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Infrastructure and Connectivity in India: Getting the Basics Right

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Infrastructure and Connectivity in India: Progress, Challenges and Way Ahead

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1. Introduction

The importance of infrastructure for growth and development has been recognized by both the theoretical and policy literature. Various studies of the 1980's and subsequent decades assessing the macroeconomic impact of infrastructure have suggested infrastructure's positive contribution to output, income, international trade, employment growth and quality of life (De 2008). Infrastructure, both in hard and soft form, serves as a key enabling factor in intra- and inter-regional resource allocation and promotion of economic activities. (Mohanty 2013). It helps in building productive capacity by bridging connectivity gaps, reducing distribution and trade costs, and facilitating the sharing of the benefits of growth with poorer groups and communities, particularly in remote and isolated areas and small and landlocked countries, among others. Thus, infrastructure not only affects production and consumption directly, but also creates many direct and indirect externalities.

Holst (2009) classified the role infrastructure into three functional economic categories: Keynesian Stimulus, Ricardian Stimulus and Neo-Classical Stimulus. The Keynesian stimulus relates to the pure expenditure component of infrastructure as reflected in national, regional and local aggregate demand and employment stimulus. In case of infrastructure that exhibits public goods characteristics, the direct and downstream multiplier effects can be substantial. The Ricardian stimulus focuses on the reduction in cost of transportation and distribution from infrastructure commitments. The modern economic theory (Neoclassical stimulus) recognizes the endogenous growth benefits facilitated by infrastructure such as increased productivity, technology and information diffusion, supply chain facilitation, and human capital development (including the effects of migration).

In many developing countries the inadequacy of transport infrastructure and the inefficiency of transport services are recognized as being among the main bottlenecks to socio-economic development and social integration (Thoopal 2000). What are the costs of not having adequate transport infrastructure? According to the World Development Report (1994) it was 1% of GNP in China in 1994. With globalization increasing the tradability of goods and services, the cost of having an inadequate transport infrastructure, if anything, is likely to be much higher in the current environment. The reasons efficient transportation infrastructure leads to significant externalities are obvious but worth reiterating. Better transportation infrastructure improves cost effectiveness of user industries by reducing transactions costs, increases reach, improves economic opportunities for the poor, reduces inequality, and contributes to competitiveness in general. Accordingly governments have traditionally accorded high priority to investment in sectors such as railways, roads, power, ports, and airports. Perhaps the most comprehensive work showing the impact of infrastructure on growth for developing countries is Straub (2008) who identifies the direct and indirect channels from infrastructure to growth. The study also shows that the infrastructure impact on more disaggregated variables, or intermediate themes, such as poverty, inequality, individual earnings, child height, export and investments is even stronger. The impact of infrastructure

percolates to almost every socioeconomic indicator of a nation and there is both theoretical and empirical evidence that validates these impacts. However, this paper focuses on the role of infrastructure and connectivity in facilitating trade and regional economic integration both within India and with the South East Asian Nations. The rest of the paper is organised as follows. The next section reviews the available evidence on the trade integration effects of infrastructure commitments. Section 3 explores India's trade integration with South East Asia. Section 4 considers the state of India's transport infrastructure. Section 5 explores financing constraints and the last section offers policy options.

2. Infrastructure and Trade Integration

Beyond the neo-classical simplification of classifying different factors into only capital and labor, an economy's infrastructure network, broadly speaking, is the very socio-economic climate created by the institutions that serve as conduits of commerce (De 2006). Bella Balassa's thesis developed in his work 'The Theory of Economic Integration' (Balassa 1961) emphasised the significance of 'non-price' factors such as trade and distribution costs as key determinants in the success of trade liberalization in a country.

Despite the fact that the world has seen a drastic fall in the trade tariffs over the past decade, international trade continues to be subject increasingly to 'non-tariff' barriers that restrict trade. These barriers can be categorized as soft barriers which are related to processes in trade and business facilitation and hard barriers such as physical infrastructure and connectivity barriers. These barriers collectively lead to a difference between the export and import prices which can also be called as the trade cost.

Empirical evidence shows that infrastructure-induced reductions in trade costs have become relatively more important than direct policy barriers as potential sources of further cost savings. Increase in trade- related infrastructure investments and improvement in the quality of infrastructure are seen to influence trade performance through reduction in monetary transaction costs, loss, damage and spoilage to goods in transit, and ensuring timeliness of delivery, among other factors. This relationship between infrastructure and trade costs can be illustrated through four dimensions: *Direct monetary outlays* for delivering traded goods are partly determined by the quality of infrastructure and the cost and quality of related services; *Timeliness*, even more than freight rates, is likely to be influenced by geography and infrastructure; *Risk* of damage, losses, or larger insurance costs is higher when infrastructure is of poor quality; *Lack of access* to a good transport or telecommunication service can have a high opportunity cost, restricting market access and limiting the likelihood of participating fully in the benefits of trade (Brooks 2008).

The dependence of trade costs on trade related infrastructure has been emphasised in various studies. Limao and Venables (2001) show that transport cost rises by 12 percent for a deterioration in infrastructure (measured as an average of the density of the road network, paved road network, rail network and the number of telephone main lines per person) from the median to the 75^{th} percentile of destinations. Bougheas et al. (1990) use a two two-country Ricardian framework to show the importance of transport infrastructure in trade

volumes. Similarly, Francois and Manchin (2006) reveal that transport and communication infrastructure and institutional quality are significant determinants not only for country's export levels but also for the likelihood of exports. Nordås and Piermartini (2004) have shown trade performance of a country depends highly on the quality of infrastructure and that among all modalities of infrastructure, port efficiency alone has the largest impact on trade.

De (2006) in his study used the gravity model to study barriers to trade and concluded that strengthening infrastructural facilities, particularly transport infrastructure and minimization of transaction costs were crucial for regional integration. He showed how higher transaction cost between each pair of partners leads to lesser the trade between them (Table 1) and suggested that reduction in transactions costs between the trading partners would lead a rise in trade volumes significantly. His study shows that barriers to trade, represented by transaction costs and country's transport infrastructure (both exporting and importing), produce a significant positive effect on bilateral trade.

[Table 1 Here]

With reduction in tariff barriers therefore economies can potentially benefit from higher trade subject to the development of trade mobility infrastructure facilities. Trade related infrastructure reduces the cost of national and international transport and is crucial for economies to expand trade flows and also fully realise the gains from trade policy liberalization reforms.

Among the various trade related infrastructure services' contributions to trade, port efficiency appears to have the largest influence. An improvement in port infrastructure that raises port efficiency not only reduces shipping costs but also the ports capacity to handle new flows and influence the composition of trade. Similarly, telecommunications infrastructure is critical for promoting trade in services such as financial services, business services, and communications etc. (De 2006). Cost of telecommunications impacts trade flows significantly. Fink, Matoo, and Neagu (2002) in their study find that higher the cost of telecommunications, the lower the bilateral trade flows between two countries.

Available evidence also indicates that basic infrastructure has a high rate of social and private return implying that not only does the quantity and quality of infrastructure matter, but so does the stage of infrastructure development. In one study, quite strikingly the multiplier effect of public investment in road systems are significantly higher for low quality roads than high quality ones suggesting that the earlier the stage of development, the higher is the private return to public investment in infrastructure (Holst 2005).

Efficient infrastructure services reduce trade cost, raise value added and potential profitability, promote capital inflows, impact comparative advantage and thus enhance and expands linkages to global supply chains and distribution networks for suppliers. Brooks (2008) intuitively argues with the help of supporting evidence that countries with greater participation in the regional production networks tend to benefit more from reduction in trade costs and trade-related infrastructure investment.

3. India's trade integration with South East Asia

In recent years, the share of developed economies in world GDP and trade has declined and there has been a concurrent rise in the share of the South. Quite clearly growth will be centred in these countries in the coming decades. The global financial crisis and the attendant slowdown which in particular affected industrialised economies the most provided a reason for southern economies to deepen intra-regional trade. Also, given demographics and rising average incomes, the South offers tremendous potential markets for capital investment as well. However, till date, barriers to South-South trade and investments are still higher than those with the industrial world, broadly owing to high tariff and non-tariff barriers within South (NTDPC 2014). Thus, promoting global and regional integration by reducing internal trade and investment barriers will be an appropriate and optimal response to the new circumstances.

India along with other developing economies of Asia has maintained robust growth rates. According to ADB, India is expected to contribute close to 16 per cent of global GDP by 2050, and achieve a per capita income of $22,000 by 2039 (ADB 2010). The outcome is not inevitable and for these expectations to be met India will need to address the high cost of moving goods within and across its borders. Logistics costs as a percent of GDP for India have been estimated to range between 12 and 15 percent, higher than for USA (9 %) and Japan (11%), among others (World Bank 2012). Besides, the Indian logistics industry is highly fragmented which is cited as a cause for the relatively high proportion of logistics expenditure in GDP. A study using panel data noted that a 0.5 per cent decrease in logistics costs (relative to GDP) leads to a 2 per cent increase in trade and a 40 per cent increase in the range of products that are exported out of a country (NTDPC 2014). In the next section we discuss the weaknesses of India's logistics, including transportation infrastructure and possible remedial measures.

