Chapter I

Introduction

The issue of development among all issues, especially in Less Developed Countries (LDC’s) is the most important one. In the post second world war period, the primary focus of world economic attention has been on ways to accelerate the overall development in general and economic growth in particular. The policy makers, economists and politicians, especially of the developing countries, capitalist, socialist or mixed systems, have given utmost attention to achieve sustainable economic growth; for it was being increasingly felt that international economic and social order would remain a distant dream until the problem of poverty, unemployment and umbrella of all i.e. underdevelopment was solved. As, development is a multidimensional process and involves major changes in social structure, popular attitudes and national institutions as well as the acceleration of economic growth, reduction of inequalities and eradication of poverty. In a technical sense development refers to qualitative and structural change in the state of an economy. Growth as compared to development refers only to quantitative and tangible increase in the national income as it can take place owing to a spurt such as a rich harvest due to timely rains, changes in international market demands, price pattern, etc. But development refers to a relatively stable long range increase in real national income that is accompanied by a change in the attitudes of the people, their motivation, institutional set-up, high investment levels, stable unemployment and better production techniques. It has been realised that development is about people and their well-being, about people developing their capabilities to provide for their families, to act as stewards of the environment, to form civil societies that are just and orderly. The international consensus emerging around a set of development goals for the 21st century captures many constituents of well-being, current and future health status, educational attainment and freedom from extreme deprivation (World Bank, 1998).

Different countries have different development experiences, but one of the major characteristics of development experience in LDC’s has been the wide regional disparity in development levels. The people of the developing world have become aware of the advancements made by their counterparts and want to modernize and because of this
there is a great pressure on governments of these countries to accelerate national development, make use of up-to-date and relevant technological innovations, adapt and facilitate necessary institutional changes, increase national production by making full use of human and other resources and improve the level of living. While the size of the country and the geographical diversity do create some imbalances in resource base, but planned development and other efforts have been made by the respective governments in last couple of years to reduce regional disparities. The present development levels of LDC’s represent a bleak picture of balanced regional growth, so wide regional disparity is still a hard reality in these countries. The policy planners and economists have identified various factors that have close correspondence with regional development levels- infrastructure being the most important one among them (Majumder, 2003).

Infrastructure is a prerequisite for economic growth. It represents the ‘wheel’, if not the ‘engine’, of economic activity. For a rapidly growing economy, infrastructure availability of adequate quality, quantity and reliability is the key determinant. Infrastructure services are central to the activities of households and to economic production. Major infrastructure failures quickly and radically reduce quality of life and productivity. Conversely, improvement in infrastructure services enhances welfare and fosters economic growth (World Bank, 1994). Further, the provision of quality and efficient infrastructure services is essential to realize the full potential of the growth impulses surging through the economy.

Infrastructure is generally defined as physical framework of facilities through which goods and services are provided to the public. Its linkages to the economy are multiple and complex because it affects production and consumption directly, creates positive and negative spillover effects and involves large inflow of expenditure. Infrastructure that makes more sense from an economic standpoint consists of large capital intensive natural monopolies such as highways, other transportation facilities, water and sewer lines and communications system. An alternative version that focuses on ownership defines infrastructure, as the tangible capital stock owned by the public sector (Goel, 2003). World Development Report (WDR, 1994) divides infrastructure stock into economic or physical infrastructure and social infrastructure. Former includes services such as electricity, transport, roads, water system, communications, irrigation etc, while latter
includes education and health facilities. Other forms of infrastructure may be identified as institutional infrastructure as banking and civil administration. The term “Infrastructure” may be classified into the following three categories:

1. **Physical Infrastructure**: includes those set of facilities without which an integrated independent modern economy cannot function and is composed of transportation, telecommunications, power, irrigation etc.

2. **Social Infrastructure**: represents the standard of living of human capital and includes housing, education, public health, sanitation and supply of drinking water etc.

3. **Financial Infrastructure**: represents the spread of monetization and other commercial activities across the region and includes money and capital market.

Putting the similar view, Rosenstein Rodan (1961) indicated that the term infrastructure originated as a military term during world war I. It was applied to such items as oil pipe lines and subsequently broadened to include various other capital items. It was adopted more preferably to “social-over head capital” in the early days of the Marshall plan to avoid confusion with hospitals, schools and other welfare type facilities. It means that infrastructure is not any new concept but a new name given as what was known as social overhead capital. The term ‘infrastructure’ and ‘Social Overhead Capital’ (SOC) are used interchangeably in the development literature but the definitions given by WDR, 1994 (World Bank, 1994) and International Encyclopedia of Social Sciences (IESS) have created some confusion. WDR(1994) comments that infrastructure is umbrella term for SOC. However, the Report itself has preferred to use the term ‘economic infrastructure’ rather than ‘infrastructure’ for same set of activities. The focus of economic infrastructure, as emphasized by WDR is on public utilities, public works and other transport sector. Perhaps WDR preferred to use the term ‘economic infrastructure’ for these activities so as to exclude socio-political activities.

