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## Industrialisation, Innovation and Infrastructure for Achieving SDGs in India

### Introduction

The Sustainable Development Goals (SDGs) involve a significant step forward from the Millennium Development goals (MDGs). Drawn from the Rio+20 outcome document, – the Future We Want – the goals are intended to advance sustainable development through greater integration of its three pillars: economic, social, and environmental. Apart from having a broader perspective, the SDGs have explicitly recognised the key roles of science, technology innovation (STI), along with information and communications technology (ICT), industrialisation and infrastructure. This is evident from goal 9, which calls for building resilient infrastructure; promote inclusive and sustainable industrialisation and foster innovation.

While dealing with SDG 9, it needs to be noted that the relevance of the Goal as well as the targets therein, in the Indian context, cannot be overemphasised. For focussed discussion the targets specified under Goal 9 may be grouped to:

- Building up of an internationally competitive, socially inclusive and environmentally sustainable manufacturing sector;
- Strengthening STI capability at all levels;
- Harnessing ICT for development; and
- Building resilient infrastructure.

In what follows, we shall, discuss each of these objectives in some detail keeping in view the national policies and programmes in these areas.

### Inclusive and Sustainable Industrialisation

It may not be an exaggeration that India's efforts overtime through various policy initiatives and institutional interventions to build a manufacturing base has been remarkable. The focus of these initiatives in the earlier period was to build a regionally balanced and diversified industrial base at the instance of public sector and increased role for the small-scale sector under the umbrella of protection and regulation. Over the years and especially after 1991 the focus has shifted towards evolving an internationally competitive industrial sector with greater integration with the world market. This implied *inter alia* dismantling of barriers to manufacturing, trade and investment (both foreign and local) along with the removal of reservations for the Micro, Small and Medium Enterprises (MSMEs). These initiatives, needless to say, have paid rich dividend as is manifested in the marked increase in the inflow of industrial investment, both local and foreign, and in high growth in the manufacturing output. Nonetheless, India's performance in the manufacturing sector lagged behind when compared to that of the service sector and also in comparison with China and some of the South-East Asian countries. To be more specific, while the share of manufacturing sector in GDP increased from about 9 per cent in 1950-51 to about 15 per cent by 1990. During the last 25 years after globalisation, the share of manufacturing sector in GDP has shown a marginal decline. This has to be compared with over 30 per cent share of the manufacturing sector in GDP in countries like China and South Korea.

As per the data released by the Department of Industrial Policy and Promotion (DIPP), there has been a marked increase in the inflow of foreign direct investment (FDI) into the country after 1991. India's share in global FDI was only 0.1 per cent by 1990 and by 2009, the share increased to 3.1 per cent. Similar trend could be seen in terms of the share of FDI in GDP that remained less than 1 per cent until 1990 and in recent periods it has been as high as 3.2 per cent. From the perspective of FDI contribution in filling the saving investment gap, it is evident that its share in gross fixed capital formation increased from a very low level of 0.5 per cent in 1970 to over 9 per cent. However, as per the DIPP data the patterns of FDI inflow have been inimical to the objective of achieving balanced regional development. The distribution of FDI into different states indicates that one of the states, Maharashtra, accounted for 36 per cent of the total FDI into the country during 2006-10 (up from 22 per cent during 2000-05). More specifically, while the share of four leading states was about 59 per cent during 2000-05, it increased to 66 per cent during 2006-10. The sectoral composition of FDI in India has also undergone significant change. Studies have noted that during the pre-liberalisation period the bulk of FDI was directed to manufacturing sector but in the post-liberalisation period FDI inflows have been received mainly by the service sector. Share of services, housing and construction in total FDI inflow had been only 8 per cent during 1990-99 which increased to over 41 per cent during 2006-10. Scholars have also indicated that there is an increase in the share of FDI taking place through mergers and acquisitions (M&As). In recent years two-fifths of all FDI inflows took the form of mergers and acquisition as compared to virtually all FDI inflows for greenfield ventures earlier (Kumar, 2000; Beena, 2014).

The share of manufacturing Gross Value Added (GVA) in the total value of output has gradually declined from a peak of 24.9 per cent in 1996-97 to 17.8 per cent in 2010-11. The declining share of manufacturing value added had its implications on the share of labour. When it comes to share of labour in manufacturing value added, it declined from 40.6 per cent in 1980-81 to 22 per cent in 2010-11. This cannot be de-linked from the increasing incidence of contract labour in the organised manufacturing sector

that increased from about 14.5 per cent in 1993-94 to over 26 per cent in 2004-05 (Uma, Abraham and Joseph, 2010). However, the share of profit in value added in the organised manufacturing sector recorded a remarkable increase from 18.5 per cent in 1991 to 53.8 per cent in 2007-08 before moderating to 47.8 per cent in 2010-11. The declining share of wages and increase in the share of profit tend to suggest a process of immiserising competitiveness with implications for inequality and social exclusion.

### Manufacturing Policies and 12<sup>th</sup> Five Year Plan Strategy

The National Manufacturing Policy, which was introduced in 2011, called for a paradigm shift in the manufacturing sector with following specific objectives:

- Increase manufacturing sector growth to 12-14 per cent over the medium term to make it the engine of growth for the economy by enabling manufacturing sector to contribute at least 25 per cent of the National GDP by 2025;
- Increase the rate of job creation in manufacturing to create 100 million additional jobs by 2025 with emphasis on the creation of appropriate skill sets among the rural migrant and urban poor to make growth inclusive; <sup>11</sup>SEP
- Increase 'depth' in manufacturing, with focus on the level of domestic value addition;
- Enhance global competitiveness of Indian manufacturing through appropriate policy support; and
- Ensure sustainability of growth, particularly with regard to the environment.