The benefits of closer connectivity between South Asia and South East Asia are potentially very large. A study by the Economic Research Institute for ASEAN and East Asia (ERIA) found cumulative gains of closer connectivity of over 2.5 per cent of GDP for India. India's initiative for regional integration with the Southeast and East Asian nations began with its Look East Policy (LEP) in early 1990's. The LEP was an effort to strengthen strategic and economic relations with Southeast and East Asian nations and hence several efforts such as closer co-operation with ASEAN, the East Asia Summit (EAS), the Bay of Bengal Initiative for Multisectoral Technical and Economic Cooperation (BIMSTEC), and the Mekong–Ganga Cooperation (MGC) have been started. India has also made efforts to improve economic relations with People's Republic of China, Japan and Republic of Korea and signed several bilateral and regional trade agreements. India's regional connectivity with Southeast Asia has been both in the form of soft connectivity (such as Trilateral Transit Transport Agreement) and hard connectivity such as Trilateral Highway, Mekong- India Corridor etc. India has thus undertaken several transportation projects to strengthen connectivity with South East Asian nations, particularly with Myanmar. India–Myanmar–Thailand Trilateral Highway, Mekong India Economic Corridor etc. are some of the major cross border connectivity projects. Box 1

represents a list of all the major Cross border connectivity projects in India. ASEAN[1] has become one of India's largest trading partners in recent years and trade with ASEAN has increased from USD 7.3 billion in 2000 to USD 76.3 billion in 2012, with a compound average growth rate of over 20 per cent (Table 2).

[Table 2 Here]

ASEAN with a population of over 615 million and strong domestic consumption is a compelling future market, especially since these countries are seeking to diminish their dependence on China. However, despite the good growth performance and the geographical proximity, the trade relationship between ASEAN and India is still limited. De (2008) estimated India's potential trade with ASEAN and ASEAN+3, with the use of augmented gravity model (Figure 1). As per these estimates, the actual trade between, ASEAN and India in 2012 was significantly below potential.

[Figure 1 HERE]

Data on intra-regional parts and components (P&C) trade which reflects the intensity of regional production sharing shows that regional production networks are significant in East Asia but India lags behind economies such as China, Malaysia and Thailand in this respect (Figure 2).

[Figure 2 HERE]

Not only is trade between ASEAN and India below potential, whatever exists is concentrated with a few countries. For example, trade with Cambodia, the Lao PDR, Myanmar and Viet Nam (CLMV) has not yet seen much momentum and stood at US$11.2 billion in 2013. In terms of FDI, approved Indian foreign investment in CLMV countries stood at US$40.9 million in 2013. For the same year, total FDI from India to the ASEAN region as a whole stood at US$ 1.3 billion. At the same time, India and the CLMV countries share similar economic characteristics when it comes to prospects for manufacturing. All of these countries have a large young labour force and inexpensive operating costs. However, CLMV countries have become a major source of competition for India in manufacturing due to their position in integrated value chains in Southeast Asia. For instance, in 2013-14, the phone manufacturer Nokia moved its operations from India's Chennai to Vietnam's Bac Ninh province largely to take advantage of cheaper regional logistics.

However, the data also suggests scope for deepening trade with CLMV countries in coming years. Favorable trading environment and reduction in trade costs through better connectivity can give a boost to the India's trade with CLMV countries. India's goal of forging stronger economic relationship with the CLMV countries however faces a number of challenges. Foremost among these is connectivity. Despite sharing a border that is 1643 km long, India's immediate neighbour Myanmar isn't connected to the country by rail and there is only one

1 The Association of Southeast Asian Nations, consisting of 10 states – Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam

inadequately road that connects the two countries. There are ambitious infrastructure projects in the pipeline like the Kaladin Multimodal project and the India-Myanmar-Thailand highway. However construction of the trilateral highway is behind schedule. Without actual physical connectivity, there is little that can move, literally. Cross border infrastructure, particularly transportation and power are the major constraints.

Cross border infrastructure may be defined as infrastructure which connects two or more countries as well as national infrastructure which has significant cross-border impact (Bhattacharyya 2009). It provides economies greater access to regional and global markets. By facilitating business to join the regional production networks and supply chains they promote efficient production, trade competitiveness, and trade flows. Greater and better connectivity will also provide more development opportunities for less developed areas in India such as the North East and less developed ASEAN member countries, particularly Myanmar, which are surrounded by the three of the most vigorous economies in the world—China, India and ASEAN. These regions are also expected to play a very important role as the physical connecting nodes. Consequently, development policies for Myanmar and North East India will be at the core of the regional approach to enhance ASEAN-India connectivity.

To unlock the trade potential between India and South East Asia and promote greater participation of India in the regional production networks it is necessary to address the non-tariff barrier constraints, including lack of connectivity of national and cross-border infrastructure, rationalise trade related logistics processes that reduce trade costs, besides removing digital and regulatory barriers.

4. Trade Infrastructure and Logistics processes in India

Although restructuring to promote competition and regulatory reform to address structural impediments has been initiated, performance of transport sectors in India remains severely deficient even after two decades of deregulation. India's logistics network is beleaguered by inefficiencies due to the lack of infrastructure and equipment, high handling costs and damages. A high percentage of logistics cost in India is accounted by transportation (62%) and inventory carrying costs (34%) followed by administrative cost (Planning Commission 2009). McKinsey & Company estimates that losses from logistics inefficiencies cost India around US $ 45 billion in 2007[2].

The quality of overall infrastructure in India therefore is a source of concern. As per the Global Competitiveness Report (2014-15) of the World Economic Forum, the overall quality of infrastructure in India has remained low as compared to countries such as Indonesia, Thailand, Malaysia, Singapore and China (Table 3).

[Table 3 HERE]

Specifically, India fares poorly in the Logistics Performance Index (LPI), developed by the World Bank to measure logistics efficiency. The major constituents of LPI include customs,

[2] McKinsey & Company (2010): *Building India-Transforming the nation's Logistics Infrastructure*, July

transport infrastructure, ease of arranging competitively priced shipments, quality of logistics services, the ability to track and trace consignments and the timeliness of consignments. India's position in the overall logistics efficiency can be seen from its ranking on the World Bank's Logistics Performance Index (LPI), the UNCTAD's Liner Shipping Connectivity Index and the World Bank's Air Connectivity Index (Table 4). All three indices show that India ranks lower than countries such as Malaysia, Thailand and China on the logistics performance.

[Table 4 HERE]

The reduction in traditional tariff barriers to trade has placed a lot of importance on trade infrastructure and logistics as a determinant of trade flows between countries (Hoda and Rai 2014). The Indian narrative with regard to infrastructure is familiar -there exists a significant gap between intent and implementation and between desired and actual investments (For more details, see section on Financing of Infrastructure). Railways and roads dominate the country's transport landscape – India has the fourth largest rail network in the world. The National Highway Development Project (NHDP) implemented in the mid- 1990's significantly improved the quality of Indian roads. The total road length increased from about 400,000 km to 4.7 million km between 1951 and 2011. Road density in India is now nearly 1.42 km per sq km, which compares favourably with many countries (NTDPC 2014). Roads development has benefitted with the launching of the NHDP and the Pradhan Mantri Gram Sadak Yojana (PMGSY). While NHDP aimed at primarily strengthening and widening high density corridors of National Highways, PMGSY was designed to improve the accessibility of habitations in rural areas. The Golden Quadrilateral project which comprises of 5846 km of highways has been completed; a sobering feature of the road network is that merely two per cent of road length carries 40 per cent of all road traffic. Some on-going national connectivity projects (Map 1) have been discussed in Box 2.

[Table 5 HERE]

[Figure 3 HERE]

Like in other populous emerging markets, roads are the dominant mode of transportation. They carry almost 90 percent of the country's passenger traffic and 67 percent of its freight. In addition, the multiple modes of transport on Indian roads make for average truck and bus speeds of only 30-40 km/hr. Additionally, lack of investment in public transportation has resulted in a significant decline in share of public transportation, from nearly 40 percent in 1994 to 30 percent today.[3] Diversion of freight and passenger traffic to roads from railways while causing substantial loss in revenue also imposes a heavy burden in terms of a much larger freight cost to GDP ratio and higher environmental cost per route km of freight and passenger traffic compared to other countries. The modal share in freight traffic stands at 36 per cent for the railways vis-à-vis 57 per cent for roads and it will further decline to 25

[3]2010, "India's urban awakening: Building inclusive cities, sustaining economic growth", McKinsey Global Institute

percent by 2020 if capacity expansion continues at the same pace.[4] The relentless cross-subsidization of passenger travel with high freight tariffs has resulted in railways losing market share to trucking, further affecting its ability to fund capacity enhancing and quality improving investments. All of India's high-density rail corridors face severe capacity constraints. One-sixth of the rail network carries over two-thirds of all rail traffic. As a result, India presently endures severe under-investment in railway infrastructure.

Lack of capacity addition has increased the load on railway infrastructure and resulted in lower speeds. For example, the speed of the average freight train has remained virtually constant between 2000-01 and 2012-13 at around 24-25 km/hour. Timeliness of delivery of freight transport by rail is erratic as the network suffers from congestion. Network productivity (net tonne-kilometer/ network length) and wagon productivity (net tone kilometer/ wagon holding) is very low in India when compared with China and Russia. The same track is shared by both passenger and freight trains in India. Since, passenger trains utilize about 65 percent of the network capacity it constrains the running of heavy freight trains. (Economic Survey 2014-15).

