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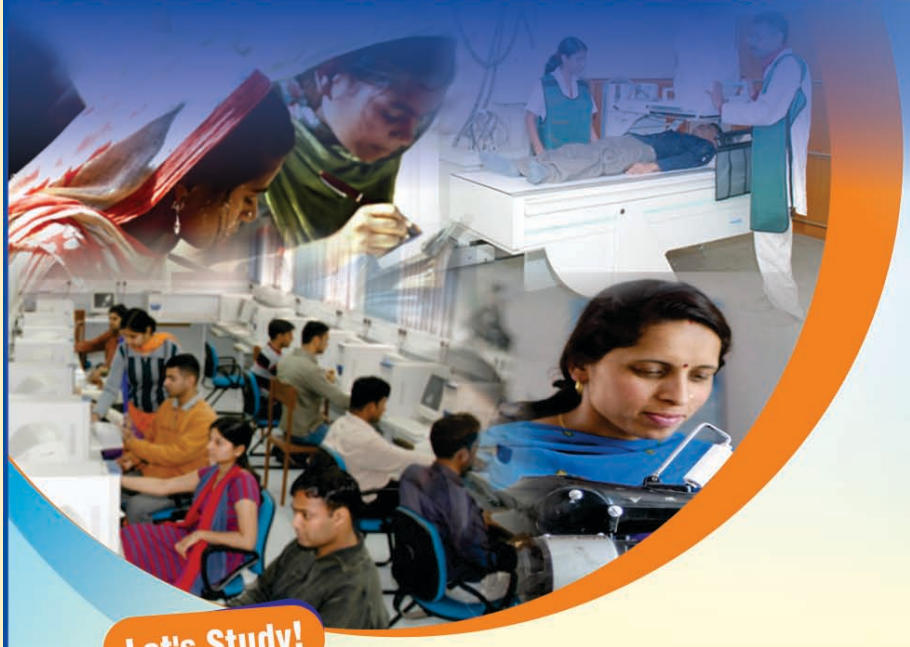

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Let noble thoughts come to us from all sides
Rig Veda

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Chief Editor's Desk

Democratizing Innovation

Among the many factors which have impacted the evolution of human civilization, role of fire is well known. However, one could possibly say that fire was only discovered by human beings as it is part of nature and humans could have come across it accidentally. But what about the sewing needle? We generally don't realize that sewing needle is among the oldest and most important of the 'technologies' human beings have created. The sewing needle gave them the ability to sew together animal hide and use it together with wooden-logs to create the first boats which helped them to cross the sea and explore new lands. It also provided them the ability to sew together sheets of hides and make durable and warm 'clothing' which would protect them from very cold weather of the new place. In a way, sewing needle laid the foundation of expansion of human beings into new areas and colonization of nature. This example gives us a glimpse into the role of knowledge and technology in the evolution of human civilization. Fire, stone implements, wheel, steam engine, printing press, microchip and many such examples are before us to highlight the role of knowledge, innovation and technology for the society. Indeed, the inflexion points of the development of human society are marked by such landmarks in knowledge and technology.

Nobel laureate Joseph Stiglitz, along with the co-author Bruce C. Greenwald has further extended this line of thought. In their recently published book *Creating a Learning Society*, they argue that the differences in the growth performance of countries can be explained to a significant extent by their ability of learning and not just from the accumulation of capital. The book points out that the transformation to 'learning societies' taking place around 1800 in the western economies had a deep impact on welfare of people compared to other factors affecting economic growth. The 'learning society perspective' put forward by them has significant implications for understanding the history of economic growth as well as designing a policy framework for a knowledge society. However, the more important question is to understand the complex process of creation of knowledge, the forces that stimulate innovation and promote technological growth in the economy.

Kenneth J. Arrow in his seminal work '*Learning by Doing'* significantly pointed out that process of knowledge production, which lays the foundation for innovation and technological growth, differs from other commodities since knowledge is a public good with significant amount of spill over and externality inherent in it. It is therefore, he argued, not quite wise to leave the production and transmission of knowledge to market forces alone. Indeed, markets in themselves are not efficient in promoting innovation as they are imperfect and there is information asymmetry. Quite in tune with this understanding, India has created a robust and multi-layered network of academic and scientific institutions such as IITs, CSIR, ISRO, Indian Institute of Science, IIMs, ICAR, Universities etc. to prepare itself for the future.

It is a testimony to this network of knowledge institutions that India has attained a premier position in the field of engineering, technology, medical research, IT services and many other knowledge oriented sectors. Innovations like very cheap Hepatitis B Vaccine and a large number of generic medicines, Jaipur Foot, most inexpensive heart surgeries, Mission to Mars at the lowest cost can be viewed as indicators of success of this model. But the world has been changing very fast and India can't be sitting on the laurels when it has to compete with 'knowledge hubs and innovation hotspots' all over the world.

As India embarks on its ambitious journey in the new era of globalized and interconnected world, it needs to build an environment where each individual is a source of creativity. Perhaps this is the time to make each home serve as the centre of 'disruptive innovation' i.e. become the source of an innovation which 'takes root initially in simple applications at the bottom of a market and then relentlessly moves 'up market', eventually displacing established competitors.' Indeed informal innovations and indigenous, traditional technology must be an organic component of this process. This is possible only if we democratize innovation. ❑

Technological Innovation in Manufacturing SMES: A Decisive Means of Competitiveness

M H Bala Subrahmanya

Perhaps India has the second largest and diversified SME base (next to China) in the global economy today. Obviously, this would offer a potentially rich seedbed for innovations and economic growth

Of late, technological innovation has been assuming increasing importance as a means of competition between nations across the world. This is because technological innovation has the potential to induce growth of individual firms at the micro level and give a new direction to industry growth at the macro level. It has emerged as a major explanatory factor for why growth rates vary between firms, regions and nations. Therefore, technological innovation is considered as the prime factor of economic change. Technological innovation is the ultimate source of productivity and growth, and it is the only proven way for economies to consistently get ahead (Solow, 1987).

Among different sectors of an economy, manufacturing industry sector has helped to drive economic growth and rising living standards for nearly three centuries and continues to do so in developing countries even now (McKinsey Global Institute, 2012). In fact, it is the manufacturing sector which has been always at the forefront of accelerating economic growth and transforming economic structure of nations through innovation and productivity growth. Thus, the stimuli for innovation and productivity growth led competitiveness emerges from the manufacturing industry (McKinsey Global Institute, 2012).

Among firms of different sizes in the manufacturing industry, Small & Medium Enterprises (hereafter SMEs) including start-ups, have the unrealized potential for innovation (Chaminade and Van-Lauridsen, 2006). This is because SMEs by their very nature are more flexible, better adaptable and receptive, have efficient internal communication, simple organizational structure and effective decision-making, among others, which are some of the "imperative qualities" for undertaking innovations (Harrison and Watson, 1998). What is more significant is that, there is empirical evidence to show that a number of SMEs in wide varieties of sectors across countries do engage in technological innovations, which play a crucial role in enhancing their economic performance (Hoffman, et al, 1998). Small firms are considered more efficient at performing innovative activities and are, in fact, the major source of innovations (Breitzman and Hicks, 2008; International Finance Corporation, 2010). That is why, small firms are alleged to be the seedbed of the new initiatives from which will emerge the successful businesses and

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industries of the future (Beesley and Hamilton, 1984).

Given these, it is important to understand the following issues:

- What is technological innovation?
- What factors determine technological innovation?
- What are the pre-requisites for SME innovations? How do innovations benefit SMEs?
- How to promote innovations in the Indian SME sector?

These issues are elaborated in the following four different sections of this article.

Technological Innovation: Meaning and Importance

Technological innovation is a concept that is sufficiently complex, multi-dimensional and impossible to measure directly (Hansen, 2001). Therefore, technological innovation has been defined in various ways. But the most widely quoted definition of technological innovation refers to OECD (1997): "A technological product innovation is the implementation/ commercialization of a product with improved performance characteristics such as to deliver objectively new or improved services to the consumer. A technological process innovation is the implementation/adoption of new or significantly improved production or delivery methods. It may involve changes in equipment, human resources, working methods or a combination of these".

Mytelka (2000) defined innovation within the context of developing country as the process by which firms master and implement the design and production of goods and services that are new to them irrespective of whether they are new to their competitors, their customers or the world.

In developing countries, however, the concept has been given a wider meaning. Cooper (1980) defined innovation as the introduction of a process or product that is new to the economy of a particular developing country, regardless of whether it has been used before elsewhere. It includes all modifications or adaptations of processes or products that are new to the economy, however minor they may be. Mytelka (2000) defined innovation within the context of developing country as the process by which firms master and implement the design and production of goods and services that are new to them irrespective of whether they are new to their competitors, their customers or the world.

According to UNU-INTECH (2004), innovation includes purchase of new machinery and equipment as well as licensing. According to the National Knowledge Commission of India, "Innovation is defined as a process by which varying degrees of measurable value enhancement is planned and achieved, in any commercial activity. This process may be breakthrough or incremental, and it may occur systematically or sporadically in a company; it may be achieved by: (i) introducing new or improved goods and services and/or, (ii) implementing new or improved operational processes and/or, (iii) implementing new or improved organizational/managerial processes" (NKC, 2007). Thus, it is important to understand that there is no uniformly accepted definition of "technological innovation" and institutions/researchers have defined it differently to suit their research contexts and environments. But broadly, Technological Product and Process (TPP) innovations may be defined to comprise 'the development of new products and processes and significant improvements in products and processes by firms, which can be altogether new to the industry or only to the firm concerned' (Bala Subrahmanya, et al, 2010).

As the above discussion indicates, technological innovation can be of different kinds. But the most notable dimensions of technological innovations are: (i) radical innovations (an altogether new product or new process to the world is introduced by a firm) and incremental innovations (improvements are made to the existing products/processes); (ii) product innovations and process innovations. Further, technological innovation is just one form of innovation. Innovation may take place in any other functional area of management such as marketing innovation, financial innovation and organizational innovation, among others.

But many see innovation as only technological in nature, resulting in the development of new products like Apple's iPad or Boeing's 787 Dreamliner (Atkinson, 2013). In fact, technological innovation is a key factor in a firm's competitiveness and it is unavoidable for firms which want to develop and maintain a competitive advantage and/or gain entry into new markets (Becheikh, et.al. 2006). Technological innovation is a means to productivity growth and higher living standards (Zemplinerova and Hromadkova, 2012). It can be a critical driver of increasing productivity and competitiveness (Council on Competitiveness, 1999).

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By virtue of its relationship with competitiveness, technological innovation emerges as a major factor promoting competitiveness and economic growth. It contributes significantly to the building up of national competitiveness. Improvements in

national innovative capacity are not a zero sum game. If many nations can improve their technological innovation capability, all will enjoy more rapid growth in productivity and with it, an improved standard of living (Council on Competitiveness, 1999).

Determinants of Technological Innovation: Basic Theoretical Underpinnings

But it is important to understand what prompts firms to undertake technological innovations? The available literature on the determinants of technological innovation of firms is diverse and complex (Bala Subrahmanya, 2001). However, broadly, there are two major approaches to describe technological innovations: they are classified as "demand-pull" and "technology-push" theories of innovation.

On the one hand, economists have often emphasized the role of demand in prompting firms to undertake technological innovations. They argued that 'necessity is the mother of invention' and without a market need, an innovation is unlikely to emerge and even if it emerges, it will not be successful. Thus, it is the market demand that is primarily responsible for innovation. Scientists, on the other hand, have strongly stressed on the role of original Research and Development (R&D) in bringing out technological (product/process) innovations. Without adequate scientific and technological capability, a firm will not be in a position to undertake technological innovations, even if it has identified a definite market for its product. Thus, scientists have tended to neglect or belittle the role of the market in innovation (Freeman and Soete, 1997).

Given the above, it is essential to understand that innovation is a two-sided or coupling activity. Therefore, the above discussed two dimensions of determinants of innovation can be compared to the blades of a pair of scissors (Schmookler, 1966), as presented in Figure 1. If a successful (product or process) innovation has to emerge, market demand is as much important as technical capability to bring out that innovation. On the one hand, it involves the recognition of a market need, or precisely, a potential market for a new product or process. On the other hand, it necessitates new technical knowledge which is the result of original research and development. Experimental design and development, trial production and marketing involve a process of matching technical possibilities to the market. Therefore,

If a successful (product or process) innovation has to emerge, market demand is as much important as technical capability to bring out that innovation. On the one hand, it involves the recognition of a market need, or precisely, a potential market for a new product or process. On the other hand, it necessitates new technical knowledge which is the result of original research and development.

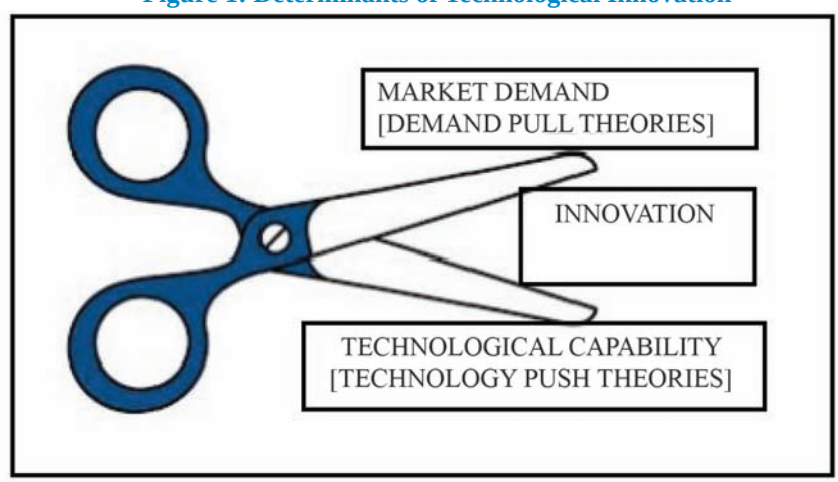
as argued by Freeman and Soete (1997), any theory of technological innovation must take into account both the elements of market demand and technical capability.

It is the role of the entrepreneur to link innovative product/process ideas to the potential market in such a way that commercial application or production takes place. Thus, technological innovation is a matching or combining process and the matching takes place in the minds of imaginative entrepreneurs. The matching process is not a 'one-off event'. It is a far more continuous process during the whole of the experimental development work and introduction of the new product or process into the market (Freeman and Soete, 1997). It is the unique characteristic of the entrepreneur that he or she is able to recognize both the technical feasibility and the market demand, and is willing to make an investment decision based on this insight (Rothwell and Zegveld, 1982; Danneels and Kleinschmidt, 2001). Thus, innovation will emerge only when a technically competent firm is able to identify and respond to customer requirements by developing and/or improving products/processes.

Technological Innovation in SMEs: Need for External Support and Achievements

In general, only a small fraction of SMEs innovates even in developed countries. This is because a large majority of them is hardly aware of the benefits of innovation. Even if they are aware, many of them suffer from internal constraints in terms of technical, managerial and financial resources, employee skills and knowledge. As a result, many of them will have neither motivation nor adequate capability to

Figure 1: Determinants of Technological Innovation



undertake innovations. One way of overcoming the inadequate expertise is to complement internal efforts with external support. But a considerable proportion of the SMEs will not be in a position to scout for, identify, access and exploit appropriate external advice and support. Further, a firm lacking internal capabilities, often, will not be able to link up with its customers and understand the market needs appropriately. Thus, a significant proportion of SMEs lacks both technical strength and market appreciation, the much needed virtues for undertaking innovations.

Where SMEs have some "threshold level of internal strength", they supplement their internal resources by seeking, obtaining and exploiting external support. External support for SME innovations can emerge from either vertical linkages or horizontal linkages or both.

Where SMEs have some "threshold level of internal strength", they supplement their internal resources by seeking, obtaining and exploiting external support. External support for SME innovations can emerge from either vertical linkages or horizontal linkages or both. Vertical linkages refer to relationship with suppliers and customers. This is particularly the case in industries which provide scope for inter-firm linkages - linkages between SMEs and large firms. Where large firms (including MNCs) are the customers of SMEs (which are sub-contractors to the former), the former tend to provide not only output marketing support but also assistance for procurement of inputs, supply chain assistance, finance, human resource training, production and operations, technical inputs, and even technology (UNCTAD, 2006). As a result, often, the customer also turns out to be a supplier of inputs, among others. Therefore, cultivating relationships with a small number of captive customers pays. Customer relationship helps to make up for the lack of resources for market research, and such a relationship can be characterized as "relational" rather than "transactional".

Horizontal linkages, on the other hand, can be policy driven or competition driven. Some SMEs, particularly in industries which do not offer scope for linkages with large firms, seek external support from government promoted SME institutions, or research institutes, due to policy encouragement. SME institutions often provide only technical inputs or information on the sources of better technology but nothing else. But research institutions either collaborate or undertake innovations for SMEs in their labs. Some other SMEs, due to competitive pressure, might seek cooperation with similar SMEs of the same industry in the same cluster or city, to undertake joint R&D and innovations. Horizontal cooperation among SMEs contributes to "collective efficiency", the competitive advantage derived from local external economies and joint action (Berry, 1997). Interactions between SMEs in the same industry and in the same cluster facilitate employees' interaction leading to sharing or swapping of tasks between them (Susman, et al, 2006). At times, an "aggressive" SME might pursue both vertical and horizontal cooperation simultaneously.

The most important internal determinants of innovative activity comprise a highly educated (preferably technically qualified) MD or founder/ entrepreneur, exclusive in-house design/R&D centre, a high incidence of qualified scientists and engineers among employees (knowledge-base), among others (Hoffman, et al, 1998).

Innovative SMEs, which obtain external support for their innovations, tend to achieve either *process innovations* characterized by cost reduction, quality improvement, or improved versions of existing products, or *product innovations* in the form of changes in product designs/dimensions to suit customer needs or altogether new products (much more than those which have carried out innovations solely due to self-efforts). Such SMEs are able to experience a larger share of innovated products in their total sales. Further, such SMEs are able to achieve a higher sales turnover growth over a period of time. This substantiates the contention that new product development and improving existing products are important means of internal growth strategies of small firms (Barrington and Ireland, 2008). What is more significant is that many of these SMEs are able to enter the international market intensively in the process (Bala Subrahmanya, et al, 2010). Thus, innovation bestows multiple benefits on innovative SMEs - cost reduction, quality improvement, product improvement, new product development, internationalization and ultimately, leading to sales growth.

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Although only a small proportion of SMEs engage in innovation activities, those that do so, appear to have a higher yield for their efforts, especially in terms of number of patents issued (Nooteboom, 1994). But patent count underestimates their yield, because 'patenting culture' is largely absent among the SMEs, even in advanced countries (Freeman and Soete, 1997; Bala Subrahmanya, 2001). Many SMEs who do not have the legal resources to file for patents, would rather rely on trade secrets, have minimal codification, or stay ahead of competitors to allow for an imitation lag. Their innovation achievement recognitions in emerging economies like India are often confined

to citations and awards from their customers, financial institutions or SME associations (Bala Subrahmanya, et al, 2001: Bala Subrahmanya, et al, 2010).

Policy Implications for Indian SMEs

SMEs occupy a place of strategic significance in Indian economy. In 2012-13, there were almost 47 million SMEs which generated more than 106 million employment and contributed more than Rs.1,28,000 crore worth of exports. India's SME sector is diverse as it produces more than 6000 products ranging from traditional items to sophisticated industrial products (Ministry of MSMEs, 2014). Perhaps India has the second largest and diversified SME base (next to China) in the global economy today. Obviously, this would offer a potentially rich seedbed for innovations and economic growth.

However, so far, no official attempt at the national level has been made to record whether at all, Indian SMEs are innovative and if yes, what is the nature of these innovations. It is important to undertake periodic surveys, to ascertain the nature, trends and intensity of innovations being carried out in the SME sector. This will provide inputs for policy making to promote SME innovations in the country.

The Ministry of MSMEs may constantly propagate the "virtues of innovations" among the vast SME populace across the country through state level Directorate of Industries and District Industries Centres. "Champion Innovators" among the SME entrepreneurs may be identified from different regions and enable them to periodically communicate their "innovation achievements" to other SME entrepreneurs. A motivated few should motivate the rest.

Other things being equal, vertical linkages in the form of inter-firm collaborations between SMEs and large firms (including MNCs) should be encouraged, by facilitating the latter to overcome information asymmetry through periodic arrangement of buyer-seller meetings at the state-level. In addition, an "Inter-Firm Collaboration Portal" may be set up with all the required information on the manufacturers of intermediate products (SMEs), provision for free registration for both buyers (large firms) and sellers (SMEs), information on (i) requirements for inter-firm collaboration, (ii) possible benefits arising out of such a collaboration, (iii) "success stories" of inter-firm collaboration from India and abroad, etc. This portal should be widely publicised.

Horizontal collaboration involving industry-institute interactions should be promoted for the benefit of SMEs. The vast network of engineering institutions across the country should be facilitated to move closer to local SMEs through collaborative work for innovations. This would mutually contribute to the up-gradation of quality. Particularly, engineering student projects should be linked to local SME technical problems towards ascertaining solutions. This exposure might even encourage innovative entrepreneurship to emerge gradually from our engineering institutions.

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To conclude, systematic and consistent policy efforts are imperative to exploit the innovation potential of the vast and growing SME sector in India. This can enhance SME competitiveness and thereby enable them to contribute more intensively to the economic prosperity of our nation in the future.

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Growth of High Technology Industries in India

Sunil Mani

The new manufacturing strategy of 2011 and the "Make in India" policy announced by the new government have continued to emphasise promoting high and medium technology industries, both manufacturing and services. This will augur well for improving the rate of growth of her economy and place it on a sure path

COUNTRIES ACROSS both the developed and developing world have been placing an emphasis on the growth and development of high technology industries. This is essentially for three reasons. First, high technology industries are known to have a higher value added per unit of labour or capital and hence are likely to contribute much to the overall GDP of the nation. Second, they have much more linkage effects with rest of the economy so that their growth is likely to lead to much more multiplier effects than low technology products and services. Third, high technology products and services can improve the standard of living of ordinary citizens of the country. For instance, the introduction of mobile phones and various biotechnology products have certainly improved the standard of living of even ordinary people and increasingly so, even in rural areas.