Moving forward from the National Manufacturing Policy 2011, the manufacturing strategy for the 12<sup>th</sup> plan specified a development strategy by focussing on broad industrial groups and specific industries therein. The key strategies encompassing cross-sectoral themes against the backdrop of the major challenges being faced by the manufacturing sector, specified in the 12<sup>th</sup> plan are the following:

- Technology and depth given the declining value added in manufacturing sector;

- Human resources development considering the skill constraint in fostering manufacturing sector
- Business Regulatory Framework (BRF) considering the various hurdles in the existing policy framework and to enhance the ease of doing business;
- Environmental sustainability by considering the adverse impact of different manufacturing sectors;
- Addressing land and water related issues, recognising the various issues relating to the availability of land and water for industrial development;
- Clustering and aggregation for reaping economies of scale and scope along with facilitating interactive learning;
- Promoting Micro, Small and Medium sized Enterprises (MSMEs)<sup>[1]</sup> considering their significant role in manufacturing output and export earning, balanced regional development, and employment generation, among others;
- Boost manufacturing exports, reforming the role and management of public sector enterprises (PSEs); and finally
- The establishment of National Investment and Manufacturing Zones (NIMZs).

The 12<sup>th</sup> plan strategy has articulated cross cutting issues at four broad categories. The broad categories of industries are: (a) Sectors of strategic importance (covering defence equipment, aerospace, capital goods, and ship building and ship repair); (b) Sectors for basic inputs (that include steel, cement, fertilisers, exploration and development of minerals); (c) Sectors for depth and value addition (that include automobiles, drug, pharmaceuticals and medical devices, petrochemicals, electronics, chemical, and paper); and finally (d) Sectors for employment generation (that include textiles, food processing, leather and leather goods, and gems and jewellery).

### **Make in India**

Towards addressing the manufacturing challenge of India a new flagship programme – Make in India – has been launched by the present government. Make in India aims at inducing companies – local and foreign – to invest in India to make India a manufacturing

powerhouse. The programme focusses on a wide range of industries with considerable potential on account of large domestic market and export competitiveness, which in turn could contribute towards substantial job creation. The industries selected include, but not limited to: automobiles, chemicals, information technology (IT), pharmaceuticals, textiles, ports, aviation, leather, tourism and hospitality, wellness, railways, auto components, design manufacturing, renewable energy, mining, biotechnology, and electronics, among others. The programme, aims at enhancing the ease of doing business *inter alia* by setting up an investor facilitation cell, integrating and providing all the central government services through an e-Biz single window online portal and ensuring all the clearances from the Ministry of Home Affairs within three months.

### **Strengthening Science, Technology, and Innovation Base**

#### *Innovation for Inclusive and Sustainable Development*

If the global development experience is any indication, Science, Technology and Innovation (STI) are the major drivers of national development across the world. According to the national innovation system perspective, which has emerged as the most widely used approach in innovation studies published during the last two decades (Fagerberg and Sappasert, 2011), development of an economy is shaped by its underlying innovation system. It has also been argued that innovation systems approach is eminently suited to understand the bearing of innovation in developing countries (Lundvall, *et al.* 2009). Innovation involves a non-linear process of learning through interaction between different actors and networks leading to competence building at different levels wherein the network of R&D organisations and universities is only one among the many. Central to this process is the co-evolution of innovations and institutions in tune with the changing socio-economic context. More importantly, innovation system is construed not only at the national level, but also at the sectoral/sub-sectoral, regional/sub-regional and at the level of different technologies. It is also understood that since innovation breeds development, for the development to be inclusive and sustainable, the underlying innovation

system has to be inclusive with focus on sustainable technologies (Joseph, 2014a,b). It is the nature of interaction and the co-evolution of institutions and innovations that guarantee an inclusive and sustainable innovation system.

It may be noted that the major point of departure of the SDGs from the MDGs as is evident from Rio+20 outcome document is its explicit recognition of the role of science, technology and innovation in promoting sustainable, inclusive and equitable economic growth. Towards accomplishing this, the Rio +20 outcome document also emphasised the importance of technology transfer to developing countries and recall the provisions on technology transfer, finance, access to information, and intellectual property rights as agreed in the Johannesburg Plan of Implementation. The document further stressed the importance of cooperative action on technology innovation, research and development for capacity building at all levels. In this context, the role of foreign direct investment, international trade and international cooperation in the transfer of environmentally sound technologies has also been highlighted.

### *India's Approach in Perspective*

India is one of the pioneering developing countries that recognised the key role of science and technology in economic development at an early stage. The science and technology paradigm for India was laid down unambiguously by the Science Policy Resolution (SPR) passed by the Indian Parliament in 1958 which called for pursuing self-reliance in technology and highlighted the need to “foster, promote, and sustain, by all appropriate means, the cultivation of science and scientific research in all its aspects – pure, applied and educational”. The agenda was taken forward with the Science Policy Statement (SPS) of 1983 and subsequently by the Science and Technology Policy (STP) of 2003. While the former aimed at achieving technological competence and self-reliance the latter emphasised the need for investment in R&D and integrating programmes of economic and social sectors with national R&D which involves building of a national innovation system.