[Table 6 HERE]

[Table 7 HERE]

Increased integration with the global economy and the higher trade flows since the early 1990s have meant that port traffic has more than doubled touching 890 million tons in 2010-11. This is expected to grow further to about 1315 million tons by 2016-17 under modest growth assumptions[5]. India's ports desperately need to ramp up capacity and efficiency to meet the surge in demand. Ports' turnaround time remains slow by world and regional standards and the connections between the wharf and inland transport need to be improved. Inland water transportation remains largely undeveloped despite India's 14,000 kilometers of navigable rivers and canals. Intermodal links also suffer from weaknesses and exacerbate the problems of ports due to delayed evacuation of cargo. Naturally, the poor infrastructure adversely affects competitiveness of domestic firms. Besides inefficient port operations and inadequate infrastructure, excessive documentation requirements and burdensome customs procedures add to the extra costs and delays for exporters and importers, stifling trade potential. The ability of a country to trade efficiently is determined by its access to world freight and logistics networks at competitive cost. India's high transport costs are also effectively a tax on exports. Textile exporters, for example – are handicapped by the fact that it takes 30-35 days to go from a factory gate in India to a NY retail outlet, about twice the time it takes from most East Asian countries[6]. Inadequate draft in the channels and harbours is another deficiency as a result of which Indian ports are ignored by liner vessels and figure lower in the connectivity index (Hoda and Rai 2014).

[Table 8 HERE]

[4] *Op cit*
[5] Working Group Study 2011
[6] NK Singh and Wallach

Shipping remains by far the main mode for international transport of goods since 90% of India's international trade is waterborne. Of this 66% is handled by the 13 major ports while the rest is handled by the 185 non-major ports, of which only around 60 are functional. Changing trade patterns and new trade relations are driving trade volumes and thus there is need for capacity expansion to handle the increased trade volumes and also accommodate changing vessel sizes. The neglect of port expansion in the 1980s because of low investments has led to deteriorating port services, obsolete equipment and infrastructure and, hence, a decline in the quality of port services. As a result, very few ports can deliver world-class service in India today. Excessive port costs affect competitiveness in world markets and can even impede economic development[7]. As an important determinant of maritime transport costs, port efficiency is critical to the success of any strategy to integrate a country with the global trade system.[8]

[Table 9 HERE]

There are 125 airports in India. Indian airports saw a healthy increase in the international cargo and passengers handled in 2014-15. Domestic passenger traffic saw an increase of 7.1 per cent and international passengers increased of 10.3 per cent during April-December 2014-15 as compared to the same period in 2013- 14. Similarly, international cargo at Indian airports witnessed an increase by 8.3 per cent and domestic by 19.3 per cent in April – December 2014-15 as compared to the corresponding period of the previous year. To improve connectivity, Airports Authority of India, finalized no frills airport model to build airports in remote areas. (Economic Survey 2014-15). However, overcrowding is common in Indian airports to handle more passengers and cargo. Many airports in India lack the runway, terminal, and cargo handling capacity to keep up with traffic flows. By some estimates, the government is short of 600 air traffic control officers (out of about 1500 required) and air traffic control equipment is unable to provide uninterrupted monitoring of all flights.

The power sector plays an important role for efficient functioning of both manufacturing and services units. India has consistently faced electricity shortages of about 7-11 percent and a peak deficit of about 10-17 percent (Hoda and Rai 2014). The dismal state of the power sector in India can be seen in the transmission and distribution (T&D) losses which are the traditional measure of efficiency in the performance of electricity utilities.

[Figure 4 HERE]

A FICCI (2012) survey of industrial units captures the difficulty of obtaining reliable and continuous power supply- 21 percent of surveyed industrial units faced power cuts of more than 30 hours per week; the cost escalation due to power cuts is as high as 30% in states such as Andhra, Tamil Nadu and Odisha.

[7] Ximena Clark, David Dollar, and Alejandro Micco Maritime Transport Costs and Port Efficiency February 2001, World Bank Working Paper

[8] *Ibid.*

ICT infrastructure is an area in which India has performed admirably and this is also visible in services trade data. Trade in services is dramatically made better by ICT infrastructure since it allows the transportation of services that would otherwise demand physical presence (medical diagnosis across distances, video conferencing, business process outsourcing, microwork). Services can be fragmented into parts and sent across communications infrastructure to create global value chains.

India has performed better in services exports because these have not been overly reliant on the quality of physical infrastructure (discussed above)– the combination of adequate telecoms infrastructure, technically qualified English speaking labour (and some diaspora engagement) enabled it to outperform other sectors. For example the IT-BPO industry had revenues of $130 billion in 2104-15, of which 88 billion came from exports.

ICT connectivity in India has been dominated by the mobile. Subscribers increased from 6.54 million in 2002 to 969.89 million in 2015. Wireline subscribers have declined recently and at 26.59 million represent only 2.5 percent of the total subscriber base.[9] The significantly lower unit costs of connectivity of wireless networks compared to the traditional wireline– mobile phones don't need lines dug to each home and handset costs have dropped dramatically- has had a strong positive effect on growth overall. In 2014 a 10% increase in rate of mobile penetration provided a boost of 1.2% in the rate of GDP growth.[10]

India's spurt in Internet connectivity also rode on the back of the increased affordability and connectivity that wireless enabled. Internet penetration per hundred population currently stands at 24.09 with 93.6% of all subscribers (283.29 million) accessing the Internet though mobile devices. In absolute terms, wireless data consumed across India increased from 10 petabytes in December 2011 to 85 petabytes in December 2014.[11] Apart from IT-BPO, this has resulted in strong Internet services growth – the digital commerce in India was as of December 2014 valued at INR 815 billion, of which 29% was e-Tail. The largely mobile based nature of internet use has also been a fillip for India's app economy which has been estimated to potentially reach INR 19 billion by 2016.[12]

At the same time, demand is increasing rapidly. IP traffic in India is forecasted to grow from 967 petabytes a month in 2014 to 4 exabytes per month by 2019 – a compound annual growth rate (CAGR) of 33% (against a global CAGR of 23%).[13] It is highly unlikely that India's predominantly wireless networks will be able to keep up with this growth – constraints include low quantities of spectrum in comparison with other countries, fragmented spectrum and very low urban optic fibre connectivity. Of this, optic fibre connectivity is particularly crucial since backhaul infrastructure is required to carry the increase in IP traffic. Funded by India's Universal Service Obligation Fund[14], the Government's massive National Optic Fibre

[9] TRAI Performance Indicator reports
[10] Forthcoming ICRIER work on the Impact of Mobile and Internet
[11] Nokia MBit Study, 2015
[12] ICRIER and IAMAI, "An Inquiry Into The Impact of India's App Economy"
[13] 10th annual Cisco visual networking index (VNI) forecast
[14] The Universal Service Obligation Fund (USOF) seeks to expand rural telecom and Internet access using resources collected from operators in the form of a Universal Service Levy (USL, a fixed percentage of operators' Adjusted

Network (NOFN) plan was supposed to dramatically extend fibre availability by laying 372,000 miles of cable at an estimated cost of $3 billion seems unlikely to deliver on schedule. Recent revaluation of the programme has revealed that almost 3 times as much cabling will be required, increasing the price tag to $11.2 billion. The rate of progress has also been quite low. Private installation of optic fibre is also saddled by institutional constraints, including problems regarding Right of Way (charges of which can often be between 5 to 20 times the cost of the fibre being laid) – however private participation in the NOFN programme has been non-existent. The NOFN is part of a larger government flagship programme – Digital India – a multipronged agenda for increasing supply of digital infrastructure, increasing digital literacy and migrating government services online. However the primary premise of the programme – that increasing supply will create its own demand – may not hold as true for the Internet as it did for telephone connectivity. Internet growth is dependent on the creation of an ecosystem on both sides of the equation.

It might be that India has exhausted the low hanging fruit that wireless technologies provided in terms of increasing connectivity with minimal infrastructural investment. Demand is beginning to burst at the seams of India's internet capacity, and additional infrastructural investment is now essential to maintain the rates of connectivity growth that in the previous decade were taken for granted.

The telecommunications sector in India is an example of a sector that has seen the emergence of a governance structure that includes creation of an 'independent' regulator along with easier rules for market entry, a mechanism for funding of universal access, management of scarce resources, access to interconnection and bottleneck facilities, and enforcement of regulatory rules via the creation of a dispute settlement tribunal. Arguably, the telecommunications sector best reflects the benefits of creating regulatory institutions. While India has been able to attract private domestic entrepreneurs who are willing to finance, operate and maintain mobile pieces of transport equipment-trucks, buses, flatcars, ships and airplanes- in a competitive environment, the public sector dominates fixed infrastructure such as roads, ports, rail lines and airports. Due to insufficient investment these have become physical bottlenecks to efficient transportation of goods and people. India has implemented regulatory reform in sectors such as telecom and electricity, and in transport sectors such as civil aviation and ports among others, although the governance and regulatory architecture has been subject to several design and implementation problems. All major reforms have been predicated on the expectation that effective regulation of infrastructure monopolies can be implemented fairly quickly. Yet building regulatory institutions has, at best been challenging and at worst, a severe disappointment. Unless India is able to create a credible, conducive, capable and transparent institutional structure for governance of logistics, the macroeconomic goals of high, stable and inclusive growth will continue to suffer.

Gross Revenues). In a recent recommendation the telecom regulator TRAI has suggested to the Ministry of Telecom that the USOF levy be reduced from 5% to 3 % in light of the fact that the reported balance of unutilized funds was around Rs 39,135 crores as of March 2014- It has been widely held that the fund has been ineffectively utilized.