India too has been attempting to promote high technology industries such as pharmaceuticals, aerospace, telecommunications equipments, nanotechnology and biotechnology products although the country has a varied success in each of these industries. In the following paper, we undertake a brief survey of the growth of high technology industries in India. We begin with an analysis of the overall trends in high technology production and this is followed by an analysis of some of the individual high technology industries. What is interesting is that although the government does not have a separate innovation policy targeted exclusively at the high technology industry, it has used a variety of specific policy instruments for promoting such industries. For instance, it has used the patent policy to promote the pharmaceutical industry, the offset policy for developing the aerospace industry and the public technology procurement industry to develop the telecommunications equipment industry.

Despite a stricter patent regime brought about by TRIPS compliance, India has continued to be an important net exporter of generic drugs to the rest of the world. Its domestic firms have continued to be innovative and have become important. In 2005, India became the world leader in Computer and Information Technology Services and has continued to maintain and improve its lead over other nations. It is now leveraging to use this capability for diffusing governmental services to even the remotest villages through a rapid diffusion of e-governance. This in essence, is a technology solution to empowering the citizens by improving governance and delivery of services. Exports of high technology manufactured products from the country are increasing and they now account for

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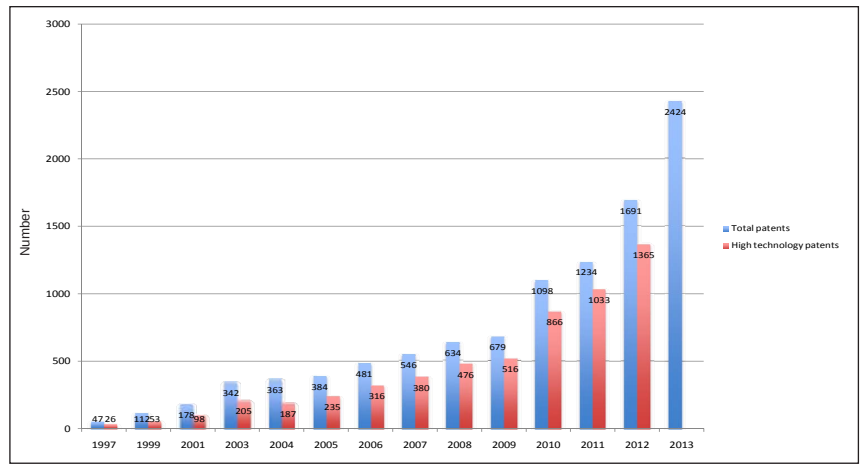
about 7 per cent of the manufactured exports from the country (World Bank, 2014). Almost two-thirds of the high technology exports consist of just two items, pharmaceuticals and aircraft parts. (Figure-1). India's technological capability in pharmaceutics is fairly well known, but her recent forays into the manufacturing of aircraft parts are an interesting step. Recent elaborations of the Defence Purchase Policy and the policy on offsets appear to have encouraged the local manufacturing. India is developing a regional transport aircraft through a mission mode National Civil Aircraft Development project. She also continues to maintain and improve her capability in the design manufacture and launch of satellites and has ambitious plans of sending a man on the moon and exploring Mars.

(i) There has been a significant increase in patenting by Indian inventors and the share of high technology patents in it has shown some sharp increases as well (Figure 2); and (ii) there has been a very discernible change in the technological specialisation with pharma going down in importance and IT related patents showing a pronounced and increasing trend (Figure 3).

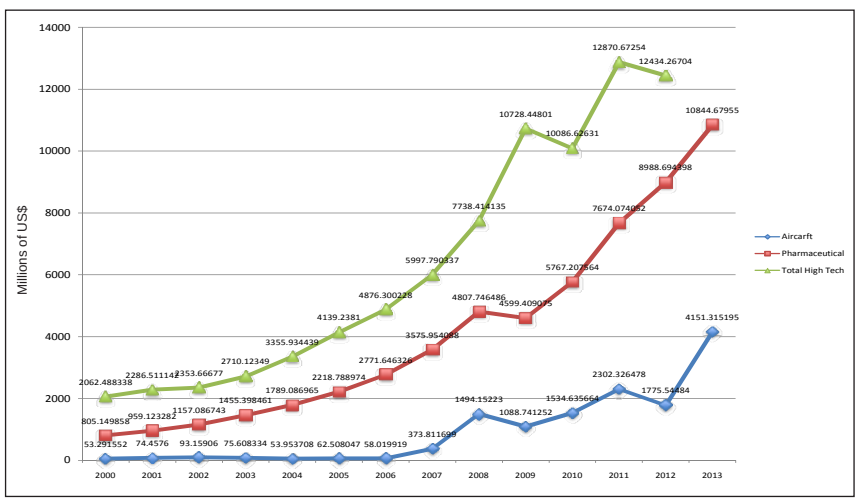
The important point is whether these patents are owned by domestic or foreign enterprises. In the case of pharmaceuticals, almost all the USPTO patents secured by Indian inventors belong to domestic pharmaceutical companies. As noted in USR 2010, domestic pharma enterprises have increased their patent portfolio even after the implementation of TRIPS. In fact, on every single indicator of innovative activity such as exports, net trade balance, R&D expenditure, patents granted to within and outside India, number of Abbreviated New Drug Applications (ANDAs) approved by the US Food and Drug Administration (implying technological capability in generic drug capability), the Indian pharmaceutical firms have done exceedingly well (Mani and Nelson, 2013). However, it is a different experience as far as software or IT related patents are concerned. As can be seen from Table 1, almost all these patents are secured by MNCs, which have established dedicated R&D centres in India to take advantage of the high quality but cheap human resources in software engineering and applications. Given the growing importance of software related patents in total patents granted, foreign ownership of Indian patents has increased significantly. This is part of the globalisation of innovation of which indeed India and China have become very important players. We will be discussing this important trend in some more detail below.

Figure 2: Trends in total and High Technology Patents by Indian inventors at the USPTO (Number of Utility Patents granted)



Source: USPTO and National Science Board (2014)

Figure 1: Exports of high technology manufactured products from India

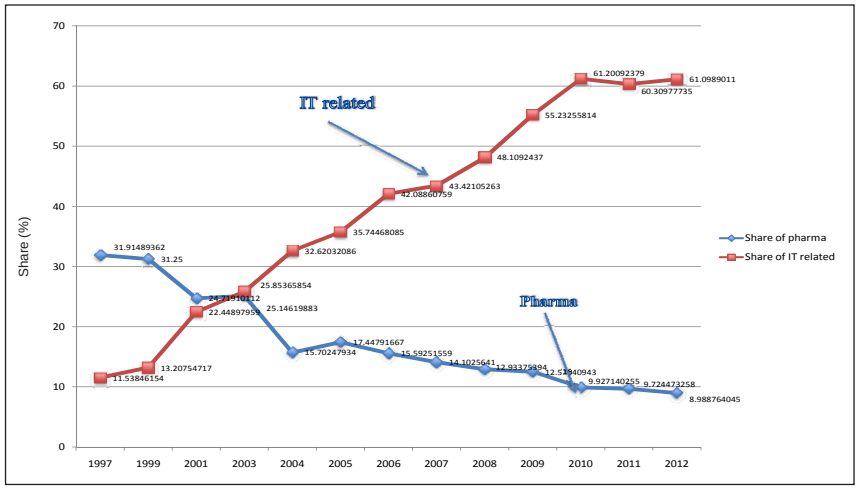


Source: Compiled from UN Comtrade and World Bank (2014)

Nanotechnology: Another high technology that is receiving some attention, in the country, is nanotechnology[1] and biotechnology. A Nano Mission Project (http://nanomission.gov.in/) was launched in India in the 11th Plan (2007-2012) with the Department of Science and Technology as its nodal agency. A sum of Rs 100 billion was sanctioned over the first five-year period to build research and development capabilities and infrastructure in nanotechnology. The 12th Plan (2012-17) aims to take this initiative forward with the ambition of making India a "global knowledge hub" in nanotechnology. To this end, a dedicated institute of nano science and technology is being set up, and post-graduate programmes in 16 universities

Figure 3: Changing importance of Pharma vs. IT related

(percentage share of total utility patents granted to Indian inventors in the USPTO)



Source: Computed from National Science Board (2014)

Table 1: Distribution of IT related patents at USPTO According to Ownership

	IT related patents (number)			Share (%)	
	Domestic	MNCs	Total	Domestic	MNCs
2008	17	97	114	14.91	85.09
2009	21	129	150	14.00	86.00
2010	51	245	296	17.23	82.77
2011	38	352	390	9.74	90.26
2012	54	461	515	10.49	89.51
2013	100	1268	1368	7.30	92.71

Source: Computed from USPTO

and institutions across the country are also expected to be launched. Besides, the mission is funding a number of individual scientist-centric research projects on fundamental research in nano-system. For the year 2013-14, about 23 such projects of three-year duration were sanctioned and until 2013-14, about 240 projects were funded. According to Department of Science and Technology (2014, p. 211), the output from nano mission, until 2013-14, was 4476 papers in SCI journals, about 800 doctoral degrees, 546 Master of Technology (M.Tech) and 92 Master of Science (MSc) degrees. We do not have any further data on innovative activity in this important field. The Consumer Products Inventory (Project on Emerging Nano Technologies, 2014) maintains a live register of consumer products that are based on nano technology and are available in the market. The inventory lists only two personal care products based on nano technology that have originated from India although the firm which developed these products is a MNC. However, the same database lists a total of 1628 for the world as a whole and 59 in case of China. Recently the government has set up a nano manufacturing technology centre as part of the Central Manufacturing Technology Institute. In most recent Union Budget for 2014-15, the government has announced its intention to strengthen the activities of the centre through a public-private partnership mode. In short, nanotechnology development in the country is more targeted at the creation of both human and physical infrastructure and its commercialisation, hitherto, remains at a very low level.

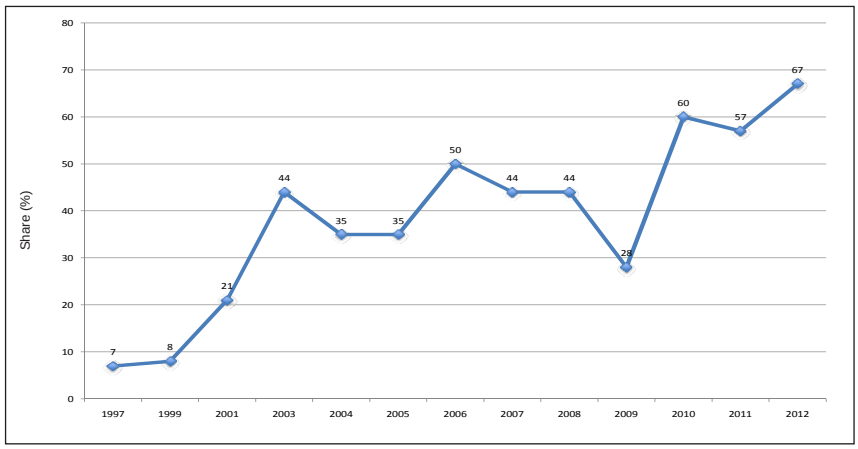
Biotechnology is another high technology area where an elaborate R&D and production capability has been created with strong policy support. Government intervention in the creation and sustenance of this industry has a history of over twenty years. This intervention has been three fold: improving the quantity and quality of human resource in biotechnology, establishing a network of laboratories and research centres to work on R&D projects in the area, and setting up of enterprises and biotechnology clusters producing biotechnology products and services. Apart from the central government, several state governments too have explicit policies for the development of this sector. This intervention has led to a surge in biotechnology publications and patents from India (Quach et al, 2006). (Figure 4). The industry consists of five sub sectors: biopharmaceutical (accounting for 63 per cent of the total revenues in 2013-14), bio services (19 per cent), agricultural biotech (13 per cent), industrial bio- tech (3 per cent) and bioinformatics (1.24). The biotechnology industry has grown at an average rate of 22 per cent per annum during the period 2003-04 through 2013-14, although year-on-year growth rates have been on a declining trend (Figure 5)[2]. Approximately, 50 per cent of the output of the industry is exported.

Communication technologies: Considerable improvements have been made in both the astronautic and even in the aeronautical segments of this high technology industry. Leveraging capabilities in communication technologies and remote sensing, the country has made considerable strides in diffusing distance education and public health interventions. Considerable strides have been made in telecommunications services as well, especially in rural areas. India has shown to the rest of the world that the organic way of diffusing telecommunications in rural areas is by promoting competition between telecom service providers, which would transliterate itself into lower telecom tariffs improving affordability and accessibility. The consequence has been that a dramatic improvement in tele densities even in rural areas has been achieved. This is best indicated by the rising ratio of rural to urban tele densities (Figure-6).

Conclusion

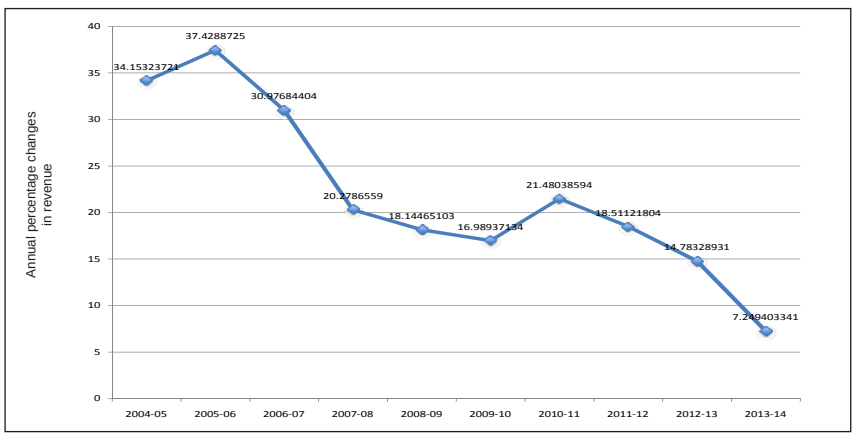
India has attempted to develop a whole host of high technology industries. Although, the share of high technology industries is still very low especially in terms of its share in manufactured exports, it is still growing. The country has been acknowledged internationally as having considerable technological capability in pharmaceutical, IT services and in the aerospace industries. Government has used a variety of policy instruments to foster such industries. All this was done through domestic enterprises. However, of late, the role of MNCs has become very important in high technology development. The new manufacturing strategy of 2011 and the "Make in India" policy announced by the new government have continued to emphasise promoting high and medium technology industries, both manufacturing and services. This will augur well for improving the rate of growth of her economy and place it on a sure path.

Figure 4: Number of Biotechnology Patents granted to Indian Inventors at the USPTO



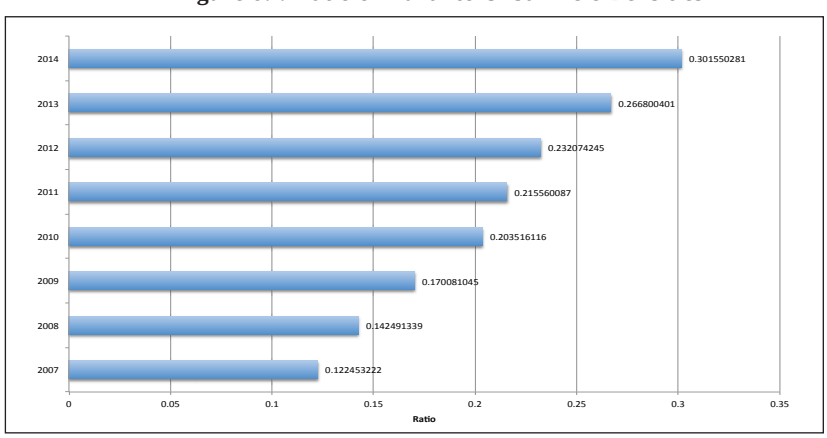
Source: Based on data provided in Appendix Table 6-48, National Science Board (2014)

Figure 5: Growth performance of the Indian Biotechnology Industry (based on sales revenue at current prices)



Source: Computed from Association of Biotech Led Enterprises (ABLE) –Biospectrum Survey, http://www.ableindia.in/publications/able-biospectrum-surveys/ (last accessed on October14, 2014)

Figure 6: : Ratio of Rural to Urban Tele Densities



Source: Department of Telecommunications (2013) and Telecom Regulatory Authority of India (2014)

Endnotes

[1] See Ramani, Chowdhury, Coronini and Reid (2014) for a survey of nanotechnology development in India.

[2] These rates are computed using sales revenue in Indian Rupees at current prices. However if one was to convert these to US Dollars and recomputed the growth rates, the industry is almost stagnant since 2010. There are, however, no official surveys or data on the size of the biotechnology industry in India.

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SPECIAL ARTICLE

E-Waste Management by Indigenous Microorganisms

M H Fulekar
Bhawana Pathak

Due to lack of social awareness about this issue and the disadvantages associated with current technologies, this waste generally ends up in creating problem environment and human health. Eco-technology is need of the hour for treating this waste

WASTE MANAGEMENT, constitutes a serious challenge to the modern societies and requires coordinated efforts to address it for achieving sustainable development. The widespread use of electronic items has made communication easier, boosted business activities and created employment opportunities. However, along with the benefits, it has brought into focus many challenges, like the rising problem of e-waste, that has to be boldly dealt with by society. In the current scenario, it is always possible that human health and environment would be drastically endangered if concerted legislations and actions were not taken for efficient management and disposal of e-waste.

India ranks 101st on the 2005 Environmental Sustainability Index and has a score of 0.10 (66th Rank) for environmental governance. E-waste is partially covered under the existing environmental regulations, but these do not stipulate the management and handling of e-waste generated within the country.

E-Waste Composition

Different types of electronic items contain different types of composition and this composition is changing with the growth of information technology sector as different types of software and technologies are arising day by day. Electronic scrap is composed of a ratio of approximately 40:30:30 of metal, plastics and refractory oxides respectively (Sum, 1991). The typical metal scrap consists of copper (20 per cent), iron (8 per cent), tin (4 per cent), nickel (2 per cent), lead (2 per cent), zinc (1 per cent), silver (0.2 per cent), gold (0.1 per cent), and palladium (0.005 per cent).

E-waste comprises of wastes generated from used electronic devices and household appliances which are no longer fit for their original intended use and are destined for recovery, recycling or disposal. Such wastes encompass a wide range of electrical and electronic devices such as computers, hand held cellular phones, personal stereos, including large household appliances such as refrigerators and air conditioners etc. E-waste often ends up in informal recycling centres, where it is sorted for reuse or broken down by hand and

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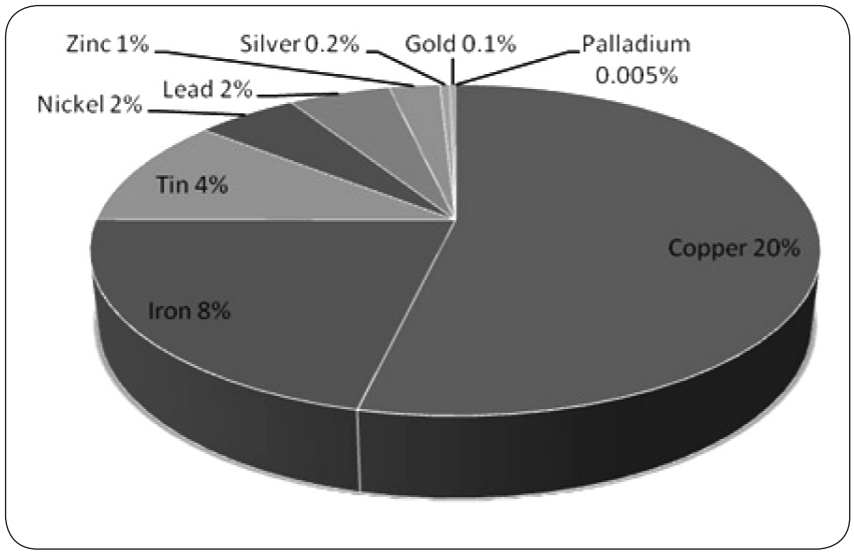
Figure-1



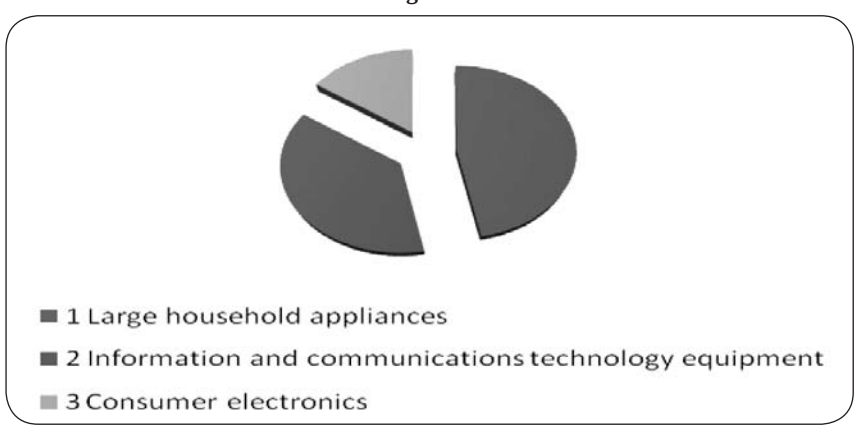
Electronic Scrap Composition (Sodhi, *et al.* 2001)

picked clean for valuable metals, then destroyed in inefficient, toxicant-producing settings. Electronic devices consist of a large number of chemical elements and compounds. For example, a cell phone can contain more tham 40 elements from the periodic table (UNEP 2009). The most common metals found in e-waste include steel (iron), copper, aluminium, tin, lead, nickel, silver, gold, arsenic, cadmium, chromium, indium, mercury, ruthenium, selenium, vanadium and zinc.(Chen *et al*., 2011)

E-waste generation in India

All over the world, the quantity of electrical and electronic waste generated each year, especially computers and televisions, has assumed alarming proportions. In 2006, the International Association of Electronics Recyclers (IAER) projected that 3 billion electronic and electrical appliances would become WEEE or e-waste by 2010. That would tantamount to an average e-waste generation rate of 400 million units a year till 2010. Globally, about 20-50 MT (million tonnes) of e-waste is disposed off each year, which accounts for 5 per cent of all municipal solid waste. Although no definite official data exists on how much waste is generated in India or how much is disposed off, there are estimations based on independent studies conducted by the NGOs or government agencies. According to the Comptroller and Auditor-General's (CAG) report, over 7.2 MT of industrial hazardous waste, 4 lakh tonnes of electronic waste, 1.5 MT of plastic waste, 1.7 MT of medical waste, 48 MT of municipal waste are generated in the country annually.