In sync with the global trend, policymakers in India also have placed science and technology at the centre stage of the agenda of achieving faster, sustainable

and inclusive growth. The decade 2010-20 has been designated by the President of the country as ‘decade of innovation’ and the Prime Minister’s Office had come up with an insightful strategy paper ‘Towards a more innovative and inclusive India: Creating a Roadmap for a Decade of Innovation’ (hereafter the Roadmap). The Roadmap is salutary document setting off a paradigm shift towards harnessing innovation for inclusive development. To begin with, given its concern for inclusive development, innovation has been understood in a broader perspective. The Roadmap departs from the earlier S&T policies when it states: “while we do need to increase R&D investment and efforts, this view of innovation is based on a myopic perception that restricts it to the confines of formal R&D”. Hence it makes the case for a “strong innovation ecosystem shaped by the interactions within and across multiple players such as Government, firms, schools/education and research institutions, finance, individual innovators, customers/users, NGOs and media. Given its broader approach towards innovation and considering the diversity of our country, it also calls for the establishment of innovation councils at the national, state, and sectoral levels.

The Roadmap has an explicit inclusive innovation strategy with a need based approach towards creating an ‘Indian model of development’. In concrete terms, it suggests a strategy that involves facilitation of innovations that lead to frugal cost products and services that are affordable to people at low levels of income. It also provided for an Inclusive Innovation Fund (Rs. 5000 crore) for designing solutions for people at the bottom of the pyramid.

### *Science, Technology and Innovation Policy (STIP) 2013*

The STIP 2013, makes a point of departure from the earlier S&T policies when it stated “science, technology and innovation for the people” as the new paradigm of the Indian STI enterprise. The Roadmap along with the STIP 2013 presents the broad contours of the new inclusive innovation paradigm and the trajectory therein.

The STIP 2013, while translating the Roadmap into policy action for inclusive development, calls for “new structural mechanisms and models to address the pressing challenges of energy and environment, food



and nutrition, water and sanitation, habitat, affordable healthcare and skill building and unemployment”. What is refreshing in the new policy, as compared to its predecessors, is its call for integrating the process of innovation with science and technology and making innovation inclusive as a means to fostering inclusive growth. It induces the national S&T enterprise to embrace S&T led innovation as a driver of development, as innovation is yet to be reckoned as an instrument of policy. Towards ensuring access, availability and affordability of solutions for below the pyramid population it envisages driving investment in science and investment in science-led technology and innovation in select areas of socio-economic importance.

The key elements of the STI policy are:

- Promoting the spread of scientific temper amongst all sections of society.
- Enhancing skill for applications of science among the young from all social strata.
- Making careers in science, research and innovation attractive enough for talented and bright minds.
- Establishing world class infrastructure for R&D for gaining global leadership in some select frontier areas of science.
- Positioning India among the top five global scientific powers by 2020.
- Linking contributions of science, research and innovation system with the inclusive economic growth agenda and combining priorities of excellence and relevance.
- Creating an environment for enhanced Private Sector Participation in R&D.
- Enabling conversion of R&D outputs into societal and commercial applications by replicating hitherto successful models as well as establishing new public-private partnership (PPP) structures.
- Seeding S&T-based high-risk innovations through new mechanisms.
- Fostering resource-optimised, cost-effective innovations across size and technology domains.
- Triggering changes in the mindset and value systems to recognise, respect and reward performances which create wealth from S&T derived knowledge.
- Creating a robust national innovation system.

With respect to innovation, the policy calls for necessary framework for enabling the integration of innovation with science and technology in identified priority areas. It also calls for new structural mechanisms and models to address the pressing challenges of energy and environment, food and nutrition, water and sanitation, habitat, affordable healthcare and skill building and unemployment. The policy acknowledges that innovation for inclusive growth implies ensuring access, availability and affordability of solutions to as large a population as possible.

The policy calls for strengthening science education, setting up of inter-varsity centres, identification of about 10 sectors of high impact potential, participation in global R&D infrastructure and performance linked incentive schemes. The new policy also upholds the need for doubling the Gross Expenditure in Research and Development (GERD) to 2 per cent of GDP, which has been a national goal set for some time. The new policy envisages achieving this goal with greater reliance on private sector R&D *inter alia* through the establishment of large R&D facilities in PPP mode, treating R&D in private sector on par with public institutions for availing public funds, and providing incentives and modifying the IPR system.

The focus of the policy is:

- Facilitating private sector investment in R&D centres in India and overseas.
- Promoting establishment of large R&D facilities in PPP mode with provisions for benefits sharing.
- Permitting multi-stakeholders participation in the Indian R&D system.
- Treating R&D in the private sector at par with public institutions for availing public funds.
- Bench marking of R&D funding mechanisms and patterns globally.
- Modifying IPR policy to provide for marching rights for social goods when supported by public funds and for co-sharing IPRs generated under PPP.
- Launching newer mechanisms for nurturing Technology Business Incubators (TBIs) and science-led entrepreneurship.
- Providing incentives for commercialisation of innovations with focus on green manufacturing.

## Harnessing ICT for Inclusive and Sustainable Development

Given the generality of purpose and innovational complementarities, ICT qualifies itself as yet another General Purpose Technology (GPT). On comparing ICT with earlier GPTs, scholars found remarkable parallels in terms of their contribution towards augmenting economic growth and human welfare. In general, it has been argued that ICTs are key inputs for competitiveness, economic growth and development. It offers opportunity for global integration, increasing economic and social well-being of the poor and enhances the effectiveness, efficiency and transparency of the public sector, including the delivery of public services. Thus viewed, there is hardly any field of human activity wherein ICT could not have its profound influence *inter alia* by revolutionising the process of information exchange and thereby reducing the transaction cost. In a sense, the potential of the new technology to contribute towards sustainable and inclusive development in the developing world and foster South-South Cooperation emanate from the fact that while the Western world held monopoly over the earlier GPTs, in case of ICT, the capabilities are more diffused and the Asian countries including India possess significant capabilities.