Fortunately there is growing awareness among policy makers that India's growth momentum is being constrained by inadequate infrastructure.[15] In a country of India's size and diversity, the demands on the public purse are enormous.[16] Growing fiscal deficits and lack of fiscal consolidation restrict the ability of the state to fund capital intensive infrastructure projects. This constraint has stimulated the development of innovative models of engaging with private sector in India and elsewhere. Since public investment will coexist with private in all transport sectors, including as public-private partnerships (PPP) – the state has to be effective not only in service delivery, but also in regulation, contracting and policymaking to obviate, *inter alia*, conflicts of interest. It is an open question whether fragmented regulatory structures add, detract or are neutral to realizing the objective of a well functioning, integrated and intermodal logistics infrastructure. Private sector participation however requires creating independent and effective regulatory mechanisms to ensure, on the one hand, fair returns to private investment and on the other hand, protection of consumer interest, including safety and affordability.

A number of research studies have shown the strong linkage between improvements in logistics and export performance. Hummels (1999) estimated that exporters with one percent lower shipping costs enjoyed a 5-8 percent higher market share. Limao and Venables (2001) estimated that differences in infrastructure quality account for 40 percent of the variation in transport costs for coastal countries and up to 60 percent for landlocked countries. Research shows that exporters in developing countries gain more from a 10% drop in their trading costs than from a similar reduction in the tariffs applied to their products in global markets[17]. Poor infrastructure in general and low quality logistics infrastructure in particular, is one of the most commonly cited reasons for India's inability to attract larger volumes of FDI. Inefficient transportation infrastructure also impedes India's ability to participate in global supply chains and regional production networks[18]. Recognizing the importance of transport and inadequacies in the network, India's Eleventh Five Year Plan earmarked US$ 500 billion to modernize, expand, and integrate the country's transport services[19]. The Twelfth Five year Plan has doubled the resources to US $ 1 trillion[20]. Even this increased amount is hardly going to suffice given the demands that are likely to be placed on transport services by a rapidly growing economy. Thus, it is both necessary and perhaps inevitable that the role of government change from that of a producer to more an enabler.

5. Infrastructure Financing in India

The investible resources of an economy comprises of domestic savings and external savings. While external savings flow in the economy in the form of external commercial borrowings, equity capital and foreign direct investments (FDI), domestic savings (for India) comprise

[15] Gajendra Haldia, Infrastructure at Crossroads, the Challenge of Governance, Oxford. 2011
[16] Budget papers various years
[17] World Bank, Doing Business in India Indicators 2012
[18] *Ibid*
[19] 11th Five Year Plan
[20] 12th Five Year Plan

three components: household savings, business or corporate savings (essentially the undistributed profit of the companies, and government budgetary surplus. Until the 10th Five Year Plan (FYP) (2002-03 and 2006-07) infrastructure investments in India were principally financed by the government budgetary allocations and the internal resources of public sector infra companies. This situation changed drastically post the 11th FYP (2007-08 and 2011-12) when the share of private participation in infrastructure investment went up and the role of financial systems in supplying debt finance for infrastructure assumed greater importance. The 12th FYP (2012-13) expects this trend to go up even further for meeting the financial requirements of growing infrastructure investments. The share of public investments in infrastructure is projected to decline to half as compared to two-third in previous plan. As a result the share of debt financing is expected to rise to about 50% in the 12th FYP (Table 10).

[Table 10 HERE]

In India, more than 50% of household savings are in physical assets such as real estate and gold and therefore not subject to financial intermediation. Of the total financial savings of households, about 55% are in the form of bank deposits which are relatively short term in nature. The rest are invested in life insurance, provident and pension funds. Investment in equity has been minor, except during the period just before financial crisis (Sinha 2014). The main sources of infrastructure financing in India have been commercial banks and NBFCs. Of the total planned investment the share of the private sector is about 48%. Almost 50% of the total investment is expected to be financed by borrowings. Out of the total debt financing sources, banks and Non-Banking Financial Companies (NBFC) have been the two major source of financing infrastructure sector and this trend is likely to continue in the 12th FYP (Table 11).

[Table 11 HERE]

Traditionally, banks have been the non-budgetary debt financing source for infrastructure projects. PPP infrastructure projects in India depend on bank loans for over 80 percent of their debt (NIFPF 2015). However, infrastructure financing through loans from banks is no longer sustainable, and is constrained by various challenges:

- Bank face the asset liability mismatches (ALM) challenge because they finance long term infrastructure loans through deposits of shorter maturity. This constraints them from being a sustainable long term source of finance for the infrastructure sector and financing by rolling over short term debt exposes the project to rollover or refinancing risks (Sinha 2014). Going forward, as the BASEL III bank liquidity norms such as Liquidity Coverage Ratio are implemented bank financing of long term projects is likely to be constrained further.

- The growing trend of stressed assets from infrastructure sector is adding to the challenge for the banks to finance such projects. The gross NPAs and restructured standard advances to the infrastructure sector together as a percentage of total advances to the sector, has increased considerably from INR 193 billion (5.1 percent of gross

advances to the sector) as at the end of March 2010 to INR 2,222 billion (22.8 percent of gross advances to the sector) as at the end of March 2015 (RBI Speech H. Khan 2015).

- The outstanding bank credit to the infrastructure sector, which stood at INR 95 billion in March 2001, has increased rapidly to INR 10,074 billion in March 2015, a compound annual growth rate (CAGR) of 39.5 percent over the last 14 years. Thus, banks are close to their maximum sector exposure limit of 15% to infrastructure which will constrain additional bank financing.

[Table 12 HERE]

For providing long term sources of financing the infrastructure, RBI created a separate class of non-deposit taking NBFCs called Infrastructure Finance Companies (IFCs). These IFCs (such as PFC, REC, IDFC, IIFCL, L&T Infra and IFCI etc.) have been the second most important source of debt financing of infrastructure projects in India after banks. The IFCs have funded INR 6.6 trillion of infrastructure loans as on Mar 31, 2015 and are expected to contribute another INR 2.0 trillion over the remaining period of 12th plan ending FY17 (ICRA July 2015).[21] Unlike banks, IFCs do not face the ALM problem that banks do since they are in a position to mobilize long term funds. However, IFCs are non- deposit taking institutions and hence the total resource base these institutions can tap is limited which makes availability of long term funds a challenge. Besides, the regulatory system restricts the sectoral allocation and exposures to a few major sectors like power, rural electrification, ports, roads etc. For credit disbursement of IFCs to grow at 20 percent (as per the projections of 12th Five Year Plan), there is a need for further capital mobilization.

While commercial banks and NBFCs have been the major source of financing of infrastructure and they cover about 80% of the financing to this sector, there is a huge gap between the available resources and investment requirements. This deficit can be met by mobilizing the vast resource base of the insurance and pension funds through the bond market. In developed economies, infrastructure projects are financed through capital markets, insurance and pension funds. (Sinha 2014) Life insurance and pension funds have diversified assets (assets of various maturities) to match the long-term liabilities and are best sources of long term finance. Assets under management of the life insurers and non- life insurance in the insurance sector increased at a CAGR of 16.6% and 9.62% respectively between March 2007 to March 2010. However, infrastructure investment from these grew by -5% and 4% respectively during the same period (NIPFP 2014). This discrepancy can be explained by the fact that statutory requirements by the regulators, IRDA and PFRDA in consumer interest, allow insurance and pension funds to invest only in assets rated AA or above (NIPFP 2015). Infrastructure assets are usually rated BBB- or at best, A. It is difficult for infrastructure assets to get a higher rating particularly in the initial construction phase, because infrastructure projects face risks related to construction, land acquisition, financing and cost escalations, and enforcement of property rights. With insurance projected to grow from

[21] http://www.icra.in/Files/ticker/SH-2015-Q3-1-ICRA-NBFC%E2%80%93Infrastructure.pdf

current 4% of GDP to 6.4% by the end of 12th FYP, the insurance penetration is estimated to rise. Thus infrastructure investment of about INR 1,507 billion is projected to be available from the insurance sector during 12th FYP.

[Table 13 HERE]

External commercial borrowings and equity/ foreign direct investments offer limited sources of financing of infrastructure due to the limits imposed by RBI on ECBs and the need of regulatory changes to make infrastructure projects more attractive to draw equity or FDI. The infrastructure investment requirements for the 12th FYP have been estimated at INR 55,746 billion crores, of which INR 19,737 billion is expected to come from the budgetary sources (both Central and State Governments) and the remaining has to be financed by debt and equity.

5.1 Long Term Financing of Infrastructure

- **Credit Enhancement Scheme**: Insurance and Pension funds have huge resources that can be mobilized to the infrastructure sector but are constrained by the regulatory requirements of IRDA and PFRDA to invest in assets with a credit rating to AA or above. The credit enhancement scheme improves the credit rating of operational investment grade infrastructure projects provided they meet certain criteria such as Debt Service Coverage Ratio (DSCR)[22] of greater than one. This facility is available only with a counter guarantee by financial institutions and or Multilateral Development Bank to ensure no default occurs.

- **RBI's 5/25 scheme to address banks ALM challenge**: In 2004, RBI announced a 5/25 flexible structuring and refinancing scheme with a view to ensure long term viability of infrastructure by smoothening the cash flow stress in the initial years and address the maturity mismatches of banks. As per the flexible 5/25 scheme, lenders are allowed to fix longer amortisation period for loans to infrastructure projects based on the economic life or concession period of the project with periodic refinancing, say every 5 years. Thus, banks while assessing the viability of the project are allowed to accept the project as a viable venture where the average DSCR and other financial and non-financial parameters are acceptable over a longer amortisation period of, say, 25 years (amortisation schedule) but provide funding (Initial Debt Facility) for only, say, 5 years with refinancing of balance debt being allowed by existing or new banks (Refinancing Debt Facility) or even through bonds (RBI 2015). This scheme allows for long term lending from the banks without the adverse ALM issues and the exposure of the banks is based on the stage of the life-cycle of the project.

