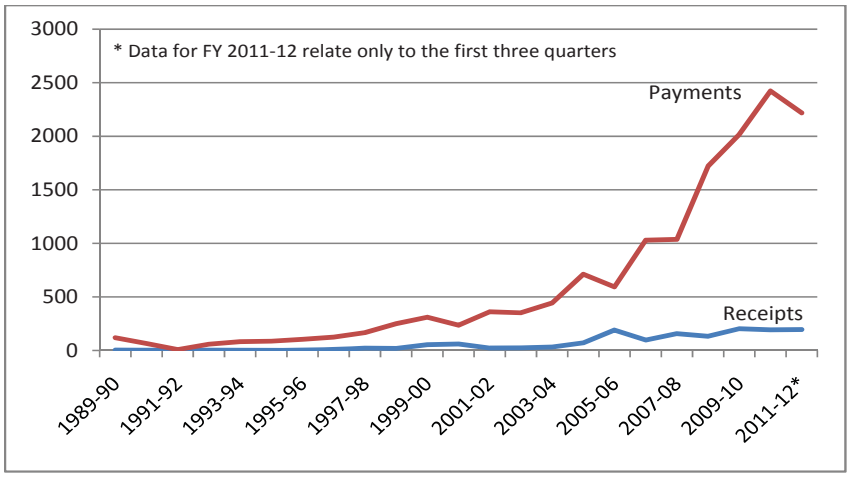

Table 1 shows that especially since the turn of the millennium, India has seen a tremendous increase in the enrolment of students for higher studies, as well as in the number of institutions. This, therefore, refutes the contention that India's competitive advantage is largely based on supply of unskilled labour. As a matter of fact, there have been several studies that have shown that one of the basic advantages that India has today is its relatively large pool of skilled workers (Ablett *et al*, 2007; Tiwari and Herstatt, 2014); Nevertheless, as a matter of fact, the quality of education in many institutions and the ratio of graduates to the overall population remains a matter of concern.

India's Success with Non-Primary Products in Foreign Trade

Benefits of India's pool of skilled labour can be observed, for example, in the ICT industry. According to a RBI (2014b) survey, India's software services exports doubled from Rs. 1,672 crores to Rs. 3,405 crores between FY 2008-09 and FY 2012-13, not including the on-site revenues generated by foreign affiliates of Indian companies. Software services exports, in the meantime, account for almost 45 per cent of total services exports from India. In the field of merchandise trade too, India's exports of engineering goods increased from $6.8 billion in FY 2000-01 to $69.5 billion in FY 2013-14 (RBI, 2014a). About 6.6 per cent of manufactured exports by India in 2012 were categorized as high-tech exports (World Bank, 2014).

Emergence as a "Lead Market"

"A lead market is a national market, which primarily on account of the size of its domestic demand, its access to technological capabilities and its embeddedness in the global economy provides key innovation impetus to a particular category of products." (Tiwari and Herstatt, 2014: 205)

We can observe a considerable movement within the Indian economy towards a greater share of knowledge-based activities. The increasing share of Information and Communication Technology (ICT) in producing goods and services, e.g. in the form of embedded solutions, is leading to reduction in the use of material components of products. Major global concerns have discovered India as a hotbed of innovations that can cater to the needs of a large group of aspiring and young consumers.

Many MNCs have discovered that consumers in emerging economies like India are unwilling to settle for second-hand, stripped-down versions of old-generation technologies that have reached the end of their lifecycle. A successive phase-out was for long advocated by the theory of international lifecycle as advanced by Raymond Vernon(cf. Vernon, 1966). However, management scholars, like the late C.K. Prahalad, termed this practice as "corporate imperialism" which was outdated (Prahalad and Lieberthal, 1998). Thanks to economic liberalization, Indian consumers today have a wide range of choices of innovative products and services from domestic as well as foreign firms at their disposal the increased competition has therefore, forced firms to innovate on all fronts – products & services, business processes, business models and organizational structures to deliver value for money, in order to reach a consumer who is extremely price-sensitive yet quality-conscious.Two quotes of senior-level managers as told to the author summarize this paradox beautifully (Tiwari and Herstatt, 2014: 6 f.):

"It's about the aspirations of the youth in India. They want everything; they know everything; but they are not prepared to pay extra!"

"To succeed in India, you need a product which costs 30 per cent of the global price and offers 95 per cent of the performance".

Not surpringly, India has become home to a series of disruptive and game-changing innovations. Products like GE's handheld electrocardiogram (ECG) Mac 400; the world's cheapest passenger car, Tata Nano; or Vortex's solar-powered Automatic Teller Machines (ATMs), Gramateller – may be regarded as products characterized by their affordability, robustness in dealing with infrastructural deficits, and (at least) "good enough" quality in a volume-driven market.