It is in this context, the SDGs highlight the need for increasing access to ICT and strive to provide universal and affordable access to internet. An implicit argument in such an approach appears to be that the needed technology, both hardware and software, is available in the international technology shelf at a falling price and what the developing countries need to do is only to remove trade restrictions as has been made out under Information Technology Agreement (ITA). Hence, as far as the developing countries are concerned, there is no need to reinvent the wheel but choose appropriately from the international technology shelf. With respect to technology and innovation, such thinking prevailed in the 1960s wherein there has been a proliferation of studies on the choice of technique implying that the core issue before the developing world is just one of choice and not development. The 1980s, however, has seen the emergence of a number of courtiers in the developing world building up substantial technological capability (Fransman and King, 1984). Various studies that analysed the process

of technological capability building in the developing world (Lall 1987, 1992) revealed that this would not have been possible had these countries remained passive adopters of Western technology. Hence, if the available empirical evidence on technological capability in the developing world is any indication, the present lopsided approach of promoting ICT use with the neglect of ICT production capabilities has the potential danger of perpetuating technological dependence on the one hand and forgoing opportunities for income and employment generation on the other. (Mytelka and Ohiorhenuan, 2000; Joseph, 2005). Here it is worth remembering that green revolution, which has been an indisputable success story so far as agricultural productivity and economic growth in the developing world are concerned, would not have been possible had the strategy been simply one of passive adoption of Western technologies. The relevant point is that to enable a general purpose technology like ICT to act as an instrument of inclusive and sustainable development there is the need for evolving capabilities both in production and use. Any lopsided approach with focus on either production or use is likely to create sources of exclusion and generate unsustainable outcomes.

India's success story in ICT which attracted the world attention mainly on account of the remarkable performance in the export of software service sector may be inspirational for other developing countries. The recorded growth in the software and service exports from India as well as the credibility that India earned has no parallels in India's economic history. In a context wherein India has been severely constrained by the availability of foreign exchange, share of software exports in total exports that almost doubled from 7.8 per cent in 2000-01 to 14.8 per cent in 2009-10, contributed significantly towards improving the external health of the economy. It is also evident that in the service sector driven growth of the Indian economy software sector played a significant role as its share in service sector GDP almost increased threefold since 2000. Indeed this has not been the handiwork of the market but has been an outcome of the innovation system built up over the years mostly at the instance of state and also other stakeholders like industry associations including the innovative efforts by the individual firms.<sup>1</sup> While, India's performance in the sphere of ICT software

production has been remarkable, its performance in the sphere of ICT hardware and ICT use has been less remarkable. This is not to ignore number of projects at the instance of the state and private actors to harness ICT for development and governance.

### Digital India

The journey of e-Governance initiatives in India took a broader dimension in mid-1990s for wider sectoral applications with emphasis on citizen-centric services by harnessing ICT. This got manifested in major ICT initiatives of the Government that included, but not limited to, railway computerisation, land record computerisation and others. The National e-Governance Plan was initiated in 2006 with 31 Mission Mode Projects covering a wide range of domains, viz. agriculture, land records, health, education, passports, police, courts, municipalities, commercial taxes, treasuries and others. Along with this national initiative, different states also started ambitious e-governance projects aiming at providing electronic services to citizens.

Despite the successful implementation of many e-Governance projects across the country, e-Governance as a whole has not been able to make the desired impact and fulfil all its objectives. It has been felt that a lot more thrust is required to ensure e-Governance in the country to promote inclusive growth that covers electronic services, products, devices and job opportunities. In order to transform the entire ecosystem of public services through the use of information technology, the Government of India launched the Digital India programme with the vision to transform India into a digitally empowered society and knowledge economy. India is one of the fastest growing markets for electronics. The demand is projected to reach US\$ 400 billion by 2020. Government of India (GoI) has launched the National Policy on Electronics 2012 with the vision to make India a globally competitive destination for Electronics System Design and Manufacturing (ESDM).

While digital India appears to have the potential opportunity to address many of the issues, the programme, as it is conceived, has many shortcomings and bound to result in suboptimal outcomes and frustrations. We need to recognise that being a general purpose technology, ICT potential is not just confined

to governance. To the extent that there is hardly any sectors of the economy and segments of the society where ICT can not have its profound influence, the digital India should be based on the twin foundations of achieving balanced development of software and hardware sector along with a balanced approach towards ICT production and use. While the former issue has attracted the attention of Digital India Programme, the latter issue is yet to receive the attention that it deserves.

### Building Resilient Infrastructure

While there is a general consensus on the role of infrastructure in development, it is generally believed that the developing countries are confronted with severe infrastructure gaps in their efforts to alleviate growth constraints, respond to urbanisation pressures and meet their crucial goals for inclusive growth (Bhattacharya *et al.*, 2012). Addressing the infrastructure deficit appears to be a major challenge for the developing countries, including India, on account of the financial and technological needs. The intensity of the challenge becomes more severe since the past paradigms towards infrastructure development on account of their adverse impact on environment are inimical to sustainable development and, therefore, of limited relevance for the developing countries. It is in this context that 3i Network (2010) outlined the broad contours of infrastructure in a low carbon economy.