- **Channelizing domestic household savings to infrastructure bonds**: The 12th FYP report states that '*the market for infrastructure debt generically belongs to the*

[22] Debt Service Coverage Ratio (DCR or DSCR) is defined as the ratio of profit to equity + depreciation + interest (i.e., gross return to capital employed) and amortized debt servicing requirement (inclusive of interest and principal repayment component).

corporate bond market and without the latter, movement in the former is unlikely'. Bond financing of infrastructure requires availability of long term savings. Thus it is important to mobilize domestic household savings to infrastructure directly through differential tax treatment for infrastructure investments such as personal income tax exemption on investment made in as well as incomes earned from long-term infrastructure bonds, tax exemption on investment incomes earned from Infrastructure Debt Funds. The Infrastructure Investment Trusts (InvIT) proposed in the Union budget 2014-15 is expected to mobilize domestic household savings through capital market and reduce pressure on the banking system (NIPFP 2014).

- **Additional sources of infrastructure financing:** Financial Institutions like National Bank for Agriculture and Rural Development (NABARD), Small Industries Development Bank of India (SIDBI), National Housing Bank (NHB) and Export-Import Bank of India (EXIM bank) can also be thought of as possibilities of mobilizing additional finances for infrastructure. Though these financial institutions have specific mandates to cater to specific sectors, one can explore the possibility or flexibility of their investment in infrastructure. (Financial Stability Report, RBI, December 2013).

- **Strengthening Municipal bond market for financing urban infrastructure:** Municipal bonds are a financing option for the urban infrastructure. Municipal bonds in India fund only 1 percent of the total urban local body (ULB) contribution as against about 10 percent in the United States. However, in spite of weak finances, none of the municipal bond issues in India have defaulted in repayment to date. This indicates that bond financing can be a feasible option for ULBs for raising finances. However, the municipal bond market in India needs to be strengthened by taking steps such as altering the regulatory and legal conditions that currently hinder the municipal borrowing in India, introducing flexibility in setting interest rate cap for issuance of municipal bonds by linking it to a benchmark market rate, treating tax free municipal bonds in the same way as other tax free instruments is necessary (RBI 2015, speech).

6. Conclusions

India's national connectivity needs to be upgraded and dovetailed into a regional roadmap. The evidence in this paper suggests the importance of both hard as well as soft infrastructure for enhancing trade flows. Hard aspects include all physical infrastructure such roads and trade and transit facilities. The softer dimensions of connectivity include measures that facilitate smooth movement of goods and people such as free trade agreements (FTAs) and transport agreements. The existence of both aspects simultaneously will produce gains of a significantly higher order-one without the other is likely to be ineffective. Thus for India to enhance regional trade (and regional integration) and reach its trade potential, it is important to improve its physical connectivity within and across borders and strengthen trading infrastructure facilities, including trade facilitation.

One estimate suggests that every year between 19,000 and 25,000 kilometres of roads and 7,400 kilometres of subways and transportation links would need to be built. At the same

time we know that the availability and quality of infrastructure services are often highly politicized and decisions of the various sectors are uncoordinated. A unitary Transport Ministry is thus a vital step towards having an integrated national transport policy that transcends individual modal interests and achieves superior coordination. Strengthening independent regulation in transport sectors is also desirable since it possesses the advantage of potentially limiting political convenience.

Given the growing use of PPP contracts in infrastructure, an increasing role will also be to ensure compliance with the PPP contracts. The challenge is considerable; not only because of the complexity and that it requires a learning process, but also because of the lack of a regulatory tradition and track record, scarcity of expertise, and weak formal and informal norms protecting private rights. Effective regulatory institutions must be designed to provide credible commitments for investors who incur large sunk costs. Increase in the role of the private sector in provision of transport infrastructure is inevitable, with the role of the state focused chiefly on policy formulation and regulatory oversight. Ownership and operation by the public sector should be in extreme cases of market failure such as for infrastructure that is financially unviable and has high social value. Given the socio-economic-political context, robust institutions for regulatory governance will no doubt take time, first to create and then for these to mature and gain legitimacy in India. Although independent regulation in India is relatively new, there is a wealth of evidence from the telecom and power sectors that can help design and implement a performance enhancing regulatory mechanism for transport that emphasizes local needs and the local context.

Other specific recommendations are as follows:

6.1 Long Term Options for Financing of Infrastructure

Financing of infrastructure projects through short term sources leads to ALM mismatches and are unsustainable. Considering that the government budgetary sources are constrained, to meet the demand for infrastructure investment, it is necessary to tap the long term sources of financing such as insurance and pension funds market.

6.2 Promoting infrastructure and connectivity in North-eastern regions

The Northeast Region (NER) of India acts as a land bridge between South and Southeast Asia and is central to India’s growing economic and strategic partnership with East and Southeast Asia. India should focus improving transport infrastructure in the NER and promote projects that expand connectivity of the NER with cross border areas. Geographically, India is also strategically positioned to connect East and West Asia. For India to emerge as an economic power in South Asia and South East Asia, the development of a dense network of transport linkages throughout this larger neighbourhood is absolutely vital.

6.3 Gateway infrastructure

India needs to significantly improve its port infrastructure by increasing the capacity of ports substantially from the current level of about 1,000 to 2,500 million MT. This should be done

through PPP mode preferably using what is called the Landlord Port model. The attractiveness of the Landlord Port Model is that it allows the state to act as the landlord while port investments and operations are carried out by private companies. The rail and road connectivity of ports also needs significant improvement.

6.4 Completion of Major Cross- border corridors

Completion of major cross border connectivity projects such as the Kaladan Multimodal Transit Transport Project; and the Mekong–India Economic Corridor are essential for India to reach its trade potential with ASEAN.

6.5 Speedy progress of Dedicated Freight Corridor

The North-South and East-West dedicated freight corridors should be completed speedily and work should be taken up in other identified networks where traffic has reached saturation levels, to improve the reliability of container delivery through the railways.

6.6 Accepting Transit and Paperless Trade

In terms of requirement of soft infrastructure, India needs to negotiate and finalize regional and transit transport agreement that will allow vehicles to move seamlessly for regional and international trade transportation purposes.

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Table 1: Impacts of Barriers to Trade

Table 1: Gravity Model Estimates: Impact of Barriers to Trade

Variables	Model 4	
	coefficients	t-values
Transaction costs	-0197***	-2.142
Importing countries transport infrastructure	-1.825*	-10.401
Exporting countries transport infrastructure	-1.032**	-6.026
Distance	-0.993***	-3.493
Adjusted R squared	0.741	
DW	1.526	
Serial Correlation	0.010	

Notes: Gravity estimates are based on fixed effect OLS. The dependent variable is Ln (Import) *Denotes statistical significance at 1% level. **Denotes statistical significance at 5% level. ***Denotes statistical significance at 10% level.

Source: De (2006)

Table 2: India's trade potential with ASEAN and ASEAN+3

	ASEAN	ASEAN+3
2000 (a)	7.13	14.57
2009 (a)	41.32	101.47
2012 (a)	76.26	182.23
2012 (p)	135.45	312.61
2015 (p)	169.32	379.75
2018 (p)	201.78	444.78

Source: De (2008)

Table 3: Overall Infrastructure Performance of India vis-à-vis ASEAN and ASEAN+3

	Export as % of intra-regional exports	Imports as % of intra-regional imports	Trade as % of intra-regional trade
India	0.53	4.49	2.37
China	28.81	23.15	26.18
Malaysia	4.04	5.43	4.68
Thailand	3.42	6.05	4.64

Source: UNCOMTRADE, estimated by Hoda and Rai (2014)

Table 4: Logistics Indices

Country	Position in World Bank's Logistics Performance Index (LPI), 2014	Position in UNCTAD's Liner Shipping Connectivity Index, 2014	Position in World Bank's Air Connectivity Index, 2007
China	28	1	46
Malaysia	25	5	83
Thailand	35	30	75
India	54	29	88

Source: World Bank 2014, UNCTAD 2014

Table 5: Status of NHDP as of December 21, 2014

Si No	NHDP component	Total length (km)	Completed 4/6 lane (km)	Under implementation		Balance for award of civil works (km)
				Length (km)	No. of contracts	
1	NHDP Phase I (GQ, port connectivity, others)	7,522*	7,519	3	1	-
2	NS-EW Corridors	6,647	5,836	441	45	370
3	NHDP Phase III	12,109	6,352	4,708	125	1,049
4	NHDP Phase IV	20,000	907	7,759	114	11,334
5	NHDP Phase V	6,500	1,973	2,107	27	2,420
6	NHDP Phase VI	1,000	0	0	0	1,000
7	NHDP Phase VII	700	22	19	1	659
	Total	54,478	22,609	15,037	313	16,832

Note: *Two projects (24 km) for Chennai - Ennore port connectivity have been re-awarded. These two projects were merged with another project (6km) under Phase I, whereby total length increased by 24 km.