Such innovations are often motivated by resource constraints thereby forcing firms and users to think out-of-the-box and create solutions that can circumvent infrastructural and business limitations. The "Mangalyaan", the Mars mission of India is a good proof for this. With a total cost of about $75 million this high tech product reportedly costs less than a civilian passenger airplane.

India's growing and price-sensitive market has been inducing firms to use frugal engineering for creating functional and less expensive products without compromising on quality. It has made significant progress in high-tech fields and has been able to develop solutions that, though driven essentially by domestic resource-constraints, have become internationally successful, including in some developed country markets ("reverse innovations").

Since constraints, such as low ICT penetration, deficient infrastructure, or low per-capita income are not unique to India, the solutions developed here often can find buyers in other developing nations of Asia, Africa, and Latin America as well. India's growing trade with African, Asian and Latin

Table 1: Higher Education in India,
Source: (GOI, 2013); * =Provisional

Fiscal Year	Universities	Deemed Universities	Colleges	Total Enrolment
1981-82	120	12	4,880	29,52,066
1991-92	155	31	7,346	52,65,886
2001-02	196	52	15,437	89,64,680
2011-12	445	129	*35,539	*2,03,27,478

American countries points towards growing acceptance of "Made in India" and/or even "developed in India" products. In fact, a study found India to have turned into a lead market for small cars (Tiwari and Herstatt, 2014).

Figure 2 depicts factors that are responsible for the emergence of a lead market. India seems to possess a natural advantage in developing attractive frugal solutions with global appeal. Its innovation system is endowed with a large and voluminous domestic market; it has significant scientific and technological capabilities and a large pool of skilled manpower; and it is well integrated in the global economy.

That gives India a leeway in moving towards an innovation-driven economy. However, many Indian firms in both private and public sectors still need to fully appreciate the true meaning of being innovative beyond conducting knowledge-intensive work. Many firms prefer to go for low-hanging fruits by focusing singularly on doing contracting work on behalf of others. Indian decision-makers need to get more assertive and less risk-averse in their businesses, as innovation necessarily involves elements of risk, but the rewards can be as gratifying. Those choosing to remain non-innovative copycats run the risk of losing their market share in the face of an intensified global competition on the domestic front.

We may summarize the prospects of India's possible emergence as an innovation-driven economy with a quote of Nandan Nilekani, former Chief Executive Officer (CEO) of India's prestigious IT major Infosys, who states:

"A talented pool of workers, along with abundant capital and investment, presents us with immense opportunities for creativity and innovation, which can, in turn, lead to rapid gains in productivity growth and GDP. This had once enabled Europe to emerge as a centre for manufacturing innovation in the nineteenth century; similarly, at the peak of its dividend between 1970 and 1990, the United States saw the birth of new technology-based industries that determined the direction of the global economy over the past few decades. Such an opportunity – to emerge as the new creative power and a centre for new knowledge and innovation – now lies with India." (Nilekani, 2008: 53)

And, not to lose heart, there is some good news even from the Global Competitive Report: Some of the so-called innovation-driven economies actually perform "worse" on the innovation benchmark than a supposedly factor-driven India. For example, India ranks 52nd out of 144 on the combined innovation and sophistication factors, whereas Brazil (56), Greece (74), Russia (75) and many other "better" ranked countries trail India on this score (cf. Schwab, 2014: 20).On the basis of our analysis, we can say that India seems to be on the right path to become an innovation-driven economy, notwithstanding rankings & reports.

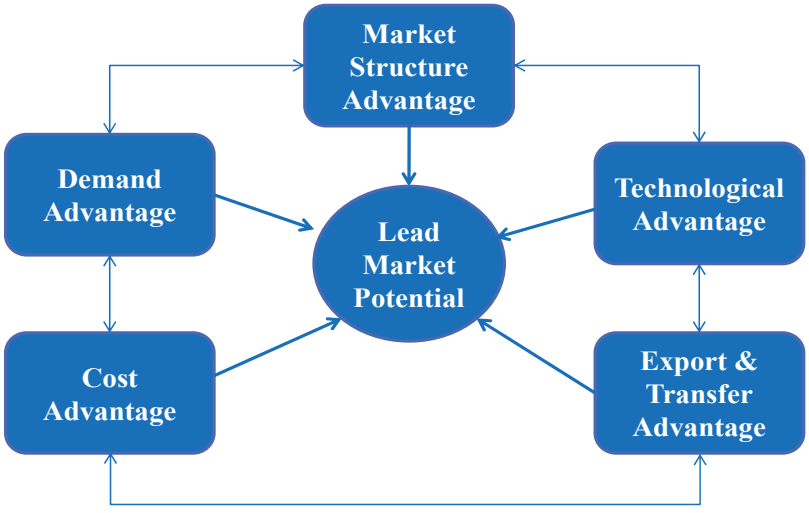

Figure 2: Factors Responsible for Emergence of a Lead Market, source: (Tiwari and Herstatt, 2014)

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