In India as the economic growth picked up there has been increasing stress on physical infrastructure such as electricity, railways, roads, ports, airports, irrigation, and urban and rural water supply and sanitation, and IT infrastructure to cater to the emerging new economy. Hence the issues raised above are of much relevance to India as well. Though much progress has been made in this direction (see Rastogi, 2008; 3i Network 2008 for a review of policies and progress) much more needs to be done. Realising this reality the state has undertaken various proactive measures towards building a vibrant infrastructure (see Box 1).

While dealing with infrastructure for development, there arise a number of issues like those relating to financing of investment in infrastructure, ensuring quality and access, governance structure and others in addition to the most important challenge of building sustainability oriented infrastructure network.

### Box 1: Recent Government Initiatives towards Building Infrastructure in India

- Prime Minister of India indicated that the government has rolled out stuck projects worth Rs. 4 lakh crore (US\$ 60 billion) in the past six months (ending November 2015), while stating that infrastructure development is the government's top priority in order to improve economic growth.
- The Union Cabinet has approved several reforms such as allowing National Highways Authority of India (NHAI) to extend the concession period for current incomplete projects in build-operate-transfer (BOT) mode.
- The Government of India has earmarked Rs. 50,000 crore (US\$ 7.5 billion) to develop 100 smart cities across the country. The Government released its list of 98 cities for the smart cities project in August 2015.
- Government of India plans to launch the National Infrastructure Investment Fund (NIFF) with an initial corpus of at least Rs. 40,000 crore (US\$ 6 billion).
- The Government of India has unveiled plans to invest US\$ 137 billion in its rail network over the next five years, heralding an aggressive approach to building infrastructure needed to unlock faster economic growth.
- The Government of India has announced highway projects worth US\$ 93 billion, which include government flagship National Highways Building Project (NHDP) with total investment of US\$ 45 billion over next three years.
- The Ministry of Urban Development has approved an investment of Rs. 19,170 crore (US\$ 2.88 billion) for improving basic urban infrastructure in 474 cities in 18 states and Union Territories (UTs) under Atal Mission for Urban Rejuvenation and Transformation (AMRUT) for 2015-16.
- The Department of Industrial Policy and Promotion (DIPP) has set up an online monitoring system for on-going projects under the Industrial Infrastructure Upgradation Scheme (IIUS).
- The Ministry of Urban Development has decided to allow the use of construction and demolition waste up to 20 per cent in construction of load bearing items and up to 100 per cent for non-load bearing purposes. This provision is expected to significantly help in reuse of such waste, in line with ongoing efforts under Swachh Bharat Mission (SBM).
- The Central Government has approved amendments to 'The National Waterways Bill, 2015' which will provide for enacting a central legislation to declare 106 additional inland waterways, as the national waterways.
- The Government of India plans to award 100 highway projects under the PPP mode in 2016, with expectations that recent amendments in regulations would revive investor sentiments in PPP projects in the infrastructure sector.
- In the Budget 2015-16, the capital outlays for roads, and railways have been increased by Rs. 140.3 billion (US\$ 2.11 billion) and Rs. 100.5 billion (US\$ 1.51 billion), respectively.

*Source:* India Brand Equity Foundation; [www.ibef.org](http://www.ibef.org)

With respect to financing infrastructure the public sector plays an important role. But, given the emergence and presence of private sector capabilities, the relevance of public private participation has increasingly been recognised (3i Network, 2008). With a view to ensure that infrastructure should not

be a constraint for growth, 11<sup>th</sup> plan envisaged that at least 75 per cent of new investment into infrastructure will come from private sector – some in the form of fully private ventures and others as public private partnerships (Planning Commission, 2006). It has also been stressed that the approach to PPPs must remain



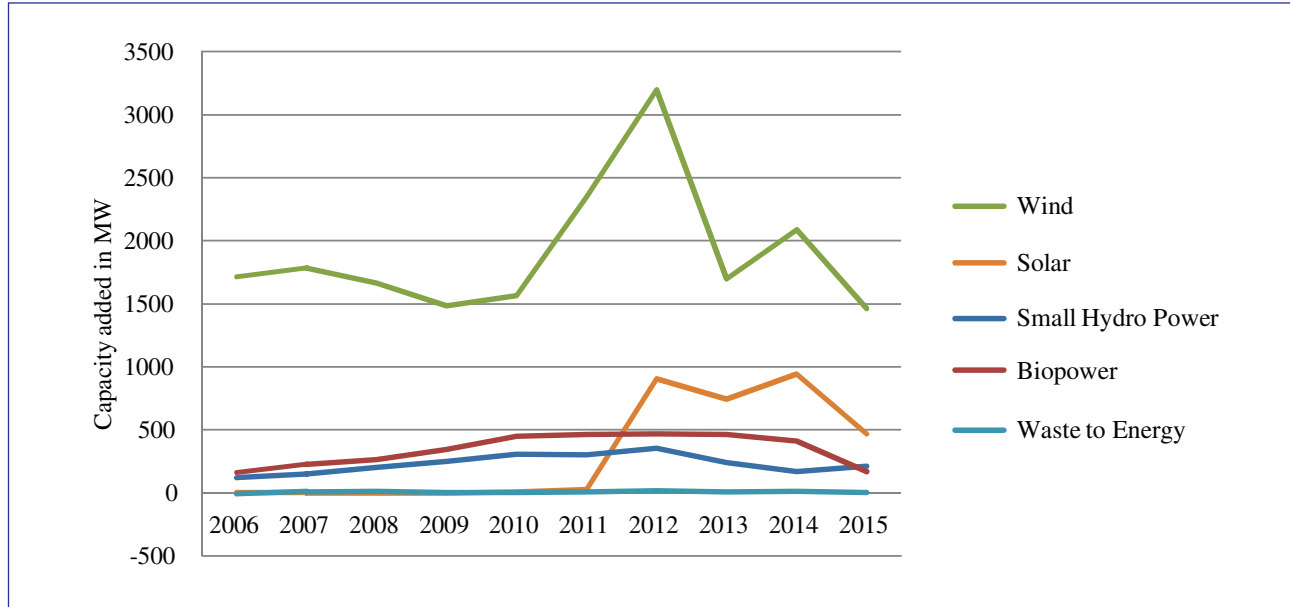
## Box 2: Recent FDI and PPP in Infrastructure Sector in India