IESS defines SOC in ‘narrow sense’ to include transportation, communication and power facilities and also encompasses education, health, maintenance of law and order and research etc. in the ‘broad sense’. Thus the term economic infrastructure of WDR coincides with SOC in narrow sense of IESS, while infrastructure as such may coincide with SOC in broad sense.
The difference between the two broad categories has been brought as under:

1. **Degree of Contribution** - while contribution of economic infrastructure is much more immediate, like that of roads; of SOC, like education, is remote and farfetched.

2. **Microeconomic Approach** - casting the two sets of activities in the format of micro economic analysis, whereby viewing the whole economy as a multi-product firm, then economic infrastructure facilities constitute the fixed factors and SOC in broad sense the variable factors.

3. **Public Goods** - SOC in broad sense is a pure public good i.e. which once provided cannot be denied to any individual or society, while economic infrastructure are partial public goods i.e. though jointly consumable, yet can be denied to an individual or a group of individuals.

Taking into consideration all the above three criteria, it is clear that SOC in broad sense has profound social dimension while in case of narrow sense (economic infrastructure) the economic dimension is dominant. Broadly, it can be said that infrastructure comprises of all those services and activities, the basic rationale of which is the ‘sustenance’ provided to income generation and production in rest of the economy rather than income generation and production within the infrastructural enterprise (Shah, 1988).

Infrastructure provision is dominated by the public sector. Because infrastructure investments are lumpy, it is difficult for planners to match the availability of supply of infrastructure with demand at all times. Moreover they are usually non-rival and non-excludable in nature, which implies that consumption of a service by one consumer does not exclude other from consuming it and nor does this consumption invokes rivalry on the basis of purchasing power or any other feature. The consumers do not voluntarily pay for these services and these necessarily become an “unpaid input”. However government steps in and provides these services through the budget. But quite recently it is argued that government investment in infrastructure is important for developing economies to compete with the developed world (Goel, 2003). Nevertheless, infrastructure provision enhances the production and distribution network of key sectors in the economy and promotes overall economic growth. In the process they also tend to affect the cost
structure and productivity in these sectors, thereby promoting growth and development in each of these sectors in particular and overall economy in general.

Some characteristics of infrastructure may be enlisted as:

1. Infrastructure includes basic facilities on which the super-structure of the economy depends. It is *sin-qua-non* for economic development.
2. It is a dynamic concept which includes those services and facilities which are multipurpose and multidimensional in nature and involves huge expenditure in its building up and maintenance with long gestation period between the investment and generation of benefits.
3. The basic rationale of investment in infrastructure does not lie in profitability in itself but in its external impacts on the economy.
4. The services supplied by this sector are so widely used and their effectiveness is so dependent on other sectors of economy that the full contribution to the economy of such a sector is difficult to identify and even more difficult to measure.
5. The services provided by this sector, by and large, cannot be imported and hence they have to be produced indigenously as it affects the income generation, and the production of economy through both demand and supply.
6. Most of the infrastructural facilities are either created or owned by the government or their construction and operation are closely regulated by the government.
7. It is a dynamic concept.
8. It plays an important role in reducing cost, increasing external economies, exploring new markets, minimizing regional imbalances and maintaining national economic unity.
9. This sector is a complementary sector to the other sectors, so the efficiency of this sector depends upon the utilization factor.

Infrastructure is an umbrella term for several activities which includes public works like railways, roads, major irrigation works and also public utilities like power, telecommunication, water supply and sanitation, sewerage etc. Although diverse in their services, these activities share among themselves similar technical features, such as
economies of scale and economic features like spillovers from users to non-users (i.e. the effects of these activities are beyond those who use them). These activities are of the nature of facilitating the working of an economy. It is for this reason that infrastructure is defined as capital of a society that is embodied in such forms as it helps in generating direct productive activities. Some widen the term to include facilities pertaining to health, education, skill-formation etc. In this widened form, it is called social overhead capital. These constituents have taken up as a part of the subject of human capital.

Whatever may be the genesis of the term, it is now widely used in the context of economics of industry, agriculture, development, etc. and yet the term has no precise definition. Many experts used the term infrastructure and social overhead capital interchangeably (Rodan, 1960). A World Bank expert defined it as the basic service or public utilities which are necessary to the commodity producing sectors of the economy. Prasad (1983) also used the term infrastructure and social overhead capital synonymously. Now-a-days the term ‘infrastructure’ is being more frequently used than ‘social overhead capital’. The prefix infra is intended to a mark off the term from its opposite; super-structure. Infrastructure and super structure are both complementary parts of a single structure.