Figure-2



Different categories of e-waste generation according to WEEE (Pinto N.V., 2012)

Hazardous Effects on Human Health and Environment

Environmental pollution by heavy metals which are released into the environment through various anthropogenic activities such as mining, energy and fuel production, electroplating, wastewater sludge treatment and agriculture is one of the world's major environmental problems. Heavy metals or trace metals refer to a large group of trace elements which are both industrially and biologically important. Initially, heavy metals are naturally present in soils as natural components but as of now, the presence of heavy metals in the environment has accelerated due to human activities. This is a widespread problem around the world where excessive concentration of heavy metals such as Pb, Zn, Cr, Cu, Cd, Hg can be found in soils.

As it is clear that e-waste contains a large amount of heavy metals, Several research studies have been reported as to how these heavy metals are harmful for environment and human health. Cd (cadmium) exposure was found to affect TSH and FT4 levels (Iijima et al., 2007; Osius et al., 1999). Studies indicate the potential disruption of transthyretin levels in the cerebrospinal fluid and brain deiodinase by Pb, Hg or Cd in animals (Mori et al., 2006; Soldin and Aschner, 2007; Zheng et al., 2001).The pollution generated by e-waste processing brings about toxic or genotoxic effects on the human body, threatening the health not only of workers but also of current residents and future generations living in the local environment (Liu et al., 2009).Workers suffer from

high incidences of birth defects, infant mortality, tuberculosis, blood diseases, anomalies in the immune system, malfunctioning of the kidneys and respiratory system, lung cancer, under-development of the brain in children and damage to their nervous and blood systems (Prakash & Manhart, 2010).

A cross sectional study was conducted to investigate the serum level of PBDEs (Poly Brominated Diethyl Ether) in 64 children aged 11–15 yrs living and working at a municipal domestic and industrial waste disposal site in Managua, La Chureca, Nicaragua. Approximately, half of all waste pickers at this dump site were minors (less than 18 years of age). The PBDE concentrations in the children's serum were found to be among the highest ever reported. These study results demonstrate that childhood exposure to PBDEs is strongly influenced by dust inhalation and ingestion at the waste disposal site, rather than by contamination of food as commonly assumed. The research report showed high levels of PBDE and heavy metals in children who worked as scavengers (Athanasiadou et al., 2008). Heavy metals exposure of child scavengers was investigated (Caudra, 2005). Blood analysis of children who worked as scavengers demonstrated that overall, the children working at the waste disposal site had higher levels of lead in their blood compared with the non-working referents groups. Among child workers at the waste disposal site, as many as 28 per cent had blood lead levels greater than the community action level of 100 ug/l recommended by the Centers for Disease Control and Prevention (CDC). The children working at the waste disposal site also had higher levels of blood mercury and blood cadmium when compared with the non-working referents groups. However, unlike for lead, the levels of mercury and cadmium observed were much lower than those levels at which adverse health effects have been observed. Sex hormones and oxidative homeostasis were disrupted in pregnant women and their foetuses at the e-waste recycling site. (Zhou et al., 2013).

Pollutants in E-waste

Pollutants or toxins in e-waste are typically concentrated in circuit boards, batteries, plastics, and LCDs (liquid crystal displays). Table-1 shows the major pollutants occurring in waste electrical and electronic equipment.

Management of E-waste

In India, the Constitution assigns solid waste management as a primary responsibility to the Municipalities under the Twelfth Schedule. Article 243W empowers the State Legislatures to frame legislations in respect of waste management. The Municipal Solid

Table-1

Pollutants	Occurrence
Arsenic	Semiconductors, diodes, microwaves, LEDs (Light-emitting diodes), solar cells
Barium	Electron tubes, filler for plastic and rubber, lubricant additives
Brominated flame- proofing agent	Casing, circuit boards (plastic), cables and PVC cables
Cadmium	Batteries, pigments, solder, alloys, circuit boards, computer batteries, monitor cathode ray tubes (CRTs)
Chromium	Dyes/pigments, switches, solar
Cobalt	Insulators
Copper	Conducted in cables, copper ribbons, coils, circuitry, pigments
Lead	Lead rechargeable batteries, solar, transistors, lithium batteries, PVC (polyvinyl chloride) stabilizers, lasers, LEDs, thermoelectric elements, circuit Boards
Liquid crystal	Displays
Lithium	Mobile telephones, photographic equipment, video equipment (batteries)
Mercury	Components in copper machines and steam irons; batteries in clocks and pocket calculators, switches, LCDs
Nickel	Alloys, batteries, relays, semiconductors, Pigments
PCBs	Transformers, capacitors, softening agents for paint, glue, plastic
(polychlorinated biphenyls)	Photoelectric cells, pigments, photocopiers, fax machines
Selenium	Capacitors, switches (contacts), batteries, resistors
Silver	Steel, brass, alloys, disposable and rechargeable batteries, luminous
Zinc	substances

Wastes (Management & Handling) Rules, 2000 were enacted by the Central Government which came into force from 25 September, 2000. Some of the guidelines for handling municipal solid wastes provided in the Schedules are relevant for the management of e-waste and can be used as a model in the e-waste recycling and disposal scheme. The guidelines include organizing house to house collection of waste; proper collection of waste from slums and squatters, hotels, restaurants, office complexes and commercial areas; organizing awareness programmes for segregation of wastes; adopting suitable waste processing technologies; and restricting land filling for non-biodegradable inert waste.

Considering the growing concern on the issue of e-waste, the Government of India has supported several initiatives, particularly the assessment conducted by the CPCB on the management and handling of e-waste which led to the preparation and the publication of the Guidelines for Environmentally Sound Management of E-waste in March 2008.

The Guidelines have been formulated with the objective of providing broad guidance for identification of various sources of e-waste and the approach and methodology for handling and disposal of e-waste in an environmentally sound manner. These Guidelines include details such as e-waste composition and recycle potential of items of economic value, identification of possible hazardous contents in e-waste, the recycle, re-use and recovery options, treatment and disposal options and the environmentally sound e-waste treatment technologies.

Treatment Technology for E-waste

E-waste contains various hazardous heavy metals and other substances like plastics, PDBE, BFRs etc. These components create a serious threat to both man and animals in the environment if not properly remediated. So, it is necessary to treat e-waste before it reaches the environment. Available technologies for treating e-waste include recycling, incineration and land filling.

Recycling may remove some contaminants but large amounts of e-waste may still end up concentrated in landfills or e-waste recycling centers, where they may adversely affect human health or the environment.8,20,000 tonnes of Cu are included in the annual flow of e-waste. Despite recycling, E-waste is a major contributor with 5000 tonnes of Cu emitted into the environment annually (Bertram et al, 2002). Obsolete refrigerators, freezers and air conditioning units which contribute to the production of ozone-depleting Chlorofluorocarbons (CFCs) may facilitate the release of these gases from landfill sites (Scheutz et al.,2004). The study effects of hazardous substances released from e-waste during informal recycling operations in China and India concluded that the data, which were described as “alarming”, suggests “a causal relationship between the release of Pb (lead), PBDEs and dioxins/furans and the determined concentrations in environmental components (e.g. soil and air), biota and humans” (Sepulveda et al., 2010).

E-waste is often incinerated, either directly as part of the municipal waste stream, and or in the form of residual e-waste fractions that have already been through a recycling process. Because of the variety of substances found in e-waste, incineration is associated with a major risk of generating and dispersing contaminants and toxic substances. The gases released during the burning and the residue ash is often toxic.

E-waste is often incinerated, either directly as part of the municipal waste stream, or in the form of residual e-waste fractions that has already been through a recycling process. Because of the variety of substances found in e-waste, incineration is associated with a major risk of generating and dispersing contaminants and toxic substances. The gases released during the burning and the residue ash are often toxic. Polybrominated diphenyl ethers (PBDEs) are flame retardants that are mixed into plastics and components. Such compounds are not chemically bound to plastics and are therefore free to leach from the surface of e-waste components into the environment (Deng et al., 2007).

E-Waste Management: Available Treatment Technologies :

Recycling

E-waste recycling involves the disassembly and destruction of the equipment to recover new materials (Cui and Zhang, 2008). Recycling can recover 95 per cent of the useful materials from a computer and 45 per cent of materials from cathode ray tube monitors (Ladou and Lovegrove, 2008). In developed countries, such as Japan, high tech recycling operations function well with little environmental impact (Aizawa et al., 2008).

Modern techniques can recover high-lead (high-Pb) glass from discarded CRT with minimal environmental impact (Andreola et al., 2007). Any ecological benefits of recycling are more than offset if the waste has to be transported long distances due to the negative environmental effects of fossil fuel combustion (Barba-Gutierrez et al., 2008).

The risks that appear during collection of e-waste are mainly due to hazardous substances which are accidentally released or spilled due to breaking of components that exposes previously encapsulated material.

During dismantling, substantial amounts of dust, containing hazardous substances, may also be generated and released (IGES, 2009).

E-waste recycling methods cause pollution, and the toxic heavy metals released from such activities may threaten the health of local people. The majority of e-waste shipments have China as a final destination and e-waste recycling has been ongoing in the Taizhou region since the 1970s (Lundgren, 2012).

Incineration

Incineration is a controlled and complete combustion process, in which the waste material is burnt in specially designed incinerators at a high temperature (900-1000oC). Advantage of incineration of e-waste is the reduction of waste volume and the utilization of the energy content of combustible materials. Some plants remove iron from the slag for recycling. As a consequence of incineration, some environmentally hazardous organic substances are converted into less hazardous compounds.

The risks associated with incineration of e-waste involve the emissions of gaseous and particle bound pollutants (metals as well as organic compounds) via the exhaust gases, as well as leaching of pollutants from the residual ashes. These issues have received considerable attention (Stanmore, 2004, Lönnermark & Blomqvist, 2005, Gullett et al, 2007).

Land filling

Most E-waste is currently land filled (Barba-Gutierrez et al., 2008). In land filling, trenches are made on the flat surfaces. Soil is excavated from the trenches and waste material is buried in it, which is covered by a thick layer of soil. In modern techniques i.e. secure landfill are provided with some facilities like, impervious liner made up of plastic or clay, leachate collection basin that collects and transfer the leachate to wastewater treatment plant.

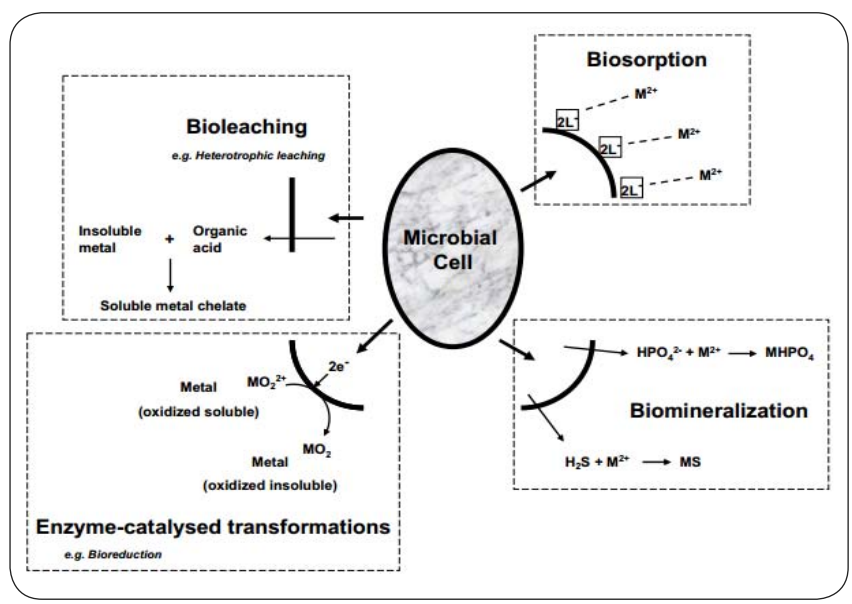
The risks associated with placing e-waste on landfills are due to leaching and evaporation of hazardous substances. The main problems in this context are the wide variety of substances the EEE contains as well as the long time spans involved. The hazardous compounds present in e-waste possess a wide range of properties that affect their compatibility when present together in landfills. Consequently, it is difficult to avoid evaporation and leaching of all compounds at the same time, and it has therefore become a common knowledge that all landfills leak (BAN & SVTC 2002).

Bioremediation for the treatment of e-waste

Bioremediation is the use of microbes to clean up contaminated soil and groundwater. Microbes are very small organisms, such as bacteria, that live naturally in the environment. Bioremediation stimulates the growth of certain microbes that use contaminants as a source of food and energy. Contaminants treated using bioremediation include oil and other petroleum products, solvents, and pesticides. Bioremediation relies on microbes that live naturally in soil and groundwater. These microbes generally pose no threat to people at the site or in the community. For example, the nutrients added for microbial growth are commonly used on lawns and gardens, and the nutrient level needed for bio-remediation need not be very high. During bioremediation process, the microorganisms cannot destroy metals, but they can alter their chemical properties via a surprising array of mechanisms (EPA, 2012). A sketch of different mechanisms of metal microbe interaction during bioremediation has been shown in Figure-3.

The present research study focuses on heavy metal concentrations, physico-chemical and microbial characterization of e-waste contaminated soil. The microorganisms adapted at e-waste metal contaminated site have also been assessed and characterized by 16S rDNA technique. Bioremediation of the soil containing metal has been carried out under controlled environmental conditions. Further, the microorganisms were exposed to selected heavy metals (Pb, Zn, Cu, Cd) separately in minimal salt medium starting from lower to higher concentrations using shake flask method in incubator shaker. The

Figure-3



potential microorganisms surviving at higher concentrations of selected metals such as; Pb, Cu, Cd and Zn have been identified by 16S rDNA technique, blast and phylogenetic analysis. Indigenous microorganisms were identified for the bioremediation of e-waste.

Approach for treatment of E-waste

The introduction of heavy metals, in various forms in the environment, can produce considerable modifications of the microbial communities and their activities (Doelman *et al.*, 1994; Hiroki, 1994 ;) Staezecka and Bednarz, 1993). Heavy metals generally exert an inhibitory action on microorganisms by blocking essential functional groups, displacing essential metal ions, or modifying the active conformations of biological molecules (Doelman et al., 1994; Gadd and Griffiths, 1978; Wood and Wang, 1983); however, at relatively low concentration, some metals are essential for micoroorganisms (e.g. Co, Cu, Zn, Ni) since they provide vital co-factors for metallo-proteins and enzymes (Eiland, 1981; Doelman et al., 1994).

Several investigations have shown that relatively large quantities of metallic cations are complexed by algae, bacteria (Strandberg *et al.*, 1981). Metal binding by isolated gram-positive and gram-negative bacterial cell walls has also been evaluated (Juwarkar, 1988; Strandberg *et al.*, 1981). In addition to the adsorptive interactions, microorganisms are also capable of accumulating metal ions (inspite of their toxicity) by metabolism mediated mechanisms such as metal transport and storage within the cytoplasm; intracellular detoxification systems, such as metal binding protein (metallothioneins) or polyphosphate synthesis (Silver, 1996). Microorganisms which are highly effective in sequestering heavy metals include bacteria, fungi, algae and actinomycetes.

Metal contaminants including Cd, Co, Cr, Cu, Mn, Ni, and Zn were efficiently leached from an artificially contaminated soil. Mn, Ni and Zn were the only target elements that were significantly leached from soil minerals. Pb leaching was slow and remained incomplete over a period of 180 days. Mineral components such as Fe, Ca and Mg were also leached but the eventual reduction in soil mass was only approximately 10 per cent. An industrially contaminated soil was also efficiently leached and approximately 69 per cent of the main toxic metals present, Cu, Ni, and Mn, were removed after 175 days. The leachate that resulted from the action of sulfur-oxidizing bacteria on contaminated soil was stripped of metals using an anaerobic bioreactor containing a mixed culture of sulfate-reducing bacteria which precipitated soluble metal species as solid metal sulfides. More than 98 per cent of the metals were removed from solution with the exception of Mn, Ni, and Pb, where 80–90 per cent were removed (White *et al.*, 1998).

Phytoremediation for Electronic Waste

Phytoremediation might be a cost effective choice complementary to engineering based approaches. Phytoremediation is making use of vegetation for *in situ* treatment of soil, sediment, and water, which has been utilized successfully in sites contaminated by PCBs and other organic pollutants reaching 1.5 million tonnes.

Due to complex nature of E waste, it is becoming difficult to manage. However, there are certain technologies available for treatment of waste. Due to lack of social awareness about this issue and the disadvantages associated with current technologies, this waste generally ends up in creating problems environment and human health. Eco-technology is need of the hour for treating this waste. Studies have been undertaken for using Bioremediation technology developed for treating heavy metals present in the e-waste. The Study concluded that potential microbes can be used for the remediation of heavy metals present in the e-waste for cleaning up the Environment. ❑

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Innovation and Globalization

V V Krishna

Whether it is in the area of big science and innovation or market driven technological innovations, globalization of innovation has dismantled the divide between nations. Given the increasing interdependence between nations and firms in systematic knowledge production that is geographically distributed, learning and catching up in innovation has become an interactive process. Globalisation of innovation is leading us to co-production of knowledge and co-innovation.

GLOBALIZATION IS not something, which is confined to social, economic and political spheres. The ICT revolution has led us to the reality of viewing the world as a 'village' with seamless communication channels and ways of reaching people across the globe. The impact of globalization has penetrated into the very social institution of science and technology (S&T) and the way in which knowledge is produced, owned, developed and marketed. The locus and structure of research and development (R&D), which is at the very core of this knowledge matrix (known as innovation process) has been transformed under the impact of globalisation. R&D and innovation have not only become buzzwords in our every day life-world but have come to play a significant part in the science, technology and innovation policies. Whether it is the case of exploiting new science based technologies (such as nanotechnology, biomedical, electronic and material sciences) or in meeting the challenges of SMEs, poor and vulnerable people, climate change and sustainable development or even in the entertainment and leisure industries, R&D and innovation has come to play a very significant role. Whilst the incremental innovation refers to small social and technical changes without necessarily involving R&D operations, radical innovations are seen to be very much dependent on R&D pursued in universities, publicly funded research labs and business enterprises including Trans National Corporations (TNCs). We will be concerned with this latter understanding of innovation and globalisation. The way in which globalisation is transforming the process of R&D and innovation over the last few decades; different phases underlying this transition; and how these developments have given rise to a new geography of innovation involving Asia is the subject matter of this chapter.

Historically speaking, TNCs and the government sponsored strategic research in North America, Western Europe and Japan (Triad) have been a dominant source of R&D and innovations. Much of the technological innovation and introduction of various consumer products in the world emanated from these global corporate giants. The whole process of scientific research,

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R&D and innovation was a closely guarded and hierarchically structured profitable enterprise, mainly confined to the corporate headquarters of TNCs. Under the impact of globalization, the last decade and a half witnessed three trends, that have redefined the relations between innovation and globalization.

Firstly, up to the middle of 1980s, much of the R&D and innovation was sourced from the respective home country base of TNCs. The R&D units and laboratories of these firms, which moved out of their home base was in a large measure restricted to the Triad region. Beyond the Triad region in the developing world, they established support laboratories. Comparative advantages of lower costs to 're-package' R&D coming out of home base, foreign country's innovation capacities, its market and adaptation of technology processes, among other factors, characterize these types of *support laboratories*. In any case, they are mainly involved in technology transfer linked to local adaptation of designs, styles and tinkering with original innovation process (adaptive R&D). The knowledge flows may be characterized as a 'one way' internationalization of R&D. The decade beginning late 1980s and the 1990s witnessed a new trend of going beyond support laboratories and technology transfer to performing R&D abroad beyond the Triad region in a significant way. TNCs established R&D units, which may be labeled as *locally integrated laboratories* (Pearce and Singh 1992; Pearce 2005). These type of laboratories were involved in the production and consumption of R&D for local, national and global markets including links with manufacturing and marketing entities. Hence, a new phase emerged with the extension of support laboratories to locally integrated laboratories (that is the globalisation of R&D), wherein, TNCs set up various types of regional, global and corporate technology and R&D units beyond the Triad regions in the developing world (Reddy 2005; 2011).

...the nature of R&D in the developing world, particularly in emerging Asian economies witnessed a transformation from 'adaptive' to 'creative R&D' for global markets. In this phase, though some innovation process was carried out by the TNCs in the developing world, it did not fully open up the innovation chain.

From the 'one-way' pattern of R&D and technology transfer to host country locations, the trend transformed into 'two-way' knowledge flow. R&D performed beyond Triad regions had begun to feed into the process of innovation, technological changes and creation of new products emanating from the TNCs. Hence, the nature of R&D in the developing world, particularly in emerging Asian economies witnessed a transformation from 'adaptive' to 'creative R&D' for global markets. In this phase, though some innovation process was carried out by the TNCs in the developing world, it did not fully open up the innovation chain. Various factors culminated to catalyse this process of globalization of R&D like global competition coupled with globalization of consumer tastes and preferences worldwide creating a need for learning; increasing science-base of new technologies which demand multi-sourcing; the limitations of TNCs, R&D and innovation at home or the Triad region to rapidly meet the changing market and consumer demands of the world. The rise of Information and Communication Technologies (ICT) and the new structure of science based technologies were seen to foster the de-linking of R&D and manufacturing activities of TNCs in the Triad region in the decade beginning middle of 1980s.

The decade since the 1990s paved the way for yet a new trend. Business and knowledge process outsourcing, R&D and technical services outsourcing and moving other institutional and organisational operations to foreign locations began to surface in a big way by the end of 1990s (Turpin and Krishna, 2007). This era witnessed the introduction of new economic reforms which promoted liberalisation and foreign direct investment (FDI) in financial institutions, services, retail and a host of sectors including R&D. The first decade of 21st century witnessed over US $ 110 billion FDI flow into Asia every year. According to a survey conducted by UNCTAD titled "World Investment Report 2005", many developing countries are considered favourable business locations for future to both TNCs and experts. China, USA, India and Brazil were the most preferred destinations scoring 87 per cent, 51 per cent, 51 per cent and 20 per cent, respectively.