- The Reserve Bank of India (RBI) has notified 100 per cent foreign direct investment (FDI) under automatic route in the construction development sector. The new limit came into effect in December 2014.
- The Government of India has relaxed rules for FDI in the construction sector by reducing minimum built-up area as well as capital requirement. It has also liberalised the exit norms. In fact, the Cabinet has also approved the proposal to amend the FDI policy.
- India and the US have signed a memorandum of understanding (MoU) in order to establish Infrastructure Collaboration Platform. The document showcases the relationship between both the Governments which intend to facilitate US industry participation in Indian infrastructure projects to improve the bilateral relationship and benefit both economies. The MoU's scope envisages efforts in the areas of Urban Development, Commerce and Industry, Railways, Road Transport and Highways, Micro, Small and Medium Enterprises, Power, New and Renewable Energy, among others.
- BNP Paribas Lease Group, subsidiary of BNP Paribas Group, has acquired 5 per cent stake in SREI Infrastructure Finance, by selling its entire 50 per cent stake in SREI Equipment Finance Limited (SEFL) to SREI Infrastructure Finance, thus allowing them to play a larger role in the infrastructure finance business.
- Private equity giant Carlyle Group is planning to invest Rs. 500 crore (US\$ 75 million) in Feedback Infra, which could make the US firm a major shareholder in the Gurgaon-based infrastructure services company.
- In the month of November 2015, among various areas of infrastructure spending by the government, the roads segment led in terms of tenders issued (59 per cent of total tenders) and contracts awarded, with an increasing shift to Engineering, Procurement and Construction (EPC) type of contracts.
- PTC India Financial Services (PFS) and India Infrastructure Finance Company Limited (IIFCL) have signed a Memorandum of Understanding (MoU) to jointly provide funding for infrastructure projects in India, particularly in the energy sector.
- France has announced a commitment of € 2 billion (US\$ 2.17 billion) to convert Chandigarh, Nagpur and Puducherry into smart cities.
- The Construction Industry Development Board (CIDB) of Malaysia has proposed to invest US\$ 30 billion in urban development and housing projects in India, such as a mini-smart city adjacent to New Delhi Railway Station, a green city project at Garhmukhteshwar in Uttar Pradesh and the Ganga cleaning projects.
- International Finance Corporation (IFC), part of The World Bank group, plans to invest at least US\$ 700 million in existing transport and logistics infrastructure projects in India.
- The World Bank has approved a US\$ 650 million debt funding for a part of the eastern arm of the Dedicated Freight Corridor (DFC) project in India.
- Indostar Capital Finance Limited and Reliance Capital Limited have invested Rs. 200 crore (US\$ 30 million) in Alliance group, a real estate company. The consortium of institutions has invested in the holding company of Alliance group, Alliance Infrastructure Projects Private Limited.

*Source:* India Brand Equity Foundation; [www.ibef.org](http://www.ibef.org)

firmly grounded in principles, which ensure that PPPs are formulated and executed in public interest with a view to achieving additional capacity and delivery of public services at reasonable cost. These partnerships must ensure the supplementing of scarce public

resources for investment in infrastructure sectors, while improving efficiencies and reducing costs. As noted in the Approach to the Eleventh Plan of India, PPPs must aim at bringing private resources into public projects, not public resources into private projects. Of

**Figure 1: Yearly Addition to Installed Capacity in Different Renewable Energy**

*Source:* Sreelakshmi (2016).

late there has been a number of major FDI projects as well as projects in the PPP mode towards addressing the infrastructure deficit in the country (see Box 2).

While the deficits in power infrastructure continue to act as a drag on the growth of the economy, in general, and industrial sector, in particular, a major challenge for the developing countries is towards evolving a new paradigm for infrastructure development that is oriented towards sustainability. Given the adverse environmental effect of conventional energy sources, the role of innovations for harnessing new and renewable sources of energy for addressing energy poverty and sustainability issues in power sector cannot be over emphasised.

Because of the concerted efforts at the instance of the Ministry of New and Renewable Energy (MNRE) and its associated agencies in research, design, development and deployment of Renewable Energy Technologies (RETs), the share of renewable energy in India's total power generation capacity has risen to 13.1 per cent. However, it still comprises just 2 per cent of the energy demand, and most of the existing potential remains to be harnessed (MNRE, 2014). However, it has been observed that despite

much potential for renewable energy sources, there has been a deceleration in the capacity addition in recent years (see Figure 1).