Source: Economic Survey 2014-15

Table 6: Benchmarking Efficiency: India vis-à-vis China and Russia

	Network Productivity	Wagon Productivity (Annual)
India	9.39	2.73
Russia	21.87	5.52
China	39.66	4.31

Source: Economic Survey 2014-15

Table 7: Railways, Backward and Forward Linkages

Sector	1993-94	1998-99	2003-04	2007-08
Backward Linkage				
Agriculture	0.01	0.01	0.01	0.02
Industry	0.63	0.76	0.93	2.04
Services	1.28	1.32	1.24	1.23
Total Backward Linkage	**1.92**	**2.08**	**2.19**	**3.29**
Forward Linkage				
Agriculture	0.13	0.12	0.16	0.07
Industry	2.15	2.03	2.11	1.18
Services	1.13	1.13	1.16	1.19
Total Forward Linkage	**3.41**	**3.28**	**3.44**	**2.45**
Calculations based on CSO input-output tables				

Source: Economic Survey 2014-15

Table 8: Cargo Traffic at Ports

Category of ports	2012-	2013-14	April - December	
			2013-14	2014-15
Major ports	545.83	555.49(1.8)	413.06	433.86
Non-major ports	387.92	420.24 (8.3)	312.84	341.31
All ports	933.75	975.73 (4.5)	725.9	775.17
Note: Figures in parentheses indicate growth over the previous year				

Source: Ministry of Shipping, Economic Survey 2014-15

Table 9: Comparative overall position of India on logistics, liner shipping and air connectivity

Country	Position in World Bank's Logistics Performance Index (LPI), 2014	Position in UNCTAD's Liner Shipping Connectivity Index, 2014	Position in World Bank's Air Connectivity Index, 2007
China	28	1	46
Malaysia	25	5	83
Thailand	35	30	75
India	54	29	88

Source: World Bank 2014, UNCTAD 2014

Table 10: Source-wise Projected Investment of Infrastructure

					(Rs. crores at current prices)		
Sectors	**Total**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**Total**
1. Public	153677	457702	510707	570862	637497	714057	2890823
Centre	856717	250758	280662	315217	354296	400129	1601061
States	680056	206944	230045	255645	283201	313928	1289762
2. Private	887504	293310	376747	490455	648077	875251	2683840
3. Total (1+2)	**242427**	**751012**	**887454**	**1061316**	**1285573**	**1589308**	**5574663**
4. GDP (market	336044	1015061	1164598	1335802	15347089	17661485	6816320
Investment as percent of GDP (mp)	7.21	7.40	7.62	7.95	8.38	9.00	8.18
Public Investment in Infrastructure	1536773	457702	510707	570862	637497	714057	2890823
Budgetary Sources (incl. equity)		234954	253832	274658	297719	323384	1384547
Internal resource generation in PSEs		91629	103171	116341	130705	147340	589185
Borrowings		131119	153703	179862	209073	243333	917092
Private Investment in Infrastructure	**887504**	**293310**	**376747**	**490455**	**648077**	**875251**	**2683840**
Internal accruals or resource generation (incl. equity)		88	113024	152042	200904	271328	825291
Borrowings		205318	263723	338413	447172	603923	825291
Total Investment	**2424277**	**751012**	**887454**	**1061316**	**1285573**	**1589308**	**5574663**
Share of Non-		414575	470027	543041	629328	742052	2799022
Share of Debt		336437	417426	518275	656246	847256	2775641
Share of Private Investment in Total Infrastructure Investment (%)	**36.61**	**39.06**	**42.45**	**46.21**	**50.41**	**55.07**	**48.14**

Source: Twelfth Five Year Plan, Vol. pp 89-90, De (2008)

Table 11: Sources of debt financing in India

				(Rs. crore at current prices)		
	2012-13	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**Total Twelfth Plan**
Domestic Bank	119066	162663	216015	285513	381389	1164646 (51.4)
NBFCs	56973	81027	112014	154124	214325	618462 (27.3)
Pension/Insurance	21681	25694	29602	33941	39331	150248 (6.6)
ECBs	46799	56020	65182	75484	88349	331834 (14.6)
Likely Total Debt	244519	325404	422813	549062	723394	2265190
Estimated Requirement of Debt	336437	417426	518275	656246	847256	2775641
Gap between estimates & likely requirement	91918	92022	95462	107184	123862	510451

Note: Figures in parenthesis refer to percentage share in total debt

Source: Twelfth Five Year Plan. Vol. 1, p. 91.

Table 12: Asset Quality of Infrastructure Loans by Scheduled Commercial Banks

As on March 31	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Total Bank Credit (A)	29,999.0	34,967.20	42,992.50	50,748.30	58,796.70	
Total Bank NPAs (Gross) (B)	682.16	818.08	914.21	1371.02	1838.54	
Total NPA to Total Bank Credit Ratio [(A/B)*100]	2.27	2.34	2.19	2.70	3.13	
Infrastructure Sector						
Total Outstanding (Gross) Loans to Infrastructure (C)	2618.00	3816.12	5371.08	6164.07	7860.45	
Share of Infrastructure in total bank credit [(C/A)*100]	8.73	10.91	12.49	12.15	13.37	
Total NPAs (Gross) in Infrastructure (D)	16.02	22.84	39.1	63.25	114.09	
NPA to Credit Ratio for Infrastructure Sector [(D/C)*100]	0.61	0.60	0.73	1.03	1.45	

Source: NIPFP (2015)

Table 13: Insurance- Projections in Infrastructure Financing

					(Rs. crores)		
	March 2011	**March 2012**	**March 2013**	**March 2014**	**March 2015**	**March 2016**	**March 2017**
GDP Projections	7877947	9016310	103191	1181028	1351687	1547006	1770548
Premium (% of	4.10%	4.40%	4.70%	5.10%	5.50%	5.90%	6.40%
Total premium	322996	396718	485001	602325	743428	912734	1133151
Total Investment	204586	251281	307200	381513	470888	578126	717738
Infra Investment	12562	15429	18862	23425	28913	35497	44069

Assumptions: 1. Advanced Estimates of GDP for FY11 based on Economic survey 2011

2. Premium as a percent of GDP for March 2011- 2017 based on estimates of Subgroup on Household Sector Savings
3. Investments estimates based on assumption of 63.14 percent of total premium collected towards investments
4. Investments into infrastructure based on assumption of 6.14 percent of total investments towards Infrastructure

Sources: Working Sub-Group on Infrastructure (undated)

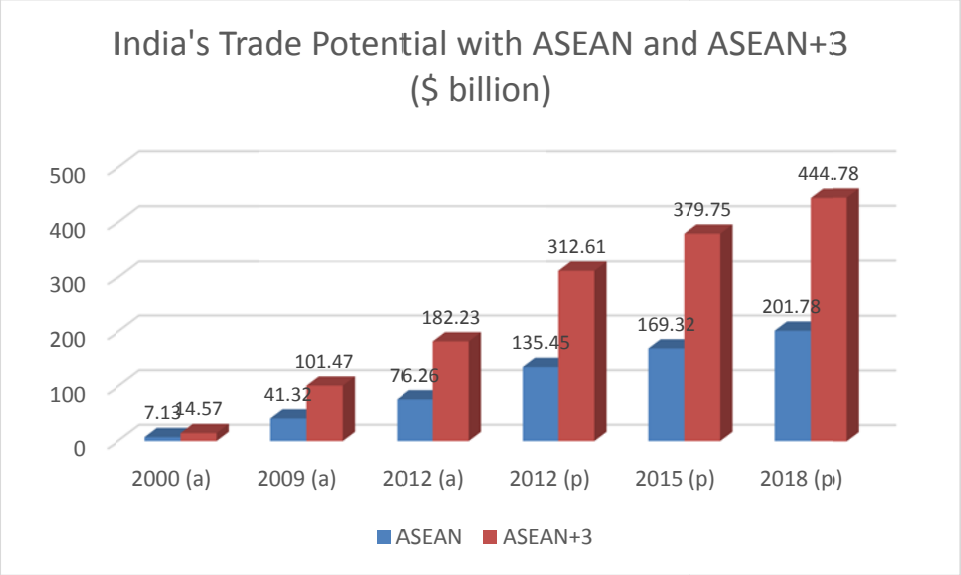
Table 14: Estimation of funding gap for the infrastructure sector

(Rs. crores)

	Particulars	12th Plan Document	WG on Savings dining 12th plan
1	**Total Investment Requirement @**	**5574663**	**5574663**
2	Finances from Budgetary sources #	1973732	1973732
3	Total Debt (a+b+c+d)	2265190	1337508
	a. Commercial Banks	1164646	744006
	b. NBFCs	618462	384477
	c. Insurance Pension	150248	147960
	d. ECBs	331834	61065
4	Equity/FDI $	825291	456487
5	**Total Investment Available (2+3+4)**	**5064213**	**3767727**
6	**Funding Gap (1-5)**	**510450**	**1806936**

Note: @ Total investment requirement is taken from the 12th five year plan document Vol 1. p.90: # Finances from budgetary sources is taken from the 12th five year plan document Vol 1. p.90: $ Equity/FDI for the 12th Plan document comprises private internal accruals/equity Source: Compiled by authors