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Secondly, as we progressed into the first decade of the new millennium, the rise of Asia propelled by China and India and emerging BRICS, gave rise to new middle class demands. The new consumerism and harmonizing and globalising life styles on a worldwide scale (for instance, in automobiles and electronic data processing technologies), meant additional burden of demand pattern on R&D, technological change and innovation process. New designs and life style products emanating from R&D labs

became obsolete or classified as 'old generation' even before reaching production and consumers. Such is the pace at which global R&D and innovation is moving with markets driven by middle and rich classes of the world in the 21st Century. Unable to sustain the market demand pattern, the corporate model of R&D and innovation pursued within home country locations within physical boundaries of the corporate firm begun to fast erode (*The Economist* 3 March 2007). The ICT revolutions coupled with advances in electronics and telecommunications have dismantled geographical barriers creating a new innovation potential at different levels of the value chain. Products such as mobile phones, computers and laptops, electronic goods, automobiles defined a new way of

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knowledge production, distribution and consumption for the first time in history. Each product has a number of components and every component or a group of components is the outcome of a specialized laboratory or R&D unit. Barring certain very traditional industries such as wine making and liquor processing in France or Great Britain or Darjeeling Tea, one can hardly find a TNC or a firm, which carries out all elements from R&D, innovation, packaging, distribution and marketing. These developments culminated with the emergence of new knowledge hubs and knowledge based innovation 'hot spots' in Bangalore, Shanghai, Singapore, Hong Kong, Seoul, Beijing, Sao Paulo to Cape Town, among other locations. According to a recent study, there are over 1,350 R&D units and laboratories set up in India and China by TNCs (Krishna et.al 2012). Whilst earlier trends of internationalization and globalization of R&D continue, all these developments gave rise to what may be termed as the globalization of innovation.

The most revealing aspect of a new trend of innovation is exemplified by the way in which global firms and TNCs such as Apple, Motorola, IBM, Siemens, Intel, Adobe, G.E, among others, generate surplus from the global supply of R&D, innovation and manufacturing chains that is globally distributed. Further, there is convergence of technologies, fields of research with non-science and technology factors in finance, banking, social, cultural, entertainment, among other sectors. All crucial components or factors of innovation are becoming impossible to locate them in one place or location in the corporate home country R&D sites in North America and Western Europe. Specialised knowledge potential and its availability is no more concentrated or a monopoly of a big firm or TNC. It is now geographically distributed around the knowledge hubs and innovation centers on the globe. Innovation has come to be seen in the footprint of networks whose actors and poles are dispersed. Various components of knowledge production and consumption chains, are not hierarchical but are horizontally connected and geographically dispersed across various actors, agencies and regulated by institutions at different locations. Innovation has not only become globalized but its process is now networked and distributed across various locations. According to a joint Survey by INSEAD and Booz Allen Hamilton in 2006 (Doz et. al 2006) 'optimising the configuration and integration of R&D networks' is becoming crucial for improving the speed of innovation for global TNCs. This survey covered 186 global companies in 19 countries (which spent 76 $billion in R&D in 2004) operating in 17 sectors. The survey asked companies to respond as to what is driving their future R&D sites.

The demands of speed and quantity of innovation for global competition are driving TNCs to enter into new forms of strategic partnerships and collaborations. Asian countries such as India, Singapore, South Korea and China, have come to occupy a new significant position in the globally dispersed networked innovation. It is not just merely the low cost skill base, but also due to the knowledge hubs and 'innovation hot spots' in places like Bangalore and Shanghai. Chesbrough (2003) termed these types of knowledge scouting process as the model of open innovation system.

Thirdly, the rise of Asia as the new growth engine of world economy has also begun to show signs of a new geography of innovation. According to National Science Board Science and Engineering Indicators 2014 of

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the *National Science Foundation* (NSF) between 1999 and 2009, for example, the U.S. share of global R&D dropped from 38 per cent to 31 per cent, whereas it grew from 24 per cent to 35 per cent in the Asia region during the same time. According to 2014 estimates of NSF, in 2011, East and Southeast Asia region, including China spent about the same (about 31.8 per cent) to that of North America (32.2 per cent) and even more than that in Europe

(24.0 per cent). The tilt in favour of Asia in global R&D funding pattern is also resonated in the science output measures issued by *Thomson Scientific Data* for 2001 and 2006. Whilst the world share of science publications of Europe and North America declined by 7 per cent and 6 per cent respectively, during the period 2001 and 2006, the Asian world share of science publications registered an increase of 87 per cent for the same time. National Science Foundation, USA, indicated similar trends.

The new geography of innovation points towards some Asian economies that have begun to show signs as new sources of specialized knowledge and innovation 'hot spots' of learning. The concepts of frugal and reverse innovations, which overlap with each other in varying forms, originated in a large measure from the experiences of India, China and other Asian countries. *Reverse innovation* refers broadly to the process whereby the goods are developed as inexpensive models to meet the needs of developing nations (for example Jaipur foot, eye surgeries and lens by Aravind Eye Clinic in India) and then engineered to suit the consumers for the world at large. *Frugal innovation* refers to 'achieving more with fewer resources' for more people. Similarly, *Disruptive innovation*, a term coined by Harvard scholar Clayton Christensen, describes a process by which a product or service takes root initially in simple applications at the bottom of a market and then relentlessly moves 'up market', eventually displacing established competitors. The insight emerging from the experiences in India and China illustrates that these types of innovations are not just scaled down versions constituted in the emerging economies to be up scaled (reverse adaptation) when introduced in the industrially advanced or developed world. They are inclusive innovations coming out of well-established R&D labs and NGO based institutions more sustainable from environmental point of view. There are now about 50 million battery-operated motorbikes running in Beijing and Shanghai, which are in high demand around the world. *Hepatitis B* vaccine's price is brought down from US $ 15 per injection to less than $ 0.10 as a result of the R&D carried out by two pharma firms in India. A Bangalore based Narayana Hrudalaya, heart hospital, has become a market model at Harvard Business School for performing the world's most economical heart surgeries. There are hundreds of such examples. Innovations in a globalized world now face stiff competition from knowledge hubs and innovation hot spots spread all over the world, particularly in Asia. The ability to reverse engineer to produce quality but alternative or similar products from Asia is widely spread around the world. The biosimilars in biomedical and pharma sector and the introduction of *Galaxy* range Tablets and mobile phones by Samsung to compete with Apple I-Pad or I-Phone are good examples. By 2020 India and China alone will provide nearly a billion middle class consumers. Hence every known big firm and TNC from the Triad region operates in Asia and vice-versa.

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The concept of *Globalisation of innovation* goes beyond a range of knowledge-based products. Emerging economies are partnering big science and high technology programmes in EU and US. India, China, South Korea and others like Russia are partner to various EU based big science and innovation programmes such as International Thermonuclear Experiment Reactor (ITER); EU version of Global positioning System called Galileo project; Facility for Antiproton and Ion Research (FAIR); ICT and nano technology. The head quarters of Human Genome Organisation and its President, for the first time, got located in Singapore in the last few years. Similarly, India and China are partnering US in various new science and innovation programmes. Whether it is in the area of big science and innovation or market driven technological innovations, globalization of innovation has dismantled the divide between nations. Given the increasing interdependence between nations and firms in systematic knowledge production that is geographically distributed, learning and catching up in innovation has become an interactive process. Globalisation of innovation is leading us to co-production of knowledge and co-innovation.

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Germany to extend Technical Cooperation for Urban Sanitation Programmes

The Federal Republic of Germany has agreed to provide Euros 4 million and services of international experts to help the Ministry of Urban Development in effective implementation of sanitation programmes in urban areas of the country. India and Germany signed to this effect an 'Implementation Agreement on Support to National Urban Sanitation Policy' recently.

The agreement valid for three years i.e till March, 2017, seeks to promote capacity development in the urban sanitation sector, formulation of state and city sanitation policies and support states for technical innovation. The focus of technical cooperation will be on enabling effective measures against discharge of untreated waste water into surface and ground water.

This technical cooperation agreement assumes significance in the context of the 'Swachh Bharat Mission' launched by the government which is to be implemented in all the 4,041 census towns.

Innovation Revolution: Harnessing India's Diversity

Vijay Kumar Kaul

Diversity in India gives rise to different challenges that can be met by offering diverse solutions in terms of products, services and their delivery systems. Businesses are using this diversity to develop products, services and supply chains that leverage the diversity of talents and capabilities in a virtuous cycle of innovation. One of the key factors of an innovative society is the diversity of its capabilities and talents. India has plenty of that. All it requires is the harnessing of this asset with a clear vision and a missionary zeal

ON SEPTEMBER 24, 2014, Mangalyaan, India's first inter-planetary mission, was successfully deployed in Mars' orbit. In 2013, after the launch of Mangalyan, India conducted a successful GSLV rocket launch. All these are just a few of the recent technology demonstrations by India. Mangalyaan cost about $70 million (about Rs 450 crores), a case of frugal innovation. India has also demonstrated several other cases of frugal innovation in healthcare and other sectors. For instance, the Aravind Eye Care system in Bengaluru performs 3,50,000 eye operations a year of exceptionally high quality, at astonishingly low cost. Dr. Devi Shetty's model for affordable heart surgery, Dr. Sethi's Jaipur foot, GE's portable ECG machine, Kerala's approach to palliative care, Aurolab's intraocular lenses are some of the other examples in Health care sector, which can boast of creating a large impact at low cost. In other sectors too, there are several examples of low cost, high impact innovations coming from India, for instance: cheap mobile phone tariffs, low cost clay fridge, Tata Swach water purification system, Husk Power rural electrification system, etc.

Where do these frugal innovations in India come from? Although India's S&T (Science and Technology) infrastructure is widely spread throughout the country, some of big centres of 'science and technology' as well as institutions of higher learning are located in the southern part of the country, especially in the states of Karnataka and Andhra Pradesh. There is also a concentration of small-medium and large scale high tech enterprises in these states which are engaged in producing low cost, high quality software solutions. Bengaluru in Karnataka is today recognized as the Silicon Valley of India because of the presence of top innovative software companies and technology firms in the now bustling city. In other parts of the country too, there are clusters of firms engaged in producing low cost, high quality industrial and consumer products, using their process innovation capabilities. All this shows India's capabilities to undertake both traditional structured innovation and frugal innovation. Both systems of innovations are important for the country. It is

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India's socio-economic context that has motivated entrepreneurs and enterprises to focus on frugal innovation. India's wide diversity in terms of geographic and socio-economic dimensions and its many perennial socio-economic problems form an opportunity base for creating living labs for frugal innovation, where a diverse set of entrepreneurs work to get an idea/vision, experiment on it with limited resources, and then design, test, market and deploy affordable solutions. These can all be termed mission-oriented innovations, and range from the publicly funded space and defence sectors to the non-governmental, often philanthropic efforts in the social and economic sphere.

It is India's socio-economic context that has motivated entrepreneurs and enterprises to focus on frugal innovation. India's wide diversity in terms of geographic and socio-economic dimensions and its many perennial socio-economic problems form an opportunity base for creating living labs for frugal innovation, where a diverse set of entrepreneurs work to get an idea/vision, experiment on it with limited resources, and then design, test, market and deploy affordable solutions. These can all be termed mission-oriented innovations, and range from the publicly funded space and defence sectors to the non-governmental, often philanthropic efforts in the social and economic sphere.

India has over the past 66 years achieved good economic progress, established a diversified industrial base, a strong service sector and also achieved self-sufficiency in agriculture. Despite all these achievements, India is still inhabited by a large number of poor, illiterate and unemployed people. Large sections of population are deprived of basic amenities like sanitation, water, basic health care and electricity. And that even this grim picture has a bleaker future, since global warming and climate change are likely to aggravate these problems of inequity in the coming decades.

Solutions to these problems need to be developed indigenously keeping in mind the diversity and abundance of India's resources, people's aspiration levels and the ecological limitations of nature. Persistence of several economic and social problems needs to be examined and factored in. To be specific, there is a need to examine the linkages between the geographic, social and economic diversity of India and the socio-economic problems that the country is facing. In general, there is an argument that diversity leads to conflict. However, it is argued in this paper that there is a positive relationship between diversity and innovation, provided the governance systems recognize and support this linkage. The present paper therefore, proposes a framework linking diversity to innovation.

It is heartening to see that the new political leadership in India has embarked on developing mass movements across the nation, to solve social and economic problems of the country. Several government initiatives that have been announced in recent times - from 'Swachh Bharat Abhiyaan' to 'Cleaning Ganga', and from 'Make in India' to 'Zero Defect and Zero Effect' are steps in the right direction. The problems before India are multiple and complex. However, developing and implementing solutions through mass movements, involving the common public, and encouraging and motivating all the stakeholders in society, are small but visionary initial steps. Problems of poverty, unemployment, healthcare, energy shortage and water scarcity need to be tackled at multiple fronts, and multiple levels, with involvement of all strata of society. Several initiatives have been taken up in the past too, but there is a need to integrate all of them, learn from their shortcomings, and make new, well-coordinated efforts towards going forward. There is a need to build an Innovation Revolution in India (IRiI). "IRiI", pronounced "ee-ree", can be said to consist of the promotion of frugal innovation focusing on solving the diverse socio-economic problems of the Indian nation and harnessing the people power in the country to create innovation leaders who will then lead to a spurt in frugal innovations in India. Local and regional solutions to local and regional problems, resulting from local and regional research and innovation, by local and regional entrepreneurs who understand the intimate linkage between economics, ecology and environment of the region, should be the goals of this revolution. After all, if India has a million plus problems, it also has a billion plus potential problem solvers!

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The concept of IRiI that this article espouses might appear foolishly simple, but if made a part of the nation's DNA, and working culture, well supported by governance systems and institutions, it can spell the end of many of India's diverse socio-economic problems in a holistic and humanitarian way. Like the other mass movements that our newly elected political leaders are championing, IRiI can also be another movement of the masses, supported and executed by strong, locally developed systems

of governance, monitoring and evaluation. Needless to say therefore, there is a need to learn from and strengthen the linkages of frugal innovation with the socio-economic diversity of the country.

India's Diversity

India is known for its geographical diversity that ranges across its natural environments and resources, rivers, lakes, seas, forests, agro-products and climates. As regards its demographics, India's diversity ranges across many cultures and religions, many castes and sub-castes, languages and dialects, foods, dresses, arts and dances, musical traditions, thriving across small and large, rural and urban regions, where the poor and rich live in relative harmony and peace. India's "Unity in Diversity" motto acknowledges that there is an underlying linkage and interconnection among geographically, socially and economically diverse groups in India. This is where the fertility of ideas, the frugality of innovation and the fervency of hope for India as a future economic and moral superpower may lie.

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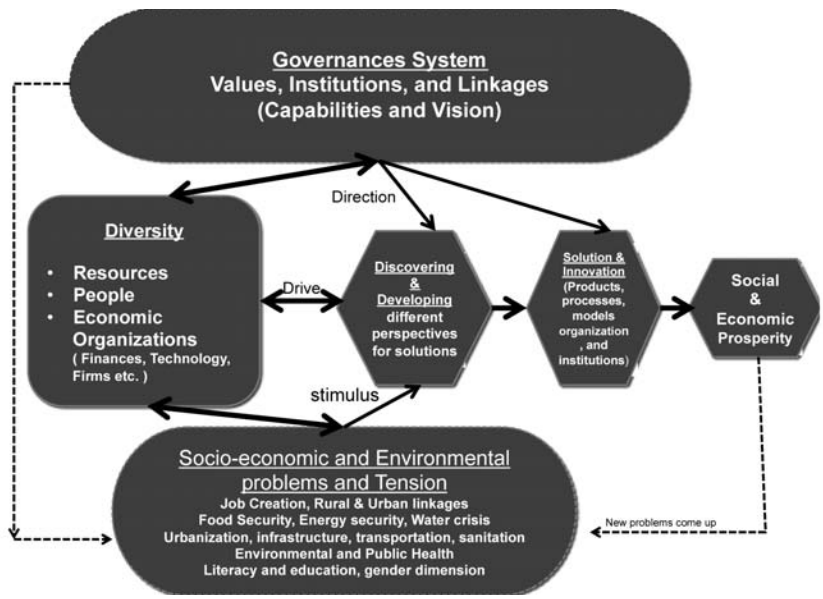
This diversity has been recognized as the main strength of India. The most visible manifestation of this strength has been in the form of creative traditions such as music, dances, literary and philosophical traditions, as also the development in mathematics and related scientific fields. India's vibrant constitutional democracy in itself reflects the strength of its diversity, and also help in managing this diversity. On the flip side, whenever this diversity is not understood properly or is misinterpreted, often by narrow, vested interests for political gains, there arise tensions, disputes or situations of conflict, bringing India some avoidable bad publicity in international forums. It is argued here that Indian systems now need to move from "managing diversity" to "managing innovation" rooted in this diversity.

It was the British who first used this diversity to 'divide and rule', in order to be able to control and govern a large subject state several thousand kilometers and several time zones away from the seat of governmental power. After independence, it was our visionary founding fathers, and subsequent national leaders, who used their own understanding of India, its history, culture and other geo-political manifestations, to develop India as a new nation state that recognized and managed this diversity, even incorporating it as a leading guiding principle of its Constitutional Democratic system. The existence of India as a nation in its present form suggests some common cultural bonding, common identity and social norms and mechanisms, that have helped resolve its tensions, disputes and conflicts, and these factors have also been constantly pushing to shape, reform and transform the Indian society. The diversity of India can be, and must be, used to develop a grounds-up innovation revolution in the country.

Diversity: Conflict to Innovation

Diversity in the Indian context has become the focus of intense political debate because most scholars are grappling with the question of whether diversity is a source of strength or whether it is leading to greater discomfort and discord. Tensions, disputes and conflicts have always existed in society because of some inherent contradictions and differences caused by such diversity. However, the underlying spirit of respect for plurality, synthesis and co-existence have transcended over the factors of ethnicity, language, religions and sub-regional identities. The assimilating, resolving and managing of these contradictions and differences has been the most striking feature of the Indian society. Many people and communities have shaped

Figure 1: Leveraging Diversity to offer Innovative solutions to Socio-economic and Environmental problems



Source: Kaul,**2014 op.cit**

India. This diversity has shaped and helped her to grow and survive.

Some claim that diversity and social cohesion are negatively correlated. Others believe that more time spent with people of varied backgrounds leads to greater understanding and harmony between groups. They assert that increasing diversity is not only inevitable but ultimately valuable and enriching. This paper moves a step further and asserts that a capable and visionary governance system can direct diversity in developing different perspectives to seek innovative solutions to socio-economic challenges before the country, ultimately resulting in social and economic prosperity of its people[1].

A good and visionary governance system uses diversity of people, resources and organizations as a tool to solve socio-economic and environmental problems. Where as these problems work as a stimulus, diversity drives people to have different perspectives, and governance systems direct these to seek and discover innovative solutions.

Figure-1 explains the mechanism of leveraging diversity to solve socio-economic problems and attain social and economic prosperity. A good and visionary governance system uses diversity of people, resources and organizations as a tool to solve socio-economic and environmental problems. Where as these problems work as a stimulus, diversity drives people to have different perspectives, and governance systems direct these to seek and discover innovative solutions. People in general have different ways of sensing problems and identifying solutions. A system of institutions, directed by effective leaders, is capable of using this diversity as an asset to solve problems created by diversity itself.

Diversity in complex urban environments represents an advantage for creativity, innovation and growth. Institutions, bureaucracy and governance mechanisms have an important role in shaping diversity of socio-economic outcomes and relationships. Here, the concept of governance is a broad notion that encompasses government, but also allows for a pluralism of actors, including non-official organisations (profit and non profit) in the process of making and managing public policies and their implementation. This calls for a more open and participatory democracy that allows all actors besides the government (civil society organisations, NGOs, grass roots movements), representing specific legitimate interests, to have a voice. Sustainability of these structures - as a necessary condition for endurable development of heterogeneous communities - depends on a widespread understanding of diversity as an asset, and as a source of dynamism, innovation, creativity and growth.

Diversity usually calls to mind differences in race, gender, ethnicity, physical capabilities, sexual orientation as well as social or political differences. The key to innovation, in economic terms, resides inside the heads of people, and the more diverse the thoughts and ideas in them, the better. To appreciate the full potential of the power of difference, however, requires opening up of the minds. Innovation provides the seeds of economic growth, and that depends as much on collective difference as on aggregate ability. If people think alike then no matter how smart they are, they will most likely get stuck at the same locally optimal solutions. Finding new and better solutions, or innovating, requires thinking differently. That is why diversity is seen to power innovation in pluralistic societies. These innovations then lead to economic prosperity of their economies. The following section discusses the innovation systems prevalent in India.

Innovation System in India

India's innovation system has been evolving overtime. A large S&T infrastructure, including research centers in public sector and in government universities, has been created in the past. The focus of the innovation systems has been on mission-oriented research, with defence and space related activities given prominence. After 1980, private sector enterprises also started participating, with the pharmaceutical industry taking a lead. Liberalization

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and globalization of the Indian economy, and the emergence of the IT sector since 1990, has boosted service sector innovation and brought India on the global economic map. Scholars have noted that important drivers of innovation in India include 'economic conditions in India and the competition, the energetic and ambitious young population in the academic, research and industrial organization, the low cost IT global hubs, the existence of a free and open society, India's status of being the largest democracy in the world, the huge diversity of the population along with the vibrant capital market, and the availability of civil and research infrastructure'[2].

In India, innovation in the economy has now moved from reverse engineering, incremental process innovation and jugaad innovation to frugal innovation. The sense of achievement in the IT and pharmaceutical sectors,coupled with

the bold achievements in the area of space and defence, has motivated young and talented entrepreneurs to experiment with social innovation, and foster entrepreneurship to serve the bottom of the pyramid. A successful frugal approach initiative is the Honey Bee network started by Prof Anil Gupta of IIM Ahmedabad, where innovators, entrepreneurs, farmers and scholars exchange their knowledge for the benefit of society.

In order to launch an innovation revolution in India, there is a need to link frugal innovation systems with the socio-economic problems of its diverse regions. Frugal innovation is a courageous way to find opportunities in the most adverse environments and in a resource efficient manner, improvising solutions using very simple, yet creative means. This implies that leaders and entrepreneurs must:

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- one, understand the fundamental needs and values of the masses;
- two, create an entrepreneurial eco system that involves partnership with other companies, the public sector and non governmental organizations (NGOs);
- and three, nurture a so-called 'innovation sandbox' that encourages new ideas[3].