Similarly, there has been a pronounced variation across different states with respect to more promising renewable sources of energy like wind and solar. Gujarat, the state with the highest wind energy potential, ranks only fourth when it comes to installed capacity, and has utilised only 10 per cent of its potential. Maharashtra and Rajasthan with relatively lower potentials have higher installed capacities as well as much higher shares of potential harvested than Gujarat. Disparities exist even among states with closer levels of estimated potential such as Andhra Pradesh, Karnataka and Tamil Nadu.

Similar to the wind energy the production of solar energy is also concentrated in a few states, namely: Andhra Pradesh, Gujarat, Madhya Pradesh, Maharashtra, Rajasthan and Tamil Nadu. Together, these states possess 56 per cent of the total solar energy potential in the country. Disparities in deployment exist among these states in the case of solar energy as well. Gujarat is doing exceptionally well, with almost 3 per cent of its potential harnessed, compared to around 0.5 per cent to 0.6 per cent in the other states.

## Concluding Remarks: South-South Cooperation

Paradoxically, during 1970s and 1980s when the developing countries had only their poverty to share, South-South cooperation has been much debated among the developing countries.<sup>2</sup> The issue seems to have taken a back seat during the last decade as the developing countries were increasingly experimenting with trade and investment liberalisation under Globalisation. But today, with increasing disenchantment among developing countries with globalisation and creation of substantial technological capabilities in the South which in turn has contributed to southern development solutions, the South-South Cooperation is gaining momentum (Joseph 2006; Chaturvedi *et al.*, 2012).

As already stated, given IT capabilities in the South, the potential for South-South cooperation in ICT is immense. While Japan and South East Asian countries (Ernst, 2001) used to hold leading position in the manufacture of ICT goods, China of late has joined the league. In the field of ICT software and services India has emerged as a major player in the world market. Though there have been apprehensions about Indian software firms focusing on low end of the software value chain, some evidence suggest that India's software sector has been moving up the value chain. Further there are a number of ICT innovations from India addressing issues specific to developing country like affordability, illiteracy and last mile connectivity. Therefore, unlike the developing countries of 1950s and 1960s that had to resort to the difficult task of importing and adapting technologies from the North, for today's developing countries that are lagging behind in the sphere of ICT, there are many a "ready to use" innovations from the ICT technology shelves of emerging countries in the South. Hence these countries have the less risky and less costly option of transferring technologies from other countries in the south to hasten their catching up process.

While China is known for its hardware production capabilities, evidence also suggest that China is also emerging as a major producer of software and much of it has been used domestically which in turn could have been instrumental in increasing the efficiency

and competitiveness of other sectors of the economy (Joseph, 2013). India and China are not isolated success stories in the South. A number of non-G7 countries have developed capabilities in the field IT and software (Arora and Gambardella, 2004; Ojo *et al.*, 2008) and a new generation of countries like Philippines, Morocco, Costa Rica and others have joined the bandwagon (UNCTAD, 2003). Thus ways and means by which these countries have managed building up IT capabilities and ways in which it has been harnessed for addressing various development issues might offer very valid lessons for other developing countries.

Thus the need for South-South cooperation is obvious because of the existence of IT capabilities in the South and marked divergence in the IT interests of developing and developed countries. Going by the available evidence, cooperation in the sphere of ICT has emerged as a major agenda in many of the regional cooperation agreements starting with the e-ASEAN framework agreement. India is very actively contributing in South-South Cooperation in ICTs (Joseph, 2005; Joseph and Parayil, 2009).

### Endnotes

- <sup>1</sup> See for details Joseph (2006), Kumar and Joseph (2006) Balakrishnan (2006) also Sen (2007).
- <sup>2</sup> See in this context among others, RIS (1987) and South Commission (1990).

### References

- Arora, A. and A. Gambardella. 2004. "The Globalization of the Software Industry: Perspectives and Opportunities for Developed and Developing Countries." *Working Paper 10538*, National Bureau of Economic Research, Cambridge, MA.
- Aschauer, D. A. 1989. "Is Public Expenditure Productive?" *Journal of Monetary Economics*, 23, 177-200
- Balakrishnan, P. 2006. "Benign Neglect or Strategic Intent? Contested Lineage of Indian Software Industry." *Economic and Political Weekly*, 41(36), 3865-3873.
- Beena, P. L. 2014. *Mergers and Acquisitions: India Under Globalisation*. New Delhi: Routledge.
- Bhattacharya, A., M. Romani and N. Stern. 2012. "Infrastructure for Development: Meeting the Challenge." Centre for Climate Change Economics and Policy and Grantham Research Institute on Climate Change and the Environment, London School of Economics, London.