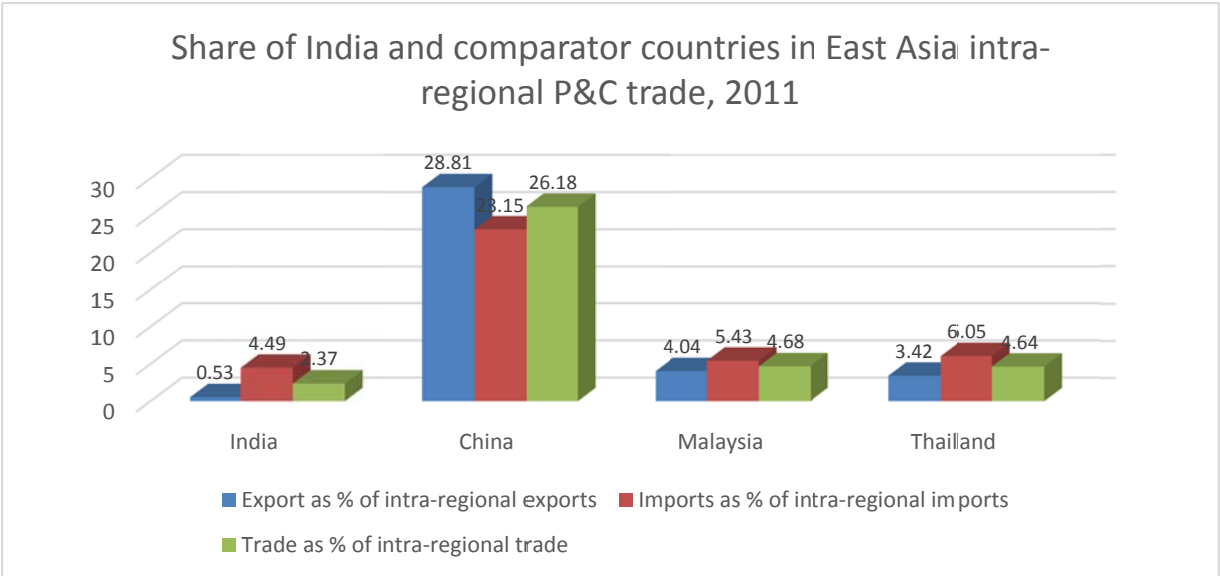
Figure 1: India's Trade Potential with ASEAN and ASEAN+3 ($ billions)



Note: Estimated potentials are based on an augmented gravity model. For technical details of the gravity estimates, see Appendix.

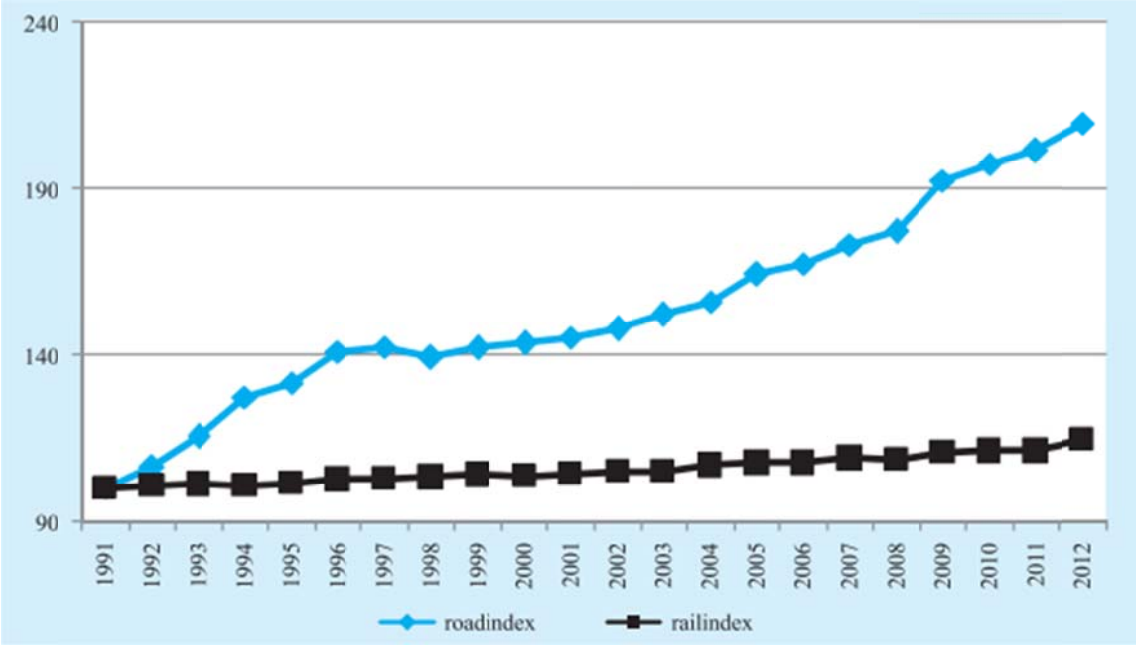
Source: De (2008)

Figure 2: Share of India and comparator countries in East Asia intra-regional P&C trade, 2011



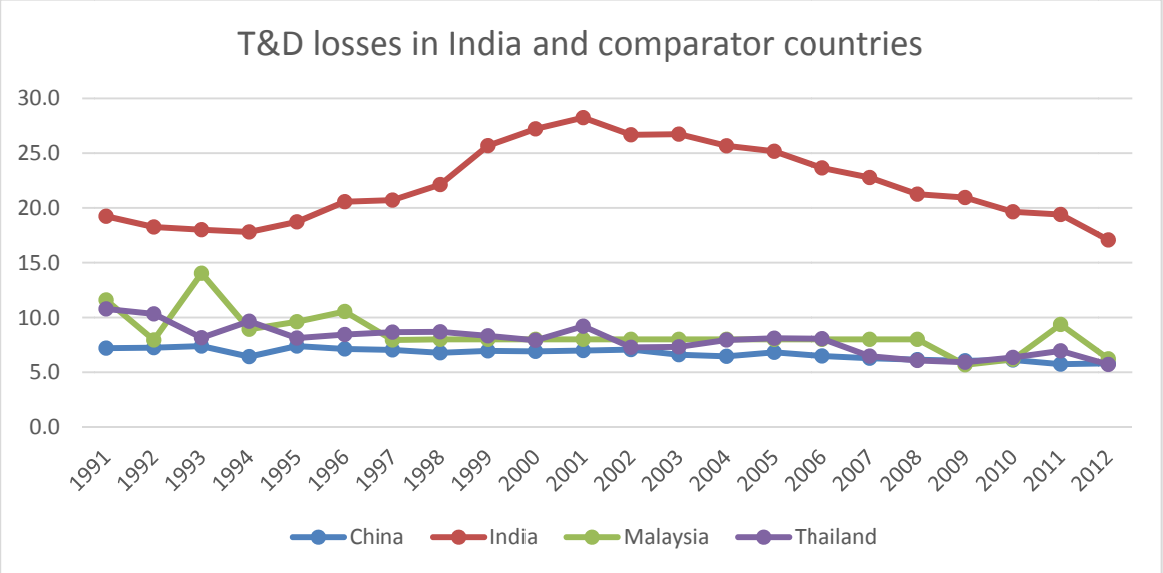
Source: UNCOMTRADE, estimated by Hoda and Rai (2014)

Figure 3: Capacity Addition in the railways and roads sector in India



Source: Economic Survey 2014-15

Figure 4: T&D losses in India and comparator countries



Source: World Bank WDI

Box 1: India's cross border connectivity projects with South East Asia

On- going Projects

India–Myanmar–Thailand Trilateral Highway (IMTTH):

The India–Myanmar–Thailand Trilateral Highway (IMTTH) is a cross-border transportation network being financed by the governments of India, Myanmar, and Thailand. This highway (3200 km long) links Moreh (in India) with Mae Sot (in Thailand) through Bagan and Mandalay (in Myanmar), and is often termed as the land-bridge between South and Southeast Asia. India has also announced the extension of the Trilateral Highway to Cambodia, the Lao PDR, and Viet Nam. The project which began in 2012 is expected to complete in November 2015.

Delhi–Ha Noi Railway Link (DHRL):

The Indian government is planning to develop the DHRL through two possible routes. Both the proposed railway routes will connect Ha Noi through Myanmar with different rail links. Route I will connect Ha Noi via Myanmar, Thailand, and Cambodia. In Route II, the route is diverted to Bangkok via Ye and the newly constructed portion of Ye and Dawei in Myanmar, and then to Ha Noi through Thailand and Lao PDR. There is about 238 km of missing railway links, which have to be built in Myanmar in order to have the Delhi–Ha Noi railway in operation.

Kaladan Multimodal Transit Transport Project (KMTTP):

The Kaladan Multimodal Transit Transport Project (KMTTP) started in 2010 in Myanmar envisaged connectivity within Indian ports and the Sittwe port in Myanmar, and road and inland waterway links from Sittwe to India's northeastern region. The KMTTP would provide an alternate route for transportation of goods to northeastern India through Myanmar. KMTTP has two major components: (i) development of the port and IWT development between Sittwe and Kaletwa in Myanmar along the Kaladan River, and (ii) building a highway (129 km) from Kaletwa to the India–Myanmar border in Mizoram.

Mekong- India Economic Corridor (MIEC):

The Mekong–India Economic Corridor (MIEC) is being built to integrate Myanmar, Thailand, Cambodia, and Viet Nam, with India. Upon completion the corridor is expected to augment trade with India by reducing the travel distances between India and MIEC countries and removing supply-side bottlenecks.

Stilwell Road

Stilwell Road (1033 km long) connects Ledo in Assam to Kunming in PRC. It passes through the Pangsaung Pass (Myanmar–India border) and Myitkyina in PRC. There has been some

good progress on Stillwell Road. The upgraded road is about 172 kms of which 105 km is in Myanmar.