The first point is self explanatory, if solutions have to be relevant to the region. The second point about the creation of an entrepreneurial eco system is discussed in the following section. The last point about the creation of an 'innovation sandbox' deals with the clear identification of key characteristics of a given product/service, framed against the number of related financial and structural constraints. There are four key characteristics for products which are targeted at the masses at bottom of the pyramid:

a. Product should be scalable;

b. Product should provide a new price performance rationale;

c. Product should use hybrid and modern technologies; and

d. Product should achieve world standards of safety, quality and sustainability.

Strengthening the Entrepreneurial Ecosystem

Entrepreneurs need a conducive business environment with a supporting entrepreneurial ecosystem to contribute to the well being of the society. A success of an entrepreneur also depends on the entrepreneurial ecosystem he/she is a part of. The ecosystems consist of a set of different interconnected actors within a specific area involving complex relationships with key players, contexts and ingredients - government agencies, industry and trade associations, consumers, investors, financial markets, capital markets, the national and regional culture as well as natural and geographic factors. Each of these components influences and is in turn influenced by the entrepreneurial ecosystem India must create, to foster the Innovation Revolution proposed here.

A good entrepreneurial ecosystem values creativity, innovation and excellence, facilitates partnerships among key players and enables the development of good ideas and technologies that reach and succeed in the market. Such an ecosystem will attract latent high-tech entrepreneurs because people see a chance to build successful companies quickly. A good entrepreneurial ecosystem also attracts local and foreign investments, leading to economic and social development at the local, regional and national levels.

India does have an entrepreneurial ecosystem in different sectors and regions, but it needs further strengthening, to bring about an innovation revolution in the country. It needs to focus on the following areas[4]:

- The government and its agencies need to play a proactive role in facilitating entrepreneurship by providing the following assistance and help:

a. by recognizing and promoting early-stage investments and early stage investors such as angel investors, venture and seed funds, and impact investors;

b. Enhance and scale-up venture incubation programs;
c. Facilitate entrepreneurial activity by simplifying regulations and procedures relating to entry and exit.

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- Provision of Easy access to equity capital and debt by:

a. Removing regulatory hurdles that inhibit domestic fund raising;

b. Establishing a "fund-of-funds (FOF)" to seed other early stage venture funds;

c. Developing and scaling up of debt offerings.

- Promotion and creation of entrepreneurial hubs by greater engagement of established business

houses, trade and industrial bodies with emerging ventures.

- Encouragement of a culture of promoting entrepreneurship over careerism.
- Promotion of adequate and effective collaboration forums where all stakeholders can come together to share experiences, expertise and develop larger, self-sustaining symbiotic relationships.

Concluding Observations

Societies which have been coming up with innovative solutions in terms of products, processes, models, organizations and institutions have been growing and prospering. This also provides a sense of ownership to associate and identify with such societies. As we find in case of India more recently, the launch success of the Mars Orbiter mission, the GSLV commercial satellite missions, and the success of the inter-continental ballistic missile, Agni-V, are all inspiring examples that provide a sense of pride for its youth in belonging to such an advanced society. Every citizen of the country feels proud of these developments, as it involves the sense of belonging to India and of being Indian. However, rather than being complacent, there is a need to keep on inventing new products, behaviors and institutions for achieving higher growth and prosperity.

Diversity in India gives rise to different challenges that can be met by offering diverse solutions in terms of products, services and their delivery systems. Businesses are using this diversity to develop products, services and supply chains that leverage the diversity of talents and capabilities in a virtuous cycle of innovation. One of the key factors of an innovative society is the diversity of its capabilities and talents. India has plenty of that. All it requires is the harnessing of this asset with a clear vision and a missionary zeal.

When questions are raised about India's inability to solve its problems despite its abundant diversity, one has to lay the blame on its governance systems that lack understanding of the critical role of diversity in the creation of an innovative society. There is no lack of capabilities for innovation; it is the lack of vision and willingness to create the right ecosystem. For instance, climate change as a serious national problem led to the announcement of the 'Action Program on Climate Change'. There are several similar initiatives which have been announced and are being implemented. However, there are no linkages of these initiatives to develop an innovation momentum in the country. A collective challenge like climate change can be used to bring people, groups, organizations and institutions to collaborate and come up with innovations and even alter existing lifestyles. Such large scale impacts can only be achieved through a clear national vision, strong leadership, effective government policies and creative implementation, leading harmoniously to the development of an innovative society.

Finally, in order to achieve social and economic prosperity by helping people achieve their true potential, innovative thinking on the part of policy makers and other institutions should be encouraged. The knowledge available within the country needs to be collected, analysed and exploited with honesty and a genuine sense of commitment towards socially inclusive progress. There is a need to build an innovation momentum all around the country, with the youth being motivated to think, create and implement innovative solutions.

Modern technology can be used to provide Indian youth with innovative education, flexible learning options and needed financial support to achieve their entrepreneurial objectives. A network of creative collaborations and innovative alliances between all segments of society needs to be nurtured. This will also require a change in our education system, which has had an overemphasis on examinations based on rote text book learning. Students should be encouraged to think creatively and to seek innovative solutions to problems that they see and feel in our society. Harnessed effectively, it is the diversity of our country which can deliver the goods in the pursuit of solutions to our endemic socio-economic problems.

Endnotes :

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2 Pankaj Sharma, et al, India's National and Regional Innovation Systems: Challenges, Opportunities and Recommendations for Policy Makers, Industry and innovation, Vol 19, No.6 517-537, August (2012)

3 Preeta M. Banerjee and Ana N. Leirner, Embracing the Bottom of the Pyramid with Frugal Innovation, Brandeis International Business School, (2013)

4 Creating a Vibrant Entrepreneur Ecosystem in India, Report of the Committee on Angel Investment and early Stage Venture Capital, June (2012), Planning Commission, Government of India. ❑

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ASSAM GETS US$300 LOAN FROM ADB

The north eastern state of Assam will get a loan of US $ 300 million from Asian Development Board (ADB) for power reforms in the state. Out of the total loan amount, US $ 45 million have been kept for revamping and replacement of various parts of Lakua Power Project. US $ 50 million have been earmarked for strengthening power distribution systems in the state, US $ 5 million for capacity development and consultancy services and a sum of US $ 200 million for Lower Kopili Hydel Project. The ADB is also expected to extend loans in the future to fund the development of solar power and hydel projects in the state. ❑

Manual Scavenging

Amrit Patel

...it is more important first to totally eliminate the inhumane and undignified century old practice of manual scavenging, within two years through letter and spirit enforcement of existing laws and amending them appropriately further, if required, and providing required infrastructure. Swachh Bharat campaign should focus on human dignity rather than merely on sanitation issues

WITH THE new government taking the initiative in seeking full participation and active involvement of all stakeholders in the drive to Swachh Bharat in five years from 2nd October, 2014, it is more important first to totally eliminate the inhumane and undignified century old practice of manual scavenging, within two years through letter and spirit enforcement of existing laws and amending them appropriately further, if required, and providing required infrastructure. Swachh Bharat campaign should focus on human dignity rather than merely on sanitation issues. Manual scavenging in India is one of the darkest blots on India's development. Even after more than precious six decades since Independence, it is a matter of national shame that thousands of scavenger families still live a socially degrading and inhuman life in the 21st century. Mahatma Gandhi, the Father of the Nation, struggled throughout his life to ameliorate the working and living conditions of this section of society and to restore to them their lost human dignity.

Manual Scavenging: India, the largest democracy in the world, has achieved a remarkable economic growth during the first decade of this century and for millions of people, India has become a land of opportunities and destination for foreign investments. However, many are still left behind due to deep rooted caste-based discrimination in all walks of life. These are the people who have been discriminated and subjugated for centuries into manual scavenging--*heinous/undignified work*-- and the society treats them as "*dirty and only meant for dirty work such as manual scavenging"*. Manual scavenging has its roots in the social ills emanating from the centuries-old caste system and because of the tag "*Manual Scavengers"*other people do not hire them for any other jobs except the one that their ancestors were doing for thousands of years and they are denied their rightful promising opportunities of dignified work. This perpetual severe discrimination along with the indifferent attitude of law enforcing authorities accompanied by the inadequacies in the existing law to wipe out the practice has been the reason for their continuing as manual scavengers. Manual scavenging anywhere in the world is a dehumanizing practice and the most degrading surviving practice of untouchability. In India,

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it is looked as an issue of *sanitation rather than human dignity* which the constitution guarantees to its all citizens. Besides social atrocities that scavengers face, they are exposed to several health problems by virtue of their occupation. According to Shree Narayanan's Public Interest Litigation filed in the Supreme Court, the hazards, *inter alia*, include exposure to harmful gases such as methane and hydrogen sulphide leading to instant death and/or cardiovascular degeneration, musculoskeletal disorder like osteoarthritis changes and intervertebral disc herniation, infections like hepatitis, leptospirosis and helicobacter, skin problems, respiratory system problems and altered pulmonary function parameters.

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Law of 1993: Manual scavenging has long been acknowledged as an offensive and inhuman practice in civilized society. In 1917, Mahatma Gandhi had insisted that the inmates of Sabarmati Ashram, which he had set up and was run like a commune, clean their toilets themselves. The Maharashtra Harijan Sevak Sangh, in 1948 protested against the practice of manual scavenging and called for its abolition. The Barve Committee (1949) made pointed recommendations to improve the working conditions of the sanitary workers. In 1957, the Scavenging Conditions Enquiry Committee recommended the abolition of the practice of carrying human excreta in head-loads. In 1968, the National Commission on Labour appointed a committee to study the working conditions of "sweepers and scavengers". All these Committees recommended the abolition of manual scavenging and rehabilitation of sanitary workers, or *safai karmacharis*. With partial acceptance of recommendations of these committees, the country legislated the "Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act, 1993" which [i] prohibits the employment of manual scavengers or construction of dry latrines not connected to proper drainage channels and [ii] violations of provisions of this Act can lead to imprisonment for upto one year and/or a fine of upto Rs.2000. However, according to the report of the Comptroller and Auditor General of India (2003) as on 2003, only 16 States have adopted the law and none of the States had enforced it. Only six States have implemented the Employees Compensation Act of the Ministry of Labour. The Tenth Five Year Plan (2002-07) had reiterated to eradicate manual scavenging by 2007 as a goal. Despite this, according to a petition filed in the Supreme Court, the Indian Railways, which actually employs manual scavengers, in its Integrated Railways Modernization Plan of Rs.2,40,000 crore did not even provide for the elimination of manual scavenging. The National Human Rights Commission, which had also called upon states to adopt and implement the Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act, 1993 noted dismal political response. In January 2005, the Supreme Court, hearing a petition filed in 2003 by the Safai Karmachari Andolan and 13 other organizations and individuals, observed that the number of manual scavengers in India has increased and directed every Department/ Ministry of the Union government and the State governments to file an affidavit through a senior officer, who would take personal responsibility for verifying the facts stated in the affidavit, within six months. If manual scavenging is admitted to exist in a given department, a time bound program for the liberation and rehabilitation of manual scavengers should be indicated.

Unenforced Law: The Employment of Manual Scavengers and Construction of Dry Latrines [Prohibition] Act, 1993, aimed at addressing the issue of manual scavenging in larger perspectives, but Government failed to enforce the law for over 18 years as a result of which tens of thousands of people still continue to be engaged in manual scavenging. Most of the manual scavengers belong to SCs or STs, and in 2011, the Union Ministry of Home Affairs directed all States that were engaging or employing a member of SCs or STs in manual scavenging may fall within the ambit of the SCs and STs [Prevention of Atrocities] Act. However, the fact is that there has been yet "not a single person convicted under the 1993 law for engaging a person in manual scavenging" although many States confirmed the prevalence of manual scavenging. In 2012, a report on *"stigmatization of Dalits in accessing water and sanitation in India"* was presented to the UN Special Rapporteur on the human rights to safe drinking water and sanitation. The report includes observations on the human rights situation of manual scavengers working in India. An abstract of the report was also presented at a Public Consultation in the UN.

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New Law: On June 17, 2011, the then Prime Minister Manmohan Singh referred to manual scavenging as "*one of the darkest blots on [India's] development process"* and asked all state Ministers in the country to pledge to eliminate this scourge from every corner of India in the next six months, by the end of 2011. Government was duty bound to enact a new comprehensive law for total emancipation of sanitary workers involved in all forms of manual scavenging, sewerage cleaning and septic tank cleaning within a time frame. Tamil Nadu Assembly on September 10, 2011, acknowledging the fact that old law is too weak and needs to be replaced with a new central law binding all State legislatures, was prompt to pass a unanimous resolution urging the Union of India to enact suitable amendments to the 1993 Act by modifying certain clauses to make it comprehensive and unambiguous, *inter alia*, widen the definition of manual scavenging, appointment of implementing authorities, power of executing authority to prevent environment pollution. The law must strengthen public accountability mechanisms and shift the focus to human dignity from mere sanitation and automatically binding on all State Governments. On March 12, 2012 Ms Pratibha Patil, then President of India, while addressing the Parliament promised for social justice and said, "*her Government will introduce a new Bill in the Parliament for eliminating manual scavenging and insanitary latrines. This will also provide for proper rehabilitation of manual scavengers in alternative occupations so that they are able to lead a life of dignity*". A similar commitment was made to the Supreme Court four days later. The bill was proposed to be introduced in the monsoon session of the Parliament, which also came only after the matter was brought before the Supreme Court following an order of the Madras High Court that the personal appearance of high dignitaries, including those in the Prime Minister's Office, might be required if the Center failed to amend the law.The preamble of the new bill aptly acknowledges that "it is necessary to correct the historical injustice and indignity suffered by the manual scavengers and to rehabilitate them to a life of dignity". The 1993 Act defined a manual scavenger as "a person engaged in or employed for manually carrying human excreta" whereas the definition of scavenger in the 2012 new bill is elaborate, inclusive and includes "a person engaged or employed for manually cleaning, carrying, disposing of, or otherwise handling in any manner, human excreta in an unsanitary latrine or in an open drain or pit into which the human excreta from the insanitary latrine is disposed of, or on a railway track".

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Rehabilitation Scheme: In 1993, the National Commission for Safai Karmacharis was set up under the National Commission for Safai Karmacharis Act. The National Scheme was launched in March 1993 for Liberation and Rehabilitation of Scavengers and their dependents and the Ministry of Social Justice and Empowerment was directed to implement it. However, according to the CAG report, the scheme failed to achieve its objectives despite an investment of more than Rs.600 crore. The preamble of the report itself said "The Scheme was undoubtedly well-intentioned but ill-conceived as it failed to harness its operational parameters to the complex structure of a highly stratified society resisting occupational reform. Nobility of purpose was not enough, as the scheme failed to deliver its social vision after ten years of continuous but regrettably half-hearted efforts. It failed in working out a coherent strategy for policy initiatives as it could not take advantage of an existing Law that prohibited employment of Scavengers. Divorcing liberation from rehabilitation was an error of judgment that weakened the foundation of the Scheme and led to uncoordinated efforts without focus. It failed in enhancing or re-orienting the skill-levels of the beneficiaries

It failed in working out a coherent strategy for policy initiatives as it could not take advantage of an existing Law that prohibited employment of Scavengers. Divorcing liberation from rehabilitation was an error of judgment that weakened the foundation of the Scheme and led to uncoordinated efforts without focus. It failed in enhancing or re-orienting the skill-levels of the beneficiaries necessary for change of occupation. For the same reason, it failed in its mission of replacing the hereditary practice by skill-based choice. It is the lack of purpose in aligning the parameters of the Scheme and lack of will in implementing it that led to the Scheme floundering on its own assumptions.

necessary for change of occupation. For the same reason, it failed in its mission of replacing the hereditary practice by skill-based choice. It is the lack of purpose in aligning the parameters of the Scheme and lack of will in implementing it that led to the Scheme floundering on its own assumptions. The National Commission for Safai Karmacharis attributes lack of commitment by the State Governments and concerned agencies accompanied by the state's complicity in the whole process for unsatisfactory performance of the Scheme. Even State governments routinely deny the existence of manual scavengers. Many government offices and buildings still have dry latrines and municipalities employ manual scavengers to clean these latrines. The CAG report faulted the Ministry of Social Justice and Empowerment for delays in disbursing funds to the Scheduled Caste Development

...meant for man and beneficiaries too are men, Besides, it is observed that many scavengers are older women, with little or no education, skills and experience. For them schemes involving a bank loan and subsidy cannot serve the purpose of rehabilitation, leave alone lack of transparency, corruption, delay, uncertainty and harassment in availing subsidy and loan.

Financial Corporations [responsible for implementing income-generating rehabilitation schemes] and for having "*hardly any workable monitoring machinery at the Ministry, State and District levels*". The Corporations and the banks failed to deliver as there was no clear definition of occupational change. The CAG reported 47 per cent loan rejection in Maharashtra and 74 per cent in Tamil Nadu. As the report perceptively pointed out, *"to expect an illiterate and poor scavenger to comply with the rigours of project-financing by commercial banks, was to say the least, unimaginative"*. The CAG concluded that most serious flaw in the scheme was "its failure to employ the law that prohibited the occupation." The CAG said "The State and Central schemes were expected to draw their strength from the law. However, the law was rarely used".

Earlier programs for rehabilitation of released manual scavengers failed because an estimated 95 per cent manual scavengers are women, whereas the majority of schemes are meant for man and beneficiaries too are men, Besides, it is observed that many scavengers are older women, with little or no education, skills and experience. For them schemes involving a bank loan and subsidy cannot serve the purpose of rehabilitation, leave alone lack of transparency, corruption, delay, uncertainty and harassment in availing subsidy and loan. Experiences suggest that schemes should be entirely grant-based, individual income generating plans must be supported by backward and forward linkages accompanied by capacity building training and counselling services.

Disputed Numbers: Despite the fact that the country has the "Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act, 1993", there are reports that about 13 lakh manual scavengers are still being engaged in this occupation in the country whereas the States have reported existence of 1.16 lakh manual scavengers. And only about 80,000 scavengers were identified as eligible to the benefits under the Central scheme for rehabilitation of Manual Scavengers. Though Karnataka has banned manual scavenging in 1970, the NHRC reports still 8000 persons have been in this occupation. According to figures released by the Government in 2011, there were 1,18,474 manual scavengers or their dependents identified under the Self-employment Scheme for Rehabilitation of Manual Scavengers [SRMS] launched in 2007.The 2011 decennial census reveals that over 26 lakh households still have insanitary latrines which are serviced by manual scavengers. Every day 1.3 million people in India (comprising more than 80 per cent Dalit women) are forced to clean human excrement, a practice called manual scavenging. Recently, the Union Government has announced at a review meeting with senior government officials on eradication of manual scavenging to undertake a survey of the number of manual scavengers in the country with a view to understanding the extent of the problem and efficiently solving it by facilitating them to avail benefits of various schemes meant for them.

Action Plan: The Prohibition of Employment as Manual Scavengers and Their Rehabilitation Bill, proposed to be introduced in the Parliament is once again a renewed attempt of the year 1993 to prevent employment of people in the cleaning, handling or carrying of human excreta. In order to remove any kind of doubt about the political will, Governments' concern and commitment and

The Prohibition of Employment as Manual Scavengers and Their Rehabilitation Bill, proposed to be introduced in the Parliament is once again a renewed attempt of the year 1993 to prevent employment of people in the cleaning, handling or carrying of human excreta. In order to remove any kind of doubt about the political will, Governments' concern and commitment and law enforcing authority's ability, transparency and accountability to end this dehumanizing activity once and for all

law enforcing authority's ability, transparency and accountability to end this dehumanizing activity once and for all, Action Plan must be formulated which include, *inter alia*, [i] It is necessary to identify manual scavengers and dry latrines jointly by designated teams of Government officials and community members so that the Governments cannot deny the

fact which often is the case [ii] technological changes that can render the occupation humane, dignified and safe avoiding any direct human contact with excreta are prerequisites to liberate manual scavengers [iii] the new law should make the village panchayat and urban local body as well as the district magistrate of the district concerned responsible to ensure that no household constructs or maintains an insanitary latrine or employs a manual scavenger [iv] the poor sanitation in rural India where dry latrines remain in use must be improved to eliminate manual scavenging. In the absence of networked sewerage facilities, even urban local bodies engage workers to manually clean septic tanks. Manual scavenging can, therefore, be eliminated by significantly improving overall sanitation in the countryside [v]in case scavengers are employees of municipalities, Government, semi-Government or private companies, the law should specifically provide for a clause/section "no termination from the jobs but should be confirmed in regular employment in a task not at all connected with scavenging" [vi] Government programs for promotion of flush latrines in place of dry latrines; livelihood rehabilitation including health of freed manual scavengers; and education of their children can effectively be implemented by local bodies and NGOs in which case administrative officials and elected representatives should be made accountable for targeted outcomes. The children of existing and freed scavengers should be guaranteed Government-funded free school education right up to college or vocational training to transfer technical skills necessary to seek employment [vii]manual scavengers must be empowered to fight collectively to change this centuries-old practice [viii] legislators must demonstrate their political will to pass the new Bill assigning top priority during the ensuing session and the Government must show concern and commitment to make it a law within three months and direct all concerned authorities to enforce without delay [ix] Panchyats at village level and local bodies at urban centers must identify manual scavengers and put in place a Development Action Plan to liberate and rehabilitate all manual scavengers during the Twelfth Five Year Plan [x] at Block level, monitoring committee chaired by the Block Development Officer should review the performance, village & urban center-wise every month [xi] at district level, monitoring committee chaired by the District Magistrate/Collector must review the performance Block-wise quarterly. District Magistrate must be accountable to ensure that targeted numbers are genuinely liberated and rehabilitated [xii] at State level, the monitoring committee chaired by the Chief Minister should review the performance district-wise half-yearly [xiii]at national level the committee chaired by the Home Minister should review the performance annually and present to the parliament. ❑

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"Make in India" - Parameters & Policy Initiatives

The 'Make in India' initiative was launched by the Prime Minister on 25th September 2014.