- Calderon, C. and L. Serven. 2014. "Infrastructure, Growth, and Inequality: An Overview." *World Bank Policy Research Working Paper No. 7034*, The World Bank, Washington D.C.
- Chaturvedi, S. 2016. *The Logic of Sharing: Indian Approach to South-South Cooperation*, RIS and Cambridge, New Delhi.
- Chaturvedi, S., T. Fues and E. Sidiropoulos. 2012. *Development Cooperation and Emerging Powers: New Partners and Old Partners*. London: Zed Books
- Ernst, D. 2001. "From Digital Divides to Industrial Upgrading: Information and Communication Technology and Asian Economic Development." *Working Paper Economics Series No. 36*, East-West Center, Honolulu.
- Fagerberg, J. and K. Sapprasert. 2011. "National Innovation Systems: The Emergence of a New Approach." *Science and Public Policy*, 38 (9): 669-79.
- Fransman, M. and K. King. 1984. *Technological Capability in the Third World*. London: Macmillan.
- Joseph, K. J. 2005. "Transforming Digital Divide into Digital Dividend: The Role of South-South Cooperation in ICTs." *Cooperation South*, 102-125.
- Joseph, K. J. 2006. *Information Technology, Innovation System and Trade Regime in Developing Countries: India and the ASEAN*. London: Palgrave Macmillan.
- Joseph, K.J. 2012. "Harnessing Software for Development: Indian Experience and the Lessons for Developing Countries." Background Paper Prepared for the Information Economy Report 2012, UNCTAD, Geneva.
- Joseph, K. J. 2013. "India's Software Industry in Transition: Lessons for Other Developing Countries and Implications for South-South Cooperation." Background Paper for Information Economy Report 2012, UNCTAD.
- Joseph, K. J. 2014a. "Exploring Exclusion in Innovation Systems: Case of Plantation Agriculture in India." *Innovation and Development*, 4(1): 73-91.
- Joseph, K. J. 2014b. "Innovation and Development in India: Changing Paradigms and Trajectories," in A. Goyal (ed) *Handbook on Indian Economy for the 21 Century*. Oxford University Press.
- Joseph, K.J. and G. Parayil. 2006. "India-ASEAN Cooperation in Information and Communications Technologies (ICTs): Issues and Prospects," in N. Kumar, R. Sen and M. Asher (eds), ISEAS, Singapore and RIS, New Delhi.
- Kumar, N and K. J. Joseph. 2006. "National Innovation Systems and India's IT capability: Are there any Lessons for ASEAN New Comers?" in B.A. Lundvall, P. Intarakumnerd and J. Vang (eds) *Asia's Innovation System in Transition*. Cheltenham: Edward Elgar.
- Kumar, N. 2000. "Mergers and Acquisitions by MNEs Patterns and Implications." *Economic and Political Weekly*, 35(32): 2851-58.
- Lall, S. 1987. *Learning to Industrialize: The Acquisition of Technological Capability in India*. London: Macmillan.
- Lall, S. 1992. "Technological Capabilities and Industrialization." *World Development*, 20 (2): 165-186.
- Lundvall, B.A., K.J. Joseph, C. Chaminade and J. Vang (eds). 2009. *Handbook of Innovation Systems and Developing Countries*. Edward Elgar.
- Ministry of New and Renewable Energy. 2014. *A Compendium of Research, Development and Demonstration Projects, 2014*. Ministry of New and Renewable Energy, Government of India, New Delhi.
- Mytelka, L. K. and John F.E. Ohiorhenuan. 2000. "Knowledge-based Industrial Development and South-South Cooperation." *Cooperation South*, No.1: 74-82.
- Ojo, A., T. Janowski, R. Basanya, and M. Reed. 2008. "Developing and Harnessing Software Technology in the South: The Roles of China, India, Brazil, and South Africa." WIDER Working Paper 89/2008. UNU- WIDER, Helsinki.
- Planning Commission. 2006. *Towards Faster and More Inclusive Growth: An Approach to the 11<sup>th</sup> Five Year Plan (2007-12)*. Planning Commission, Government of India, New Delhi.
- Rastogi, Anupm. 2008. "The Infrastructure Sector in India, 2007", in India Infrastructure Report 2008, Oxford university Press, New Delhi
- RIS. 1987. *South-South Economic Cooperation: Problem and Prospects*. Research and Information System for Developing Countries, New Delhi.
- Sen, A.K. 2007. "Looking Beyond the Traditional Domain", 16 February, *The Hindu*.
- South Commission. 1990. *The Challenge to the South: The Report of the South Commission*. New York: Oxford University Press.
- Sreelakshmi M. S. 2016. "Innovation and Development of Renewable Energy." Project report submitted as part of the MA Applied Economics Course, Centre for Development Studies, Trivandrum.
- 3i Network. 2008. *India Infrastructure Report 2008: Business Models for the Future*. New Delhi: Oxford university Press.
- 3i Network. 2010. *India Infrastructure Report 2008: Infrastructure Development in a Low Carbon Economy*. New Delhi: Oxford university Press.
- UNCTAD. 2003. *E-Commerce and Development Report 2003*. United Nations Conference on Trade and Development (UNCTAD), United Nations, Geneva.
- Uma, S., V. Abraham and K. J. Joseph. 2010. "Impact of Trade Liberalization on Employment: The Experience of India's Manufacturing Industries." *Indian Journal of Labour Economics*, Issue 4: 53(4) 587-605.



<b>Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation: Targets and Indicators</b>	
9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all	9.1.1 Proportion of the rural population who live within 2 km of an all-season road 9.1.2 Passenger and freight volumes, by mode of transport
9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries	9.2.1 Manufacturing value added as a proportion of GDP and per capita 9.2.2 Manufacturing employment as a proportion of total employment
9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets	9.3.1 Proportion of small-scale industries in total industry value added 9.3.2 Proportion of small-scale industries with a loan or line of credit
9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	9.4.1 CO <sub>2</sub> emission per unit of value added
9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending	9.5.1 Research and development expenditure as a proportion of GDP 9.5.2 Researchers (in full-time equivalent) per million inhabitants
9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States	9.a.1 Total official international support (official development assistance plus other official flows) to infrastructure
9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities	9.b.1 Proportion of medium and high-tech industry value added in total value added
9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020	9.c.1 Proportion of population covered by a mobile network, by technology