Tiddim–Rih–Falam Road

The Tiddim–Rih–Falam (TRF) road up gradation project (started in 2006) aims to build connectivity between India's northeastern states and Myanmar, and to enhance bilateral border trade. It has two road components: Rih–Tiddim (80 km) and Rih–Falam (151 km).

Proposed projects:

India–Myanmar–Lao PDR–Viet Nam Corridor and the Sittwe Industrial Zone

Viet Nam and Myanmar authorities have identified a new route through Yangon, Meikhtila, Tarlay, Kenglap (Myanmar), Xieng Kok, Loungnamtha, Oudomxay, Deptaechang (Lao PDR), Tay Trang, and Ha Noi (Viet Nam) following which a new corridor can be set up between India and Viet Nam through Myanmar and Lao PDR.

Bangladesh–PRC–India–Myanmar Economic Corridor

The Bangladesh–PRC–India–Myanmar Economic Corridor (BCIM-EC) is a Track II initiative to enhance regional cooperation among the member countries. The Kolkata to Kunming Highway plan (K2K Highway) was unveiled at the 10th BCIM Forum meeting held at Kolkata in February 2012. The route of the K2K Highway is identified as through Kolkata, Dhaka Imphal, Mandalay, Lashio, Muse, and Kunming (2,490 km). It also links Ledo (in Assam) through the old Stilwell Road. A large part of this route overlaps with the Trilateral Highway, and follows Asian Highways 1 (up to Mandalay) and 14 (from Mandalay to Kunming).

Source: De 2014

Box 2: National Connectivity Projects in India

National Highway Development Program Phase VI:

The National Highway Development Program (NHDP) Phase VI plans to develop approximately 1,000 km of greenfield expressways using PPP mechanisms. This initiative plans to use build, finance, operate, transfer (DBFOT) pattern after a build, own and transfer (BOT)mode, incorporating the maximum viability gap funding (VGF) of 40%. The highways are to be constructed on new alignments, and have been projected to cost about Rs 16,680 crores. The Ministry of Road Transport and Highways final report, submitted in November 2009 had focused on a list of 60 projects consisting around 18,637 km. the report charted the development of the highway network in three stages: Phase I (up to 2012), Phase II (by 2017) and Phase III (by 2022).

Chennai – Ennore Port Road Connectivity Project:

The Chennai Ennore Port Road is a 30 km long project budgeted at cost Rs 600 crore, and aims to link the Chennai, Ennore ports and the Ennore SEZ with the vast and upgraded National Highway system. Progress in the form of awarding a contract for road work has been made, but the land acquisition hurdle has faltered projects in the past. If successful, this initiative will bridge the often overlooked gap between highway connectivity and maritime transport, and will boost cargo evacuation and trade.

Delhi – Mumbai Industrial Corridor:

The Delhi – Mumbai Industrial Corridor (DMIC) aims to develop an industrial belt from Mumbai to Delhi to capitalize on the economic gains from the Western Dedicated Freight Corridor (DDFC), and encompasses seven states, DMICDC will develop the required additional road and rail capacity to markets and ports, and handle all project development services – from raising financial instruments, to establishing industrial investments. Included in this initiative will be nine mega-industrial zones, six airports, three ports, a high speed freight line, a 4,000 MW power plant and a six lane highway running the length of the corridor. However, the project has met several delays and according to the latest plan, Phase I should be completed by 2017. The project envisions doubling employment potential, tripling industrial activity and quadrupling exports from this area within the next 5 years.

Chennai Bangalore Industrial Corridor:

Chennai – Bangalore Industrial Corridor has also been proposed, drawing inspiration from the DMIC. The first phase will begin in Chennai and extend toward Karnataka, and the second phase will complete the corridor to Bangalore. A long term plan by the Indian Railways have also been submitted to create a high speed rail to connect the planned industrial and IT parks, integrated cities, and special economic zones. The objective is to boost trade with Southeast Asian countries, attract foreign investment, connect manufacturing and knowledge hubs and activate local commerce. The initial Regional Perspective Plan is expected to be rolled out this year, and the final report is to be submitted around 2016.

Bangalore – Mumbai Economic Corridor:

This corridor links the DMIC with the Chennai – Bangalore Corridor. The UK government has agreed to conduct a feasibility study jointly with the Indian government on this project. The Indian government has pegged a $50 billion investment as necessary for such a corridor. The DMICDC has initiated allocation process to select a consultant for a feasibility study, which will be funded and procured by the Government of India.

East Coast Economic Corridor:

Asian Development Bank has begun a feasibility study on the Vishakapatnam – Chennai leg of the proposed East Coast Economic Corridor which aims to connect Kolkata to Tuticorin, via Chennai. As per the commitment made by the Government of India in the Andhra

Pradesh Reorganization Act, 2014, the Vishakapatnam – Chennai section of the corridor will be the first focus.

Dedicated Freight Corridors:

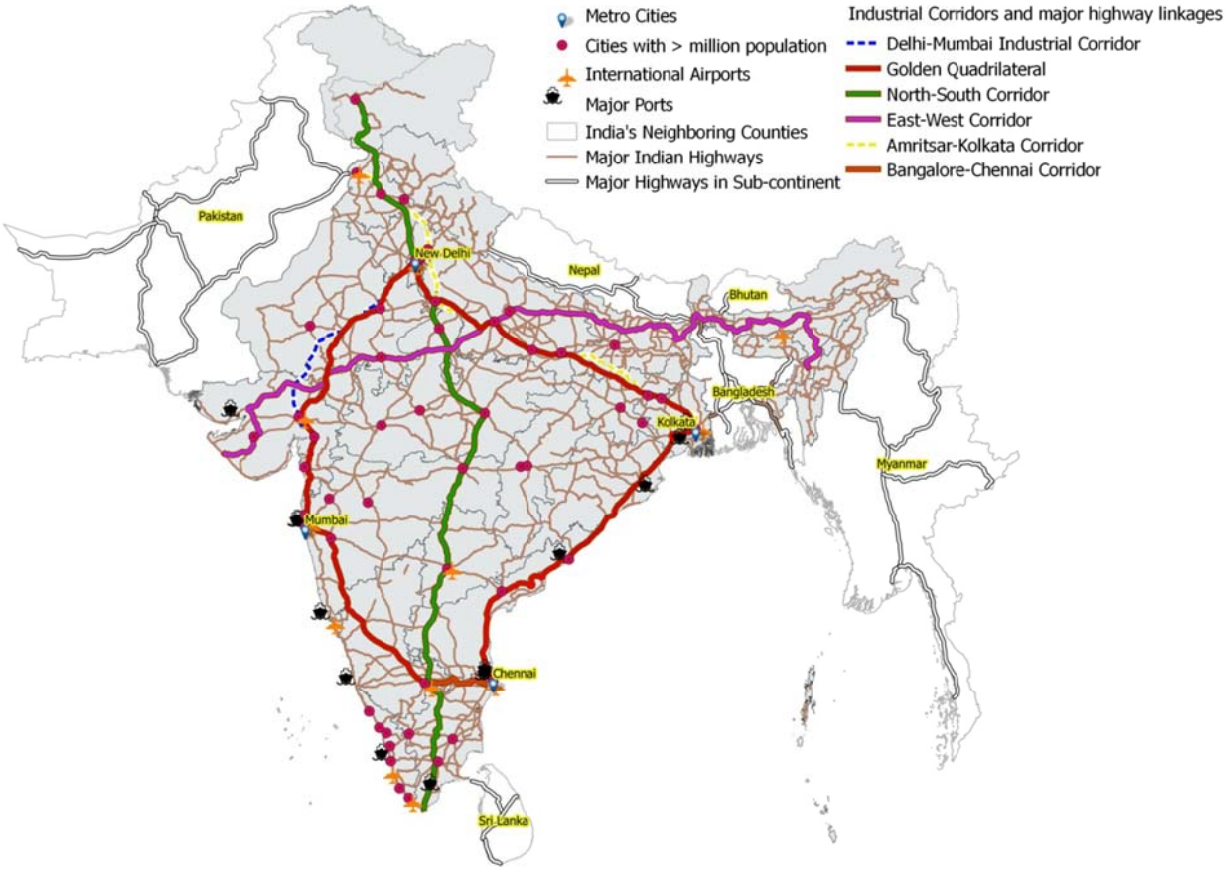
The Government of India set up the Dedicated Freight Corridor (DFC) project in an effort to meeting the ever increasing demand for freight and cargo movement. Phase I is scheduled to be completed by 2016, running 920 km from Rewari to Vadodara. Phase II is planned to cover stretches of 127 km and 426 km to the Jawaharlal Nehru Port, and is expected to be completed by 2017. An Eastern corridor is planned to tap the potential of the deep sea port proposed in South Bengal, handling movement of coal and steel. The Eastern corridor is expected to be completed by 2016-2017. The Indian Railways Vision 2020 report further recommended creating DFCs along four additional corridors covering 6,163 km, though a North-South Corridor, East-West Corridor, Southern Corridor and East Coast Corridor.

High Speed Rail Corridor:

Elevated high speed railway corridors, with the capacity of travelling at 250-350 km/hour have been mentioned in the Indian Ministry of Railways Vision 2020 document. The High Speed Rail Corporation of India was set up in July 2012 to handle tenders, conduct pre-feasibility studies, allocate contracts and manage projects. They will be implemented through PPP mode, on a DBFOT basis.

Source: De 2014

Map 1: Industrial Corridors and Major Highway Links



Source: ICRIER