New Initiatives

Several new initiatives designed to facilitate investment, foster innovation, protect intellectual property and build best-in-class manufacturing infrastructure have been put in place under the "Make in India" initiative. New processes to business with India have been introduced which include: Process of applying for Industrial License & Industrial Entrepreneur Memorandum made online on 24×7 basis through eBiz portal - a single window IT platform for services; Validity of Industrial license extended to three years; States asked to introduce self-certification and third party certification under Boilers Act; Major components of Defence products' list excluded from industrial licensing; Dual use items having military as well as civilian applications deregulated; Services of all Central Govt. Departments and Ministries to be integrated with eBiz by 31 December, 2014;Process of obtaining environmental clearances made online; Advisories sent to all Departments/ State Governments to simplify and rationalize regulatory environment; All returns should be filed on-line through a unified form; check-list of required compliances should be placed on Ministry's/Department's web portal; All registers required to be maintained by the business should be replaced with a single electronic register; No inspection should be undertaken without the approval of the Head of the Department; For all non-risk, non-hazardous businesses, a system of self-certification to be introduced.

New Infrastructure

New infrastructural projects have been identified like creation of new smart cities and industrial clusters in identified industrial corridors having connectivity. New youth-focused programs and institutions dedicated to developing specialized skills to facilitate the process of transforming India into a manufacturing hub are also being planned. A new 'National Industrial Corridor Development Authority' has been created to coordinate, integrate, monitor and supervise development of all Industrial Corridors. Work on five smart cities is in progress as a part of the Delhi-Mumbai Industrial Corridor: Dholera, Shendra-Bidkin, Greater Noida , Ujjain and Gurgaon. The Chennai-Bengaluru Industrial Corridor with master Plans for three new Industrial Nodes [Ponneri (TN), Krishnapatnam (AP), Tumkur (Karnataka)] is in progress. It is also planned to link the North-eastern States with other Industrial corridors in cooperation with the Japanese government. New Industrial Clusters are being created for promoting advance practices in manufacturing. Approval has been accorded to 21 Industrial projects under Modified Industrial Infrastructure Upgradation Scheme with an emphasis on use of recycled water through zero liquid discharging systems and Central Effluent Treatment plants. Approval has also been accorded to 17 National Investment and Manufacturing zones. The Intellectual Property regime will be strengthened through further upgradation of IT facilities; Compliance with global standards and online Application processes. An Act recognizing National Institute of Design (NID), Ahmedabad, as an institute of National Importance has been notified. This will enable NID to confer degrees, promote research and function as an Apex body in Design Education. Four more NIDs are being developed. Major impetus will be given to skill development through Indian Leather Development Programme. Four new branches of Footwear Design & Development Institute at Hyderabad, Patna, Banur (Punjab) and Ankleshwar (Gujarat) will be established.

New Sectors

With the easing of investment caps and controls, India's high- value industrial sectors – defence, construction and railways – are now open to global participation. Policy in Defence sector has been liberalised and FDI cap raised from 26 per cent to 49 per cent. Portfolio investment in Defence sector is now permitted up to 24 per cent under the automatic route. 100 per cent FDI is allowed in Defence sector for modern and state of the art technology on case to case basis. 100 per cent FDI under automatic route has been permitted in construction, operation and maintenance in specified Rail Infrastructure projects such as Suburban corridor projects, through PPP, High speed train projects, Dedicated freight lines, Rolling stock including train sets and locomotives/coaches manufacturing and maintenance facilities, Railway electrification, Signaling systems, Freight terminals, Passenger terminals, Infrastructure in industrial park pertaining to railway line/sidings including electrified railway lines

and connectivities to main railway line and Mass Rapid Transport Systems. Norms are also to be eased for FDI in the Construction Development sector

Most importantly, the Make in India program represents an attitudinal shift in how India relates to investors: not as a permit-issuing authority, but as a true business partner. Towards this, dedicated teams will guide and assist first-time investors, from time of arrival and there will be focussed targeting of companies across sectors.

Manufacturing Policy

The need to raise the global competitiveness of the Indian manufacturing sector is imperative for the country's long term-growth. The National Manufacturing Policy is by far the most comprehensive and significant policy initiative taken by the Government. The policy is the first of its kind for the manufacturing sector as it addresses areas of regulation, infrastructure, skill development, technology, availability of finance, exit mechanism and other pertinent factors related to the growth of the sector. The Policy envisioned an increase in manufacturing sector growth to 12-14 per cent per annum over the medium term; an increase in the share of manufacturing in the country's Gross Domestic Product from 16 per cent to 25 per cent by 2022; creation of 100 million additional jobs by 2022 in manufacturing sector as also appropriate skill sets among rural migrants and the urban poor for inclusive growth; an increase in domestic value addition and technological depth in manufacturing; enhancing the global competitiveness of the Indian manufacturing sector; ensuring sustainability of growth, particularly with regard to environment.

The focus sectors for the Manufacturing Policy are:

- Employment-intensive industries like textiles and garments, leather and footwear, gems and jewellery and food processing industries.
- Capital goods industries like machine tools, heavy electrical equipment, heavy transport, earthmoving & mining equipment.
- Industries with strategic significance like aerospace, shipping, IT hardware & electronics, telecommunication equipment, defence equipment and solar energy.
- Industries where India enjoys a competitive advantage such as automobiles, pharmaceuticals & medical equipment.
- Small & medium enterprises.
- Public sector enterprises.

The National Investment and Manufacturing Zones with a minimum area of 5000 hectares (50 sq kilometeres) with minimum processing area of 30 per cent are being conceived as giant industrial greenfield townships to promote world-class manufacturing activities. The central government will be responsible for bearing the cost of master planning, improving/providing external physical infrastructure linkages including rail, road, ports, airports and telecom, providing institutional infrastructure for productivity, skill development and the promotion of domestic and global investments. The identification of land will be undertaken by state governments. State governments will be responsible for water requirement, power connectivity, physical infrastructure, utility linkages, environmental impact studies and bearing the cost of resettlement and rehabilitation packages for the owners of acquired land.

The regulatory mechanisms would be simplified as far as possible. Timelines will be defined for all clearances. Central and State governments will provide exemptions from rules and regulations related to labour, environment etc. subject to the fulfilment of certain conditions. Mechanisms would be developed for the cooperation of public or private institutions with government inspection services under the overall control of statutory authorities. Process of clearances by centre and state authorities would be progressively web-enabled. A combined application form and a common register would be developed. The submission of multiple returns for different departments will be replaced by one simplified monthly/quarterly return. A single window clearance would be available for units in NIMZ as well as ease in environment approvals.

The policy intends to leverage the existing incentives/schemes of government. A technology acquisition and development fund has been proposed for the acquisition of appropriate technologies, the creation of a patent pool and the development of domestic manufacturing of equipment used for controlling pollution and reducing energy consumption. The fund will also function as an autonomous patent pool and licensing agency. It will purchase

intellectual property rights from patent holders. Any company that wants to use intellectual property to produce or develop products can seek a license from the pool against payment of royalties.

Some incentives are being offered to manufacturing units like:

- Transfer of Assets: In case a unit is declared sick, the transfer of assets will be facilitated by the company managing the affairs of NIMZ; Relief from capital gains tax on the sale of plant and machinery of a unit located in NIMZ will be granted in case of the re-investment of sale consideration within a period of 3 years for purchase of new plant and machinery in any other unit located in the same or another NIMZ.
- Green Technology & Practices: 5 per cent interest in reimbursement & 10 per cent capital subsidy for the production of equipment/machines/devices for controlling pollution, reducing energy consumption and water conservation; A grant of 25 per cent to SMEs for expenditure incurred on audit subject to a maximum of INR 1,00,000;A 10 per cent one-time capital subsidy for units practising zero water discharge; A rebate on water cess for setting up wastewater recycling facilities; Incentives for renewable energy under the existing schemes; An incentive of INR 2,00,000 for all buildings which obtain a green rating under the IGBC/LEED or GRIHA systems.
- Technology Development: Incentives for the production of equipment/machines/devices for controlling pollution, reducing energy consumption and water conservation; SMEs will be given access to the patent pool and/or part of reimbursement of technology acquisition costs up to a maximum of INR 20,00,000 for the purpose of acquiring appropriate technologies up to a maximum of 5 years.
- Special benefits to SMES: Rollover relief from long term capital gains tax to individuals on sale of residential property in case of re-investment of sale consideration; A tax pass-through status for venture capital funds with a focus on SMEs in the manufacturing sector; Liberalization of RBI norms for banks investing in venture capital funds with a focus on SMEs, in consultation with RBI; The liberalization of IRDA guidelines to provide for investments by insurance companies; The inclusion of lending to SMEs in manufacturing as part of priority sector lending; Easier access to bank finance through appropriate bank lending norms; The setting up of a stock exchange for SMEs; Service entity for the collection and payment of statutory dues of SMEs.
- Government procurement: The policy will also consider use of public procurement with stipulation of local value addition in specified sectors. These include areas of critical technologies such as solar energy equipment, electronic hardware, fuel efficient transport equipment, IT based security systems, power, roads & highways, railways, aviation and ports.
- Industrial training & Skill upgradation measures: The creation of a multiple tier structure for skill development, namely: Skill-building among large numbers of a minimally educated workforce; Relevant vocational and skill training through establishment of ITI in PPP mode; Specialized skill development through the establishment of polytechnics; Establishment of instructors' training centre in each NIMZ.
- Exit mechanism:It envisages an alternate exit mechanism through job loss policy and a sinking fund or a combination of both.

(Compiled from material available in the DIPP website on 'Make In India')

National Air Quality Index (AQI) launched as initiative under 'Swachh Bharat'

'The National Air Quality Index' (AQI) was launched recently by the Ministry of Environment & Forests. The AQI would be a 'One Number- One Colour-One Description' for the common man to judge the air quality within his vicinity. The formulation of the index was a continuation of the initiatives under Swachh Bharat Mission.

The index constituted part of the Government's mission to introduce the culture of cleanliness. Institutional and infrastructural measures were being undertaken in order to ensure that the mandate of cleanliness was fulfilled across the country.

Under the new measurement process, an effort had been made to include a comprehensive set of parameters. While the earlier measuring index was limited to three indicators, the current measurement index had been made quite comprehensive by the addition of five additional parameters.

There are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe. The proposed AQI will consider eight pollutants (PM10, PM2.5, NO2, SO2, CO, O3, NH3, and Pb) for which short-term (up to 24-hourly averaging period) National Ambient Air Quality Standards are prescribed.

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)

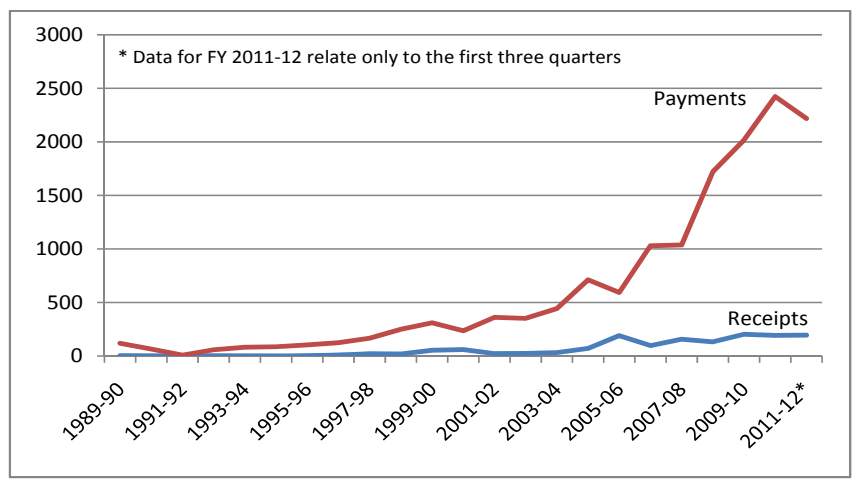

Table 1 shows that especially since the turn of the millennium, India has seen a tremendous increase in the enrolment of students for higher studies, as well as in the number of institutions. This, therefore, refutes the contention that India's competitive advantage is largely based on supply of unskilled 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.

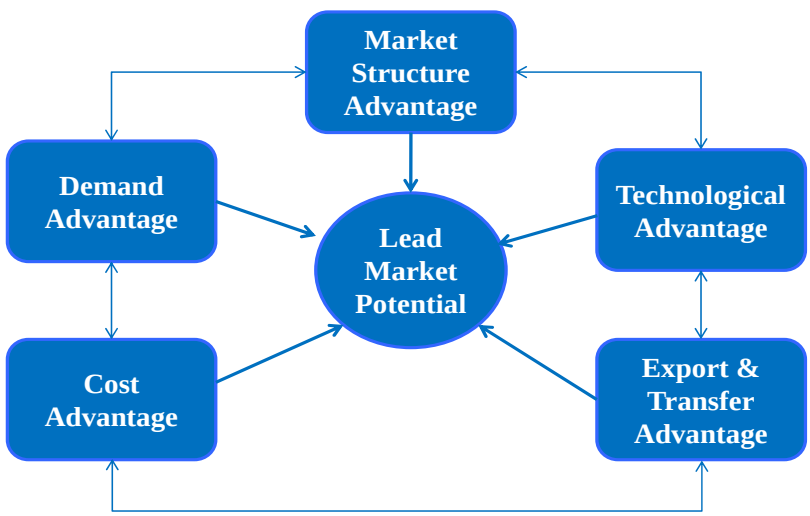

Figure 2: Factors Responsible for Emergence of a Lead Market, source: (Tiwari and Herstatt, 2014)

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International Lessons on Innovation For Socio Economic Development In India

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...the regional position of India has compelled its innovation spectrum to expand in most of the areas else the survival theory has challenged the existence of many sectors. Nations, particularly India shall have to create a positive business environment and a culture that supports innovation for the incumbent entrepreneurs and firms, who in turn shall be responsible towards job creation, wealth generation and socio-economic development of the country

THERE IS a limited literature on innovation. Rogers (1983) defines innovation as an idea, practice, or object that is perceived as new by individuals or units that adopt it. Damanpour (1991, p. 556) defines innovation as "the adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organisation". Others define innovation as "something that is new or improved and that which creates value". Thompson (1969) defines innovation as "the ability to provide products and services differentiated from the competition and made profitable by their value to their customer". The entrepreneurial firms are typically small, in most cases are family-owned (Brockhaus, 1980), fast-growing (Drucker, 1985), and innovative.

Innovation undertaken by modern advanced nations tend to produce high-income products, requiring high levels of education and skills, be of a large scale and require sophisticated management techniques, be associated with high levels of labour productivity, and be linked, through inputs and outputs, with the rest of the advanced technology system. If these innovations are transferred unmodified to LDCs (Less Developed Countries), the result will be a concentration of resources, of savings and infrastructure, on a small part of the economy. Income will be concentrated in this area, leading to markets for the high-income products the system produces. Resources available in the low-income nations will tend to be under-utilized, including raw materials as well as labour.

Many of the well-established characteristics of the dual economy[1] can be seen from characteristics of innovations done by advanced nations: the capital intensity of productive techniques, the heavy reliance on imported managers (human capital), skill deficiencies, un-and under-employment and a relative (often absolute) deprivation of the economy outside the modern sector. Only

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economies, which are growing very rapidly and are selective about the choice of forms of innovation and adept at modifying them, are able to overcome this dualism, by absorbing a growing proportion of their workforce into the modern sector. South Korea and Taiwan provide the obvious examples. This walking on two legs is also followed in India.

More appropriate form of innovation may be roughly defined as technology that will be more suitable to the generic needs of low-income consumers. This means that more appropriate technology will be more suited to low income consumers. Innovators internationally, create most of the wealth, new or a proportionate jump from the existing, while the managers and others tend to safeguard it. Much of the growth comes from entrepreneurs and this leads to creation of employment. They bestow new value to old assets and create entirely new fountains of wealth (Joshi, 2010). More appropriate innovation may be socially not very useful. Learning effects would be such as to outweigh the loss in output.

Thus, it is necessary to research why some companies are able to create more value than others! How do some sectors create more wealth than others? Why certain nations do better than others and what is the underlying cause for such successes in creation of wealth? Is innovation an important factor towards socio-economic development of a nation? (Joshi, 2010).

Capital Stretching Innovations[2]

We need to understand the level of technological rest that the developed nations have based on which the less developed nations manage to innovate. This gives us an important dimension (i) The precise nature of that technology shelf, (ii) The availability within the LDCs of required initial managerial and entrepreneurial capacity (iii) The changing nature of that required managerial and entrepreneurial capacity in the course of transition to modern growth.

In fact, the most reasonable explanation for the import substitution syndrome is that it is a response to a real shortage of entrepreneurship and that it permits time, through informal learning by doing or more formal education processes, for this entrepreneurial capacity to work and develop.

As the economy shifts from a natural resource based growth pattern in the import substitution phase to a human-resource-based-system in the export substitution phase, there is an increasing sensitivity to the continuously changing factor endowment, first in terms of the efficient utilization of the domestic unskilled-labour force, and later in terms of the incorporation of growing domestic skills and ingenuity. In other words, the appropriate type of technology finally in place must be one in which not only the initial choice from the shelf but also the adaptations and adjustments consciously made thereafter, in response to changing domestic resource and capability constraints, play an important role.

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Lessons on Innovation from Korea and China

Until the mid- to late 1970s, neither Korea nor Taiwan (China) employed explicit technology policies. The main exceptions were restrictions placed on direct foreign investment and a fairly perfunctory review of license agreements in Korea. The ability of two nations to close the initial productivity gaps was a result of firms' responses to the incentives contained in national economic policies.

Among these policies

a. the relative neutrality of the foreign trade regime with respect to profitability between domestic and foreign sales and the relatively low variance in protection across sectors;

b. export earnings in Korea and undervaluation of the real exchange rate in Taiwan (China) to encourage exports to a greater extent that would have been the case given the protection afforded to new industries in the domestic market,

c. a relatively undistorted labour market that, along with some movement toward market rates of interest (particularly China and Taiwan), kept the wage-rental ratio closer to scarcity value than in other developing nations.

The responses to these incentives led to a set of favourable but unintended technological consequences. Technology and knowledge were relatively easy to acquire and absorb in these sectors even without a large stock of higher educated engineers. The machinery deployed to manufacture the increased output was quite labour intensive, in response to the low wage rental ratio (Westphal et al, 1977). The simple equipment and the absence of continuous processing were conducive to minor innovations for increasing productivity, which were often suggested by blue-collar workers. Thus, the trade and factor price regime were complementary and were conducive both to obtaining static gains in output and to fostering the move toward best practices.

In Korea, the growth of large firms was encouraged by the use of selected credit methods. As domestic real wages increased and newer lower-wage competitors entered the international market, large Korean firms were encouraged to acquire the technological capacity to enter sectors that were more capital intensive (Pack and Westphal, 1986).

In Taiwan (China), the transfer of technology and knowledge in the consumer industries, in which the early export drive was concentrated, was similar to that in Korea (Pack 1992). Taiwan entered newer areas, however, it did not encourage the growth of large-scale firms capable of substantial research and development. Taiwan utilized central institutions such as Industrial Technology Research Institute, as well as China Productivity Centre, to introduce new technologies, develop new products and processes, diffuse new knowledge and scan international markets for both products and processes. (Dahlman and Sananikone, 1990).[3] Total Factor Productivity has been the sole factor why nations have begun to grow and develop.

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What Innovators require?[4]

1. Think the choice of being entrepreneurial as a better choice. This may need a thorough evaluation of rewards and risks involved with respect to the opportunity costs-benefits. If the benefits outstrip the costs, the time is to plunge the opportunity, seize and act upon. The rewards and costs could be psychological and financial.
2. Make an inventory of likes and dislikes based on preceding experiences and to discover from them.
3. Search for market gaps and in personal competencies, skill sets and in the relationship networks, as this may be imperatives to develop upon the market opportunities. It may also exist in the weaknesses of competitive offering, customer frustrations with existing product or services.
4. Assess the profile of the potential customers. Study and test on restricted customers whether they really feel the need for the product or services that might fill the need gaps. Hence, assess the size of the market and make corrections while forecasting.

Barriers to Innovation and Innovators

The market driven barriers are connected to various market failures such as insufficient appropriability. Others are risks, in adequate size of research undertaken etc. Yet another barrier is 'short-termism', which is an effect of pressure. Financial barriers are also an important type. These barriers can cause reluctance amongst the lenders to assist in the financing process, while new opportunities are seized. Government policies can also hinder in the process to innovate. Certain policies can go directly or indirectly related to the area where the innovation would have a role to play, whether it is the markets or the industries! Local laws can hinder as well shield the participants and this may act against the endowment to innovation.

Innovation Champions are required to overcome the natural resistance and without them, it can cause a major barrier to innovation in the firm. This may include lack of communication, inappropriate incentive systems and obstructions by different departments. Centralisation of power in an organisation affects innovation negatively in older firms (while being positively correlated with innovation in new ventures. Lack of time is also frequently mentioned in the barriers to innovation. The issues related to strategy have been contributed by many researchers. The failure of strategy in some firms while introducing flexible manufacturing with the long term aims is also a problem.

Lessons for India

Small and medium enterprises (SME's) have a wider impact on the Indian economy. Research gives evidence on both incremental and radical innovation by these firms, they are likely grow in the same manner as their Chinese counterparts.

There has been a worldwide concentration in stimulating new enterprises and helping small enterprises mature. Various governments have been attempting to expand programmes to fuel entrepreneurship. The governments of most developed economies perceive new and smaller enterprises as the spring of economic growth and wealth creation. Entrepreneurship and innovation, since they are closely linked, are high on the policy agenda in India. South Korean example of Dedicated Community of Entrepreneurial Ventures is one which is immensely helpful in counterbalancing any lags in development.

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The importance of innovation in SME's is to what are the drivers of economic growth and how they help the national economy to grow. The recognition of the importance of innovation and SMEs can been seen as it has led to the development of the National Systems of Innovation in several countries. At the forefront

of the research in this body of work and has coined the term 'gazelle' to refer to SMEs that have a high growth rate. Henderson and Clarke (1990) say that entrepreneurs are responsible for creating new jobs, increase the local incomes and wealth, while helping in connecting the community to the larger, global economy. Many economists argue that they are the 'growth engines' of the economy. But we still lack in discovering the role that innovation plays in fuelling the growth in the SME's.

Managing innovation in SMEs investigates the innovative practices of SMEs in terms of how these firms actually manage innovation or the process of developing new products and services. It is important that this be studied religiously. It has been deeply researched that for product innovation, an active strategic commitment to research and technological change is required. Keizer et al (2002) discovered that there were three factors, which were significantly contributing to the innovative practices in a given firm and those were using innovation subsidies, having links with knowledge centres and some percentage of contribution in the R&D centre.

Who says India is not Innovative? Perhaps India Inc that includes the entire plausible sectors one can think of, are contributing to make India towards a developed economy, where autonomy and respect shall matter. Some are actively engaged independently and others in joint efforts. India has now become a world player to reckon with in any sector. Be it the education (technical, professional), Pharmaceuticals, management in Medical services, Agricultural, the green revolution, Telecommunications, IT enabled services, Space sciences, Nuclear science and applications, Thermal, Hydro, Gas & Allied power resource generation, Oil and Natural gas reserves exploration, Software and the Hardware industry, Banking and allied financial services, Railways and other transportation sectors like metro railways, Infrastructural development, Project management, Shipping and Port management, Genetics, Bio medicines and Engineering, Heavy engineering, Petroleum and Petrochemicals, Consumer goods, Drug research, Botanical research, Toxicological research, Geological research, Plant research, researches in the basic sciences and many more including the advance researches and applications in the Defence sectors (Army, Navy and Air Force) are the living examples of exemplary performance in its own domain, absolutely '*world class in India*', as it may be termed.

Today, in India, one can feel that innovations have been dispersed in the small and medium enterprises as well, including few of the many areas that have been listed earlier, whether they are product, process or service innovations.

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Endnotes

1 Dual Economy refers to that which has sections conversant with technology and those who are not aware of the technology at all.

2 Howard Pack, "Technology and Employment: Constraints on Optimal Performance ," in Technology and Economic Development: A Realistic Perspective, ed. Samuel M. Rosenblatt (1979).

See also Carl Dahlman and Larry Westphal, "The Transfer of Techonology: Factors in the Acquisition of Technology," Finance and Development (December 1983), and "Technological Effort in Industrial Development- An Interpretative Survey of Recent Research," in The Economics of New Technology in Developing Countries, ed. Frances Stewart and Jeffrey James (1982); and Martin Bell and Keith Pavitt, "Accumulating Technological Capability in Developing Countries," World Bank Economic Review Supplment (1992).

3 From Gustav Ranis, "Industrial Sector Labor Assumption," Economic Development and Cultural Change, April 1973. pp.392-97. Reprinted by permission

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J&K DIARY

RELIEF FUND FOR FLOODS IN J&K

The Centre has allocated a fund worth Rs 120 crore for rehabilitation and relief for the flood hit Jammu and Kashmir. Out of the total sum of Rs. 120 crore, Rs. 50 crore would be given as concessional finance to build micro enterprises, Rs. 5 crore will be spent under 'Seekho aur Kamao' programme to impart training to 2,000 youths. Rs. 30 crore are earmarked for pre-matric and post-matric scholarships. Also, Rs. 1.30 crore worth scholarship amount will be given to 2,000 girls under the Maulana Azad Education Foundation.Along with these steps , various government schools, madrasas, ITIs, colleges and health centres will be constructed under 'Jan Vikas Yojana' with an allocation of Rs. 25 crores by the ministry.Rs.4 crore have been kept for skill up gradation and training of traditional arts and crafts for 1000 people and organising bridge courses for madrasa students under the initiative of 'Nai Manzil'. ❑

CENTRE ALLOCATES RS. 7.90CRORES FOR CIVIL DEFENSE

In the wake of the recent floods in this state, the civil defense of Jammu and Kashmir has been allotted Rs 7.90 crores out of the total sum of Rs 8.17crore, earmarked for the state in the Five Year Plan from 2012-17.Out of the this total amount, Rs 27 lacs are allotted for the districts of Jammu and Udhampur on pilot basis. However, Rs 7.90 crores have been kept aside for the coming three years for the disaster prone 13 districts namely Doda, Badgam, Kargil, Anantnag, Baramula, Poonch, Leh, Kupwara, Pulwama, Srinagar, Rajouri and Udhampur that need special regard. ❑

JAMMU KASHMIR AROGYA GRAM YOJANA' UNDER CSIR LAUNCHED

The 'Jammu Kashmir Arogya Gram Yojana' was launched recently under which the CSIR (Council for Scientific & Industrial Research), affiliated with the Ministry of Science & Technology, will identify a thousand villages in Jammu & Kashmir for the growth of aromatic plants with active participation of local farmers and owners of the land. The Government will initially spend over Rs.25 crores on this scheme in addition to technical support by a team of CSIR scientists. This scheme is a new concept whereby the agricultural land with the potential for growth of aromatic plants will be identified and CSIR scientists as well as aroma experts from different parts of the country will educate and train the local farmers to bring up this cultivation. This will not only enable the local farmers to usher in a new area of cultivation but, will also prove economically beneficial to them since the net profit for the farmers through this venture has been estimated to be Rs. 1 – 1.5 lakhs per hectare per annum. One of the important reasons to start this new scheme from Jammu region was that the IIIM (Indian Institute of Integrative Medicine), Jammu has been actively pursuing research and production of aromatic medicinal and perfumery products for several decades and some of the products produced from this laboratory are of international export quality. Nine varieties of scientifically tested and commercially beneficial plant saplings will be provided by IIIM Jammu and under the guidance CSIR experts, the project will start from the border district of Kathua..

Study of Sectoral Innovation Behaviour in SMEs

Nomita Sharma

Small and medium enterprises in different sectors need to analyze new techniques to manage innovation as innovation is the only vehicle that can take them long way in this competitive journey

SMALL AND medium enterprises (SMEs) are regarded as the main source of entrepreneurship and innovation. These enterprises provide employment to large number of people and contribute significantly to growth and GDP of an economy. In the world economy, knowledge as a determinant of competitive advantage is gradually replacing traditional factors of production like labour and capital. In order to survive and compete in the globalized market, small and medium enterprises need to use knowledge to innovate. In India, small and medium enterprises contribute about 45 per cent of the gross turnover in the manufacturing sector and 40 per cent of total exports. These small-scale enterprises however, lose out to the big enterprises in terms of financial sustainability, range of products, marketing clout, brand and bargaining power. At the same time, it is observed that there are number of small and medium enterprises which are growing and becoming competitive. These enterprises operate in a niche area, produce better products and keep on innovating in their operations through improvement in technology and introduction of modern technology. Innovation has become one of the dominant paradigms in management and research. It has been described as the 'Industrial Religion of the 21st century' that offers both a belief and a palliative concerns about economic change, re-structuring, competition, competitiveness and survival in a turbulent and uncertain business world. One can create new and differentiating market opportunities by being innovative. Small and medium enterprises (SMEs) can also gain competitive edge over others through innovation. There are several definitions of innovation, each of which suggests different meaning and different forms of an innovative activity. Innovation includes a process that begins with an invention, proceeds with the development of the invention and results in the introduction of a new product, process or service to the market place. It also involves commercialization of new or improved products and process. There is a need to clarify the terms "new", "significant" and "improved". First, what is new to one firm is not necessarily new to another. It is possible that the same behaviour in two separate firms may be labeled as "innovative behaviour" in one firm but not in the other firm. Second, the significant degree of improvement is necessary to qualify one activity as an innovation. Different writers have recognized these differences on innovation and argue on the meaning of the term by presenting different forms and manifestations of the activity. Innovation is of two types: product innovation and process innovation. Product innovation is the development and commercialization of a product with new or improved performance

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characteristics. Process innovation is the development or adoption of new or significantly improved production or delivery methods. It may involve changes in equipment, human resources, working methods or a combination of these. Innovation can also be described as incremental or radical innovation. Incremental innovation involves small significant changes on continuous basis and radical innovation involves big changes that may impact the industry as a whole. In a developing country like India, radical innovations are rare. Most of the innovations are incremental innovations. In innovation, three stages have been recognized: imitation, creative imitation and innovation. Mostly, innovation in developing countries moves from imitation to creative imitation and to innovation. In India, we can define innovation as creation of new and improved products and process and adoption of new technology to produce better products and services.

SMEs: Innovation and Research Issues

It is observed that irrespective of the sector, SMEs in India are characterized with the following features: high contribution to domestic production; significant export earnings; low investment requirements; operational flexibility; location wise mobility; capacities to develop appropriate indigenous technology; import substitution; contribution towards defence production; technology-oriented industries; competitiveness in domestic and export markets. At the same time, it is found that small and medium enterprises have number of limitations which come in their way to survive and grow, namely – low capital base; concentration of all functions in the hand of one/two persons; inadequate exposure to international environment; inability to face impact of WTO regime; inadequate contribution towards R&D; lack of professionalism etc. There is a need to explore the innovative behavior in selected sectors in the small and medium enterprises, like if the SMEs have introduced new technology, what are the factors which have helped in its absorption. Small and medium enterprises are forced to compete with the large enterprises in a more liberalized and globalized business environment. There is a need to investigate as to how innovation is helping the SMEs in competing with the large enterprises and helping in their survival. The study was conducted in four sectors i.e. Auto-component, Pharmaceutical, Information Technology and Textile (Garment Manufacturing).

SMEs: States & Performance

In India, a SSI unit is defined as one where investment in plant and machinery whether held on ownership terms or on lease or by hire purchase does not exceed Rs.5 crore (Rs.50 million). Micro-enterprises are popularly known as "Tiny Units". A tiny unit is one where investment in plant and machinery does not exceed Rs.25 lakhs (Rs.2.5 million). The medium enterprise is defined as one where investment in plant and machinery whether held on ownership terms or on lease or by hire purchase does not exceed Rs.10 crore (Rs.100 million). The SMEs sector in India contributes 8 per cent to India's GDP. It is estimated that in terms of value, the sector accounts for about 45 per cent of the manufacturing output and 40 per cent of the total exports of the country. The sector is estimated to employ about 59 million persons in over 26 million units throughout the country. Further this sector has consistently registered a higher growth rate than the rest of the industrial sector. But inspite of these limitations, the SMEs have made significant contribution towards technological development and exports. SMEs have been established in almost all-major sectors in the Indian industry such as: food processing, agriculture inputs, chemicals and pharmaceuticals, engineering/electricals/electronics, electro-medical equipment, textiles and garments, leather and leather goods, meat products, bio-engineering, sports goods , plastics products and computer software.

Mostly, innovation in developing countries moves from imitation to creative imitation and to innovation. In India, we can define innovation as creation of new and improved products and process and adoption of new technology to produce better products and services.

The Indian IT sector is one of the most dynamic sectors and has been through variety of changes in the recent areas. Participation of small firms in this sector has been quite high. The NASSCOM data suggests that IT industry has a large number of small enterprises. About 88 per cent of the total firms have a turnover of less than Rs.10 crore which are considered as medium enterprises. This suggests that large shares of IT firms are small entrepreneurial ventures managed by self-employed individuals. However, the industry is highly skewed in terms of share of the market: top 5 firms have a share of 32 per cent in the revenues. The next top 47 firms with a turnover between 100 and 1000 crore had a share of 35 per cent . Firms with turnover of less than 100 crores (98 per cent of the total firms) have a share of only 11 per cent (NASSCOM, 2003).Moreover, a comparison of the size distribution of firms for recent years with some earlier years would suggest that small firms have grown slowly in recent years (NASSCOM, 2003).In case of pharmaceutical sector, there are large numbers of small pharmaceutical firms in India, almost all of which are small. According to the McKinsey Report, Indian pharma 2015 *(Unlocking the potential of the Indian pharma market)*, the Indian pharmaceutical industry is growing in leaps and bounds with a CAGR of 13 per cent from 2002 to 2007, and is expected to grow at a CAGR of 16 per cent over 2007 to 2011.The industry is on the global radar now, more than ever with India, being viewed as the most sought-after destination for pharmaceutical activities, primarily research and development and clinical research. India's prominent position in the world pharmaceutical sector can be credited, in part, to her mastery over pharmaceutical engineering technology, and reverse engineering of patented drug molecules. In case

of auto-component industry, these firms are driven by global competition and the recent shift in focus of global automobile manufacturers, business rules are changing and liberalization has had sweeping ramifications for the industry.The Indian auto-component sector is one of the few sectors in the economy that has a distinct global competitive advantage in terms of cost and quality. India's process-engineering skills, applied to re-designing of production processes, have enabled reduction in manufacturing costs of components. The Indian auto-component industry is extensive and highly fragmented. Textile industry accounts for about 8 per cent of GDP, 20 per cent of the industrial production and over 30 per cent of export earnings of India and has only 2-3 per cent import intensity. About 38 million people are gainfully employed with the industry making it the second largest employment providing sector after agriculture.

Empirical Findings and Analysis:

The study that was conducted in Delhi, NCR showed that innovative practices followed by SMEs in the selected sectors vary to a great extent. It depends on different factors like nature of product and process, supply and demand pattern, kind of raw material used, skill requirement and market forces. These practices are driven by needs of customer and their individual capacity. Moreover, these practices are also integrated together in some other sectors which give rise to another innovation. This integration makes enterprises more competitive and also provides more benefits to customers. In Information Technology sector, custom application development and maintenance (CADM) are used by SMEs. This is a system where enterprise develops customized application and maintains it. In addition, enterprises use system integration, infrastructure management services, I.T. consulting, application management and use of customer/employee identification using smart cards embedded with smart chips. These cards are RFID enabled and provide information regarding the customer. These enterprises further adopt the use of digital signage, mobile point of sale (POS) and intelligent database. Customer care portal (CCP) is also used by some enterprises where the aim is to help service providers integrate their I.T. environment cost effectively. Some of the innovative practices followed by the SMEs in case of auto-component sector and textile (garment manufacturing) include use of CAD/CAM. This refers to integration of computer-aided design (CAD) and computer-aided manufacturing (CAM) systems during product development. This also includes use of automated supervisory control and data acquisition (SCADA) system. In this system, both supplier and client are linked by a computer network. In the case of garment manufacturing

Table 1: Comparative Study of Sectoral Innovation Behaviour in Small and Medium Enterprises

Parameters	I	II	III	IV	V	VI
Industry	**Information Technology**	**Information Technology**	**Information Technology**	**Pharmaceutical**	**Pharmaceutical**	**Pharmaceutical**
Size	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**
Type of Innovation	Product/Process (Offshore programming and IT consulting with programming languages i.e ASP.NET, VB.NET, C#.NET,VB6.0, SQL Server etc.)	Product/ Process (Computer peripherals, desktops, notebooks, TFT-LCD monitors, GSM mobile phones, DVD players.)	Product/Process (End-to-end billing and content management solutions for communication service providers, financial services, media.)	Product (A wonder drug Jyoti Amritum DS for HIV/ AIDS. It is simple herbal formulation with no side-effects and affordable at all stages of disease.)	Product/Process (Manufactures a liposomal drug. This is the best oral antifungal broad-spectrum drug for continuation of treatment of fungal infections.)	Process (All the raw materials are inspected and tested. All the products are manufactured in accordance with cGMP guidelines.
Barriers	Financial/ Technical/ Marketing/ Hiring/ Building Customer Trust	Internal/ Technical/ Building Customer Trust	Marketing/ Building Customer Trust	Drug Testing, Marketing, long time to make new drug, Building Customer Trust	Marketing, High Cost of R&D.	Marketing/ Building Customer Trust
Management of Innovation	Cost cutting/ hiring competent engineers/ technical training	Cost cutting/ hiring competent engineers/ technical training	Hiring competent engineers/ training/ R&D/ networking	Cost cutting/ networking/ taking govt. support(DST)	Focus on infrastructure/ technical assistant from associations.	Networking with other enterprises.

sector, practices such as use of no-pilling fabrics, use of fabrics with micro craters for special finishing, use of low density fabric, use of decatizing process, use of Microelectronic control units which are attached to the standard industrial sewing machine to handle more complex tasks. Practices such as use of novel drug delivery system (NDDS), clinical research work are used in case of pharmaceutical sector. Some SMEs have even done research on medicine for deadly disease like HIV virus. They are also engaged in developments and commercialization of technologies that have led to the successful launch of Liposomal drugs. They also deploy use of Liposome Technology to ensure the best quality of the products. These innovations are aimed at making life-saving drugs affordable to everybody. There are some SMEs which are engaged in clinical research also. Apart from these practices, small and medium enterprises across the sample sectors also implement six-sigma techniques to ensure better quality.

Comparison of Innovation in Sample Sectors

The analysis of innovation behavior in the selected sectors shows that SMEs vary in their innovative behaviour. This variation is due to factors like nature of the product, product life cycle, financial position of enterprise, growth of the sector, demand and supply factors. In the initial phase of their development, these enterprises face barriers like financial, technical and operational but they focus on their present strength to manage these barriers. Over a period of time, they have established themselves. The comparative study of innovation and its management in small and medium enterprises is given in Table 1.

The scope of innovation also varies across the selected sectors. This is influenced by factors such as nature of sector, interdependency on the other sectors, seasonal demand patterns and cost of innovation. For example, in auto-component sector, SMEs have tier structure where they are suppliers to large enterprises. So they make products as per specifications mentioned by them. In case of Information Technology sector, the scope of innovation is wide because of its interdependency with the other sectors. For example – the software required for auto-component or pharmaceutical or garment manufacturing will have different parameters and will produce different output. In pharmaceutical sector, the scope is limited in product innovations because of the high cost of R&D and long time in developing a new medicine. Therefore, most of the enterprises focus more on process innovations or incremental innovations. As far as textile (garment manufacturing) sector is concerned, the scope is limited. This is because the demand pattern fluctuates very fast, products have seasonal demand and the different types of garment which are worn by people are limited.

Conclusion

Some of the innovative practices followed by the auto-component sectors include the use of CAD/CAM that refers to integration of computer-aided design (CAD) and computer-aided manufacturing (CAM) systems during product development, automated supervisory control and data acquisition (SCADA) system. In information technology sector, innovative practices that are used are custom application development and maintenance (CADM), system integration, use of digital signage. In the case of textile (garment manufacturing) sector, practices like use of no-pilling fabrics, fabrics with micro craters for special finishing. In case of I.T. sector, both product and process innovations have been observed. As the sector is very profitable, it has been able to make a difference in the other sectors due to integration of operations. Therefore, both product and process innovations happen frequently. In case of pharmaceutical sector, practices like novel drug delivery system (NDDS), clinical research work are followed. It is evident that the cost of research and developing a medicine is very high. These costs have been rising even though pharmaceutical companies have been concentrating on stopping investment on products that are unlikely to make it to the market and have reduced overall time between synthesis and launching. This increase is due to the shift to more complex products.

Table 2: Scope of Innovation in SMEs

S.No.	Sector	Scope of Innovation
1.	**Auto-Component**	The scope is limited in product innovation as SMEs work in Tier system and mainly supply to OEM/ Large enterprises. They get designs from large enterprises and make components as per the fixed specifications. But there is scope for process innovation as they thrive for quality improvements in the final products.
2.	**Information Technology**	The scope of innovation is wide because of use of technology in the other sectors. Even small incremental innovation can produce more benefits financially and non-financially. For example – If an enterprise adds one more feature in the software, it can charge more money from the clients.
3.	**Pharmaceutical**	The scope is limited in product innovations because of the high investment involved in the innovation and less resultant output. The period of developing a new drug is also very long. But there is scope for process innovations or incremental innovations in the clinical research and new drug delivery systems.
4.	**Textile (Garment Manufacturing)**	The scope of product innovation varies in different sub-sectors. It is limited in fabric production but it is quite high in textiles/fabric design. As the demand pattern changes very fast, product innovation is limited. Moreover, the type of categories in garment is limited so it limits product innovation also.

Moreover, the number of trials required to support a new product has risen over the last ten years. There is also a general consensus regarding payback time of innovation. The payback time of innovation is often very long. In case of auto-component sector, the product designs are provided by the large enterprises so there is very less scope for product innovation in SMEs. Most of the innovators in case of SMEs focus on process innovations. SMEs work in tier system and mainly supply to OEM/ Large enterprises. They procure design specifications from large enterprises. Then they make components as per the fixed design specifications. But they do adopt innovative practices in processes to maintain quality. This helps them in maintaining competitive edge. In case of textile (garment manufacturing), the pattern of demand changes very frequently. Moreover, there are limited types of garments that are normally worn by people. Due to these reasons SMEs prefer to focus more on the process innovations than on product innovations. The small and medium enterprises recognize the use of technical and financial information, new research information or latest trends in the market. But the extent of their usage varies across the sectors. Innovative enterprises have progressed to medium level from small level. This is an important factor in case of labour-intensive sector like auto-component and textile (garment manufacturing) sector but it is not an important factor in case of knowledge intensive sector like information technology (I.T.) and pharmaceutical sector. It is further found that older firms are innovative in case of auto-component and textile sector but in case of I.T. and pharmaceutical sector, even new firms are adopting new technologies. The results further present that enterprises are more into process innovations than into product innovations. Only in case of information technology sector, SMEs are engaged in both process and product innovations.

Implications and Recommendations

The findings of the study reveal that the small and medium enterprises in selected sectors adopt innovative practices which are different in different sectors. Keeping in view the above results, following recommendations are suggested:

1. There should be some mechanism by which SMEs are motivated to innovate. This can be done by instituting monetary/non-monetary rewards for innovative firms. This will also provide motivation for non-innovative firms to change.
2. There is a need to focus on up-gradation of infrastructure. It will provide progressive environment to the SMEs for innovating.
3. There is a need to develop a progressive environment based on trust and competition.
4. There is a strong need to maintain the database of SMEs which are innovative and non-innovative.

...older firms are innovative in case of auto-component and textile sector but in case of I.T. and pharmaceutical sector, even new firms are adopting new technologies. The results further present that enterprises are more into process innovations than into product innovations. Only in case of information technology sector, SMEs are engaged in both process and product innovations.

5. This database can be made sector wise as innovations and its underlying reasons differ across sectors.
6. Small and medium enterprises in different sectors need to analyze new techniques to manage innovation as innovation is the only vehicle that can take them long way in this competitive journey. It will also provide a clear picture of sector wise innovation in India if sector wise data can be collected.

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DO YOU KNOW?

Carbon Credits

A carbon credit also called as carbon offset, is a financial instrument that denotes one tonne of CO2 (carbon dioxide) or CO2e (carbon dioxide equivalent gases) reduced from the atmosphere as a result of any emission reduction project to offset the carbon emissions that they produce. They are based on the concept of 'polluter pays' by complying with the 'cap and trade' principle to bring down the amount of carbon emissions. The main objective of carbon credits and its market is to reduce the harmful greenhouse gas emissions into the atmosphere. This is achieved by bringing together the various voluntary organisations that possess the rights to issue and exchange these carbon credits. All the listed companies and their administration decides the total amount of carbon emissions that is allowed to emit as a group, and this amount is usually kept below the amount emitted in the previous year, so as to keep reducing the level of emissions with each passing year. After, the total amount of green house gas emissions is worked out, each company is delineated an amount. If during that year the company is able to emit less than their limit, it can sell the remaining to another company and this transaction does not affect the target emissions of the group. This means that the overall amount of emissions allowed remains unchanged and only the shifting takes place among the member companies. This motivates the companies to emit less than their specified amount that can also add to their Corporate Social Responsibility. And the companies who exceed their limit of emissions have to pay for that surplus by purchasing the new permits. So, in a way, it urges the company to emit out less to gain extra profit by marketing their right to 'pollute'. In this way, the Greenhouse gas mitigation projects can generate credits, that can be used to fund carbon reduction schemes between trading partners both at the domestic level and international level, particularly in developing nations contributing to Clean Development Mechanism (CDM) as a part of Kyoto Protocol.

Being a developing country, India is capable of handling the CDM projects in sectors like power, steel, cement, textile, fertilizers, wind mill and biogas production, that can help produce carbon credits that could be marketed in the developed nations. In India, Delhi Metro Rail Corporation (DMRC) became the first rail project in the world to earn carbon credits by employing regenerative braking system in its rolling stock that can reduce 30 per cent electricity consumption.

Net-neutrality

Net-neutrality, a term coined by Columbian Law Professor, Tim Wu, is the principle according to which, the data packets on the Internet are allowed to move impartially, with regard to the content, source or destination. Since Internet usage is a basic and fundamental component of freedom of speech and hence democracy, the web activists around the globe have been asserting that Internet should remain free for all, serving as an open platform to bring about competition and innovation. However, now the Internet Service Providers (ISPs) argue that since they are providing the user a service, they should be allowed to decide as to how they will deliver it and even charge their users for the same. This is a challenge to the idea of net-neutrality. ❑

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YOJANA WEB- EXCLUSIVES

Yojana publishes articles on various topics in its 'Web-Exclusives' column for the benefit of its readers on the website of Yojana : www.yojana.gov.in. Announcements about the articles under the Web-Exclusives section are carried in the Yojana magazine of the month.

We are carrying the following articles under the Web-Exclusives section of Yojana for November 2014

1. India's Resilient External Debt - Dasarathi Mishra
2. Sustainable Rural Economy Through Informed Community: A Perspective Towards Indian Situation- Arobindo Mahato
3. Role of Agricultural Infrastructure in Agriculture Development -Jaideep Kharb

Please send in your comments and suggestions to us on ***yojanace@gmail.com***

Labour Reforms to boost Employment

A string of labour reforms that seek to boost employment and provide social security benefits to labourers was announced by the Prime Minister on 16th October, 2014. Clubbed under the Pt. Deen Dayal Upadhayay Shrameva Jayate umbrella programme, the five main schemes launched are :

- A dedicated Shram Suvidha Portal: That would allot Labour Identification Number (LIN) to nearly 6 lakhs units and allow them to file online compliance for 16 out of 44 labour laws
- An all-new Random Inspection Scheme: Utilizing technology to eliminate human discretion in selection of units for Inspection, and uploading of Inspection Reports within 72 hours of inspection is mandatory
- Universal Account Number: Enables 4.17 crore employees to have their Provident Fund account portable, hassle-free and universally accessible
- Apprentice Protsahan Yojana: Will support manufacturing units mainly and other establishments by reimbursing 50 per cent of the stipend paid to apprentices during first two years of their training
- Revamped Rashtriya Swasthya Bima Yojana: Introducing a Smart Card for the workers in the unorganized sector seeded with details of two more social security schemes.

The Shram Suvidha Portal has been launched to create a conducive environment for industrial development. The four main features of this Portal are:

a) Unique Labour Identification Number (LIN) will be allotted to units to facilitate online registration.

b) Filing of self-certified and simplified Single Online Return by the industry. Now Units will only file a single consolidated Return online instead of filing 16 separate Returns.

c) Mandatory uploading of inspection Reports within 72 hours by the Labour inspectors.

d) Timely redressal of grievances will be ensured with the help of the portal. The portal will be operative in four central organizations namely Chief Labour Commissioner, Directorate General of Mines Safety, Employee Provident Fund and Employees' State insurance Corporation. In this endeavor of the Ministry, complete information of all 11 lakh units for these organizations has been collected, digitized and de-duplicated reducing the total number to 6-7 lakh. It is proposed to allot LIN to all these 6-7 lakh units.

To bring in transparency in labour inspection, a transparent Labour Inspection scheme is being developed. The four features of the inspection scheme are:

(i) Serious matters are to be covered under the mandatory inspection list.

(ii) A computerized list of inspections will be generated randomly based on pre-determined objective criteria.

(iii) Complaints based inspections will also be determined centrally after examination based on data and evidence.

(iv) There will be provision of Emergency List for inspection of serious cases in specific circumstances. A transparent Inspection Scheme will provide a check on the arbitrariness in compliance mechanism. Immediately on inauguration, an sms/email were sent to 1800 Labour inspectors of these enforcement agencies.

Dedication of Portability through Universal Account Number (UAN) for Employees Provident Fund:

Under this scheme complete information for approximately 4 crore subscribers of EPF has been centrally compiled and digitized and a UAN has been allotted to all. The UAN is being seeded with Bank account and Aadhar Card and other KYC details for financial inclusion of vulnerable section of society and their unique identification. Camps are being organized to facilitate opening of bank account and Aadhar card for those subscribers who have no bank account or Aadhar card as on date. This will ensure portability of the Social Security Benefits to the labour of organised sector across the jobs and geographic areas. The EPF account of employee will be now be updated monthly and at the same time, he will be informed through sms. Finally it will ensure that each of the 4 crore or more EPF account holders have direct access to their EPF accounts and will also enable them to consolidate all their previous accounts (approximately Rs 27000 Crore are currently lying with EPFO in inoperative accounts). Subscribers have been informed through sms/email immediately on inauguration. The minimum pension for employees has been introduced first time so that employees'

pension is not less than Rs. 1000 per month. The wage ceiling has been raised from Rs. 6500 to Rs. 15000 per month to ensure that vulnerable groups are covered under EPF Scheme.

Recognition of Brand Ambassadors of ITIs :

The Industrial Training Institutes (ITIs) in the country are the backbone of the vocational training system, only source of supply of skilled manpower to manufacturing industry. There are 11,500 ITIs having about 16 lakh seats. But this is grossly inadequate for supplying skilled manpower to Indian industry. Only 10 per cent of the workforce has got formal or informal technical training. Only one fourth of this is formally trained. A major initiative has been undertaken to revamp the apprenticeship Scheme in India after extensive consultation with industry, states and other stakeholders with the vision of increasing apprenticeship seats to more than 20 lakhs in next few years. There are four components of this initiative, which are given below:

a. Making the legal framework friendly to both, industry and youth. The necessary Bill amending the Act was placed and passed in Lok Sabha on August 14, 2014. b. Enhancing the rate of stipend and indexing it to minimum wages of semi skilled workers. c. Apprentice Protsahan Yojana which will support manufacturing units mainly and other establishments by reimbursing 50 per cent of the stipend paid to apprentices during first two years of their training. d. Basic training component (mainly class room training part) of the curricula is being restructured on scientific principles to make it more effective, and MSMEs will be supported financially by permitting this component in government funded SDI scheme.

The Apprentice Protsahan Yojana will support one lakh apprentices during the period upto March 2017. Selected Apprentices and the Establishments ready to participate in this scheme from various states will be invited and it is proposed that Prime Minister will give sanction letters to these to mark the launch of the new scheme.

NORTH EAST DIARY

POWER SCHEME FOR ARUNACHAL PRADESH AND SIKKIM

Under a new Central Sector Plan Scheme, the Ministry of Power approved the Comprehensive Scheme for Strengthening of Transmission & Distribution (T&D) Systems (CSST&DS) in the north eastern states of Arunachal Pradesh and Sikkim, with an expected cost of Rs.4754.42 crore. The scheme will be undertaken to strengthen the intra–state T&D systems in the North Eastern states that have remained very weak. At present , only 5 out of 20 districts of Arunachal Pradesh are connected to transmission network at 132/220 KV. The 33 KV system is the base of power distribution system in the State. The power demand in Arunachal Pradesh is scattered over large distances since it has low density of population, which is spread over its geographical area of 84000sq.km. Keeping that in view , it will take up the projects for strengthening intra–state T&D systems of the two States through 31 new 132 KV sub–stations, 14 substations of 66/11 KV, 2035 km of transmission lines (132 & 220 KV) and 2204 km of transmission lines (33 & 66 KV). The project would be implemented through PGCIL with its consultancy fee of 1.2 per cent of its implementation cost. These projects would be owned and managed by the State governments once they are commissioned. ❑

ARUNACHAL TO GET INDO-CHINA FRONTIER HIGHWAY

An Indo-China frontier highway is all set to come up in the north eastern state of Arunachal Pradesh. This highway would be built parallel along the McMohan line in Arunachal Pradesh and would have a length of 1800 kms.The proposed highway will traverse through East Kameng, Tawang, Upper Subhansiri, Upper Siang, West Siang,Kibito, Dong, Chaglagam, Desali, Dibamg valley, Vijaynagar, Hawai in the border areas of the state.This proposed highway will be built up with the objective to facilitate smooth travel from one part of the state to its other parts and it will be intersected with tunnels to have the continuous link since this area has rough snow fed terrain. This highway will be the biggest single project in infrastructure in the history of India with its expected cost of more than Rs. 40,000 crore. After its work, an industrial corridor is also slated to come up in the southern part of Arunachal and eventually all the three projects will be interconnected. ❑

CENTRE AIDS INFRASTRUCTURE IN NORTH EAST

The centre has provided Rs.3000 crores to be utilized by the state governments in the north eastern region with the aim to build up the network of roads to better the connectivity in the states citing the growth in its tourism and trade sector. The centre is now giving much emphasis through its investment in the north eastern region to upgrade the existing infrastructure in order to boost the booming tourism in these scenic mountainous states. ❑

Sanitation Situation In India: An Analysis

Srishty Anand

Never has such a benevolent cause been addressed from that podium to be greeted with a dispensation of resources from business industry at this rate. Time will bear witness to how it fructifies

THE PRIME Minister has recently been voicing concerns regarding rather unusual and infamous issue- cleanliness and open defecation. He simultaneously invoked Corporate Social Responsibility wing of industry of how CSR must be taken up to its intent. Tata Consultancy Services pledged 100 crores for constructing 10, 000 toilets in schools, Coal India' 235 crores for improvement of sanitation in schools, Bharti Foundation' 100 crores for toilet creation in Ludhiana, HUL' initiative to create 24,000 toilets by 2015, ITC plans to build 10, 000 toilet facilities… it's a lengthy list.

The Problem

It is no news that a little more than half of India's population practice open defecation according to latest MGD India Country 2014 report. It is no novel challenge as portrayed by unprecedented pouring in of resources as though to terminate an epidemic. Open defecation is no malaria or plague that marked its presence in India a couple of months or years ago. It has always been there and its stranglehold has tightened over the decades. Sanitation has perpetually been under Indian government's radar since it was added to the national agenda during the country's First Five-Year Plan (1951-56). However, Government of India's first programme, Central Rural Sanitation Programme (1986), on rural sanitation came with the thrust of the International Water and Sanitation Decade in 1980's. Later, the reputed Nirmal Bharat Abhiyan (NBA) was implemented with effect from April 1st, 2012- beginning of the 12th Five Year Plan of Government of India. NBA overrode Total Sanitation Campaign, initiated in 1999, and was strengthened with the objective of accelerating the sanitation coverage in rural areas. It was a mere change in nomenclature while the agenda remained more or less similar. As per NBA baseline survey, in 2011-12, the nation spent Rs.1916.32 crores while in 2012-13 the figures stood at Rs. 2909.26 crores. These are the combined share of both central and state government after which the percentage of individual household toilets in India is 40.20 per cent. One can only imagine the national funds have been flushed in this sector and to what end. So the question is not as much about the financial sustainability as much as the lack of implementation and understanding of loopholes in the sector. HUL announced its target of building 24, 000 toilets till 2015 not after 15th August, 2014, but in November 2013. As much as the media has lauded re-appearance of these figures, roughly 110 toilets have been constructed so far as per its website accessed on 24th September,2014 (http://www.domexforsanitation.com/contribution.php). This therefore, questions not just credibility of vows the corporates take, but also the underestimation of road blocks in the sanitation sector. The players of not so successfully pitched programs as NBA and HUL have to enter into a dialogue to settle on a methodology to attain a brilliant

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break through if they really intend to do what they have pledged. Pumping funds, without any technical know-how or partnership with someone who does, seems more of a populist measure than anything else.

One must question and also seek an answer as to why have the continuous efforts by the Government of India in the past three decades failed or, to say the least, been inconsequential. Where is the strategy faulting? Significant numbers of toilets are being built, then why does India top the global chart with such an abominable rates of open defecation? 75 per cent of all Indian households reported having individual latrine as per Ministry of Sanitation and Drinking Water in 2011 as opposed to 32.70 per cent by Census 2011. This mismatch, often termed as 'missing' or 'ghost' toilets, was partly due to over-reporting and also due to rise in population. The gaffe was also due to the lack in supporting infrastructure and provisions like water, waste disposal and sewerage. Toilets, without any water facility to sustain its hygiene levels and with clogged sewerage such that the pots are overflowing, will never suffice in an attempt to eliminate open defecation. Meeting a 'target' for construction of 'x' number of toilets alone is not worthy for applaud. Construction alone doesn't implicate usage. It involves anomalies like supportive infrastructure, citizen's mindset and civil use of the given infrastructure. For a '*Swachh Bharat*', these anomalies have to be taken into account. In an urban setting, for example, for a public toilet to be fully functional, interdepartmental cooperation is germane. The water supply department (Jal Board), Municipal Corporation and public- as an anonymous but responsible entity, have to work together.

So to conclude this section, one doesn't have any qualms about the Prime Minister pin pointing an issue and the corporates recognizing a long prevalent problem. Instead, it is a suggestion that let's not forget what has been accomplished however minuscule and rush towards starting afresh. Rather let's converge and unite the resources to achieve a '*Swachh Bharat*' because implementation and sustenance reinforces successful expenditure of the funds available.

From Citizen's Viewpoint

Molestation, rapes and gang rapes due to open defecation has archaically being recorded as episodes of mishaps, especially in rural India. The bone of contention here is not that the effort that has been mobilized after PM's speech, as much as 'why now'. Can we say that the nation's conscience had a stroke of awakening regarding a long prevailed social deprivation and its soul rendered to its dear '*maa-o aur behen-o*' who have been bearing the brunt of it all this while? Can we say that the corporates who have so promptly hopped on this bandwagon of eliminating open defecation are truly presuming the roles of devoted citizens and their chosen cause is free of any political innuendoes whatsoever? One might beg to differ and want to see what's in the underbelly of this charity. All the CSR activities and funds thereon were diverted towards proper sanitation of India, as if current problems of poverty, hunger, illiteracy, ecology and environmental depletion were off the list. As much as one can appreciate PM's perspective without a speck of doubt atleast, the pilgrims on their way to the altar of 'sanitation drive' have had their conscience crippling tainted. What happens when the party is not in power and there's no such 'vision' to emulate- women's quandaries get pushed onto the periphery and a long wait for a whistleblower ensues? Such a chain reaction is rare to see in Indian polity and hence narrates volume about the same.

Whose Narrative is This Anyway?

The atrocious gang rapes and killing of women is what has been framed as the foundation of all this policy formulation regarding elimination of open defecation and restoring women's dignity. One can't hesitate from claiming this as shameful. India can't be unwary of the cost at which we will, if we ever do, attain zero open defecation. Its cost is- dignity of adolescent girls and women, the insensitivity with which their pains are dealt with if they ever garner courage to file a complaint, the injustice they are served with if they manage to file one and indignation of their families. None of this was thought to be a cause worth moving resources until the PM uttered those profound words. Women's narrative of their very own everyday experience went unheard except when a man chose to voice it on their behalf from Red Fort's pedestal marking India's 67th Independence Day. A red letter day for the women nonetheless. Never has such a benevolent cause been addressed from that podium to be greeted with a dispensation of resources from business industry at this rate. Time will bear witness to how it fructifies. ❑

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Joint Indo-Canadian Science Programme Focusing on Clean Water Technologies

A joint Indo-Canadian science programme focusing on clean water technologies was launched recently. The new programme will be pursued through a joint collaboration between the Department of Science & Technology and the National Science and Engineering Council of Canada. This joint venture would enable building up of 'Safe and Sustainable Infrastructure' and 'Integrated Water Management', thus addressing the vital aspects related to effective water management and clean water supply. This new initiative is in keeping with the Prime Minister's, "Clean River Mission" and "Clean Ganga Mission", and will help develop a value based relationship and also enable to promote industrial research & development (R&D) projects with application potential through participation of scientific institutions and industrial units. The Department of Bio-Technology under his Ministry is already, in cooperation with Canadian agencies, working on a number of projects to develop a software product for non-invasive detection of tumours using MRI and PET images. This will also contribute in making India a manufacturing hub for affordable and innovative products taking cue from Prime Minister's widely acclaimed "Make in India" call.

Development Roadmap

Agro-food processing Facility Launched

India Food Park - one of India's largest facilities for processing agricultural produce was launched recently by the Prime Minister. Built under PPP(public private partnership) model, the agri food facility is located in Tumkur, 80 kms from Bangalore. Spread across 110 acres, it has the latest technology for food processing, cold storage and ready to eat foods. The facility is expected to directly benefit over 6000 farmers and is projected to provide indirect employment to over 25,000 people. The Food Park has facilities such as incubation centres, R&D laboratory and alliance with international testing laboratories. The mega food park infrastructure project is a flagship programme of the ministry of food processing industries. The objective of the programme is to provide state-of-the art infrastructure facilities for food processing along the value chain from the farmer to the market. The government plans to have four more food parks and 17 mega parks under the food processing ministry.

Financial Assistance for Construction, Operation & Maintenance of Pay & Use Toilets

The Swachhta Udyami Yojana for extending financial assistance for construction, operation & maintenance of Pay & Use Community toilets as also procurement & operation of sanitation related vehicles was launched recently. The scheme, launched under PPP mode, has the twin objectives of cleanliness and providing livelihood to safai karamcharis and liberated manual scavengers.

The objective of the scheme for construction, operation and maintenance of Pay & Use community toilets is to provide easy accessibilty of the community toilets to household who do not have this facility as also for the floating population in public places with high foot falls such as bus stops, railways stations, etc. Proper maintenance of such facilities by the entrepreneurs with a stake in the scheme, could also be ensured. Manual scavenging could also be done away with through this scheme. Individual beneficiaries and self-help groups (through state channelising agencies-SCAs) are eligible for assistance through the scheme in collaboration with reputed organsiations. A maximum amount of Rs 25 lakh with repayment period of upto 10 years and at a rate of interest of not more than 4 per cent per annum would be given as loan for setting up of a unit of 10 seater toilet . Women beneficiaries would be eligible for a rebate of 1 per cent per annum on interest and beneficiaries making timely repayment would be eligible for rebate of 0.5 per cent. There would be a moratorium period of six months in addition to implementation period of six months. Manual scavenegers would be able to avail a maximum subsidy of RS 3.25 lakhs under the self employment scheme for rehabilitation of manual scavengers (SRMS) in accordance with the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act.

The scheme for Procurement & Operation of Sanitation related vehicles has been launched with the objective of creating appropriate infrastructure for tapping under utilized potential, facilities for collection of garbage from the source and employment opportunities for the target group of safai karamcharis/manual scavengers. The scheme is open to manual scavengers/safai karamcharis who will be given maximum loan amount of Rs 15 lakhs per beneficiary or per self-help group with a repayment period of upto 10 years. As in the other scheme, the rate of interest would be not more than 4 per cent per annum with a rebate of 1 per cent per annum on interest for women beneficiaries and a further rebate of 0.5 per cent for beneficiaries for timely repayment. The moratorium period and subsidy are the same as in the other scheme.

Programme for Value Addition of Dehaired Pashmina in Leh

The Pashmina Promotion Programme (P-3) was launched recently by the Ministry of Textiles. The foundation stone of Pashmina Dehairing Plant at Pashmina Dehairing Plant Complex, Skalzangling, Leh was also laid.

Under P-3, major provision has been made for establishment of latest technology imported Pashmina Dehairing Plant at Leh with a total grant of Rs.19.35 crore including other machineries like Scouring, Drying, and boiler along with construction of building for installation of these machineries at Leh. The existing Dehairing Plant has obsolete Chinese dehairing machine and is not sufficient to de-hair 45 tonne of Pashmina wool produced here. With present capacity, it can only de-hair up to five tonne pashmina, leaving 40 tonne to be sold in the market as raw, which renders loss of value addition of Pashmina. The capacity of the proposed new imported plant would be 10 kilogram pashmina per hour with approximate cost of Rs.11 crore. Under the Pashmina Promotion Programme (P-3) ,additional financial assistance of Rs. 30 crore for improving quality and quantity of pashmina wool as well as living standard of poor nomads (wool growers) of Ladakh region has been announced. Financial assistance would be provided under different components like creation of Common Pashmina Facilitation Centre for Wool testing, Disease Surveillance Centre, Geographic Information System (GIS) Lab, Shelter for Nomads, Portable Electric Units for Handloom Spinning/Weaving, Solarized Community Centres, Open Fodder enclosures, establishment of Pashmina Dehairing Plant, Distribution for Foundation Stock to farmers and construction of shelter for Housing of Pashmina Stock.

The Ministry of Textiles is implementing Pashmina Wool Development Scheme with the help of Ladakh Autonomous Hill Development Council, Leh from 10th Five Year Plan for development of this Sector in Ladakh region. In the 12th Plan, this programme has been expanded with enhanced financial assistance of Rs. 41.21 crore. Ladakh region produces the finest Pashmina wool (specially fiber) in the world, which has a high global demand . Ladakh region produces about 45 tonne of Pashmina wool every year from the population of about 2.50 lakh Pashmina goats. The Programme aims to increase pashmina wool production up to 65 tonnes by the end of 12th Five Year Plan.

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