Further, turning to economics, one may start from the broad premise that the function of economic activity is to generate flows of income and output. This characteristic in a general sense, is common to the infrastructure activities as well as super-structure activities. Infrastructure comprises all those facilities and activities, the basic rationale of which is the sustenance, which they provide to income generation and production in the rest of the economy, rather than income generation and production within the infrastructure enterprises themselves.

Infrastructure is indispensable to achieve the main development targets in developing countries, such as urbanization, industrialization, export promotion, equitable income distribution, and sustainable economic development. The importance of infrastructure for economic development could hardly be again said, as the superstructure of a nation's overall wealth hinges on it. It represents a broad spectrum of activities and services without which no activity can be undertaken in the economy. It plays a key role in our society and constitutes the wheels, if not the engine of development (Prakash,
Infrastructure increases economic productivity, gains degree of specialization (Bougheas et al., 2000), lowers production costs (Romer, 1987), improves quality of life, alleviates poverty, raises international competitiveness, attracts foreign investment and is helpful in urbanizing the economy (Henderson, 2003). In fact, the pay-off from better infrastructure services goes beyond reducing technical inefficiencies and financial losses (Barro, 1990). An adequate quantity, quality and reliability of infrastructure are thus important preconditions for overall economic growth. Infrastructure's linkage to the economy is very multiple and complex, as it affects production and consumption directly, creates positive and negative spillover effects and involves large inflows of expenditure (Goel, 2003). Infrastructure investment generally works through employment, income and investment multipliers. Physical and financial infrastructure helps the movement of direct productive activities and thus, improves the physical resource base in the economy. Social infrastructure, on the contrary, improves the human resource base in the economy.

The precise linkages between infrastructure and development are still open to debate. The building up of the infrastructure is a pre-requisite condition for economic development. Because of long gestation and heavy investment requirements, the gap between actual and required infrastructure pushes the economy into the trap of vicious cycle. A state is backward in respect of infrastructure, it is poor because it cannot spend adequately on the development of infrastructure which results in poor performance, high cost, presence of increasing returns to scale, existence of excess capacity and less than optimum utilization of resources along with the low productivity levels. Whereas, the adequacy of infrastructure helps to determine country’s success and failure in diversifying production, expanding trade, reducing poverty and improving environmental conditions. So, infrastructure is an instrument in the development of industry by reducing cost, generating economies of scale and by increasing the productivity of inputs thereby raising factor income which results in changing consumer demand patterns from food and basic necessities to desires for diverse manufactured goods and services, decline in family size and overall population growth. Thus, the theory of economic transition in the context of the economic growth implies changing emphasis with in an economy from that of primary sector to secondary and tertiary sectors because of changes in demand patterns.
As India is a country with great resources and diversity with different geographical and climatic regions, the disparity in development levels across all the regions is inevitable because of imbalance in resource base. Therefore, the forefathers of independent India adopt the planning as an instrument to ease off the adverse effects of regional disparities. In fifty years of ‘planned’ development the efforts have been made to exploit available resources in optimum way to spark off some sort of development in every region. But, regional disparity is a still hardcore reality in Indian economic development. In last couple of years efforts have been made to identify various factors that have close correlation with development levels.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Deficit</th>
<th>Eleventh Plan Targets</th>
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<tbody>
<tr>
<td>Roads</td>
<td>65590km of NH comprise of only 2 percent of network; carry 40 percent of traffic; 12.4 percent 4- laned; 50 percent 2- laned and 38 percent single- laned</td>
<td>6-laned 6500 km in GQ; 4-laned 6736 km NS-ES; 4- laned 20000 km ; 2 laned 20000 km; 1000 km Expressway</td>
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<tr>
<td>Ports</td>
<td>Inadequate berths and rail/roads connectivity</td>
<td>New capacity: 485 m MT in major ports; 345 m MT in minor ports</td>
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<tr>
<td>Airports</td>
<td>Inadequate runways, aircraft handling capacity parking space and terminal buildings</td>
<td>Modernize 4 metro and 35 non-metro airports; 3 greenfield in NER; 7 other greenfield airports</td>
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<tr>
<td>Railways</td>
<td>Old technology; saturated routes; slow speeds (freight: 22 kmph; passengers: 50 kmph); low payload to fare ratio(2.5)</td>
<td>8132 km new rail; 7148 km gauge conversion; modernize 22 stations; dedicated freight corridors</td>
</tr>
<tr>
<td>Power</td>
<td>13.8 percent peaking deficit; 9.6 percent energy shortage; 40 percent transmission and distribution losses; absence of competition</td>
<td>Add 78577 MW; access to all rural households</td>
</tr>
<tr>
<td>Irrigation</td>
<td>1123 BCM utilizable water resources; yet near crisis in per capita availability and storage; only 43 percent of net sown area irrigated</td>
<td>Develop 16 mha major and minor works; 10.25 mha CAD; 2.18 mha food control</td>
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<tr>
<td>Telecom/ IT</td>
<td>Only 18 percent of market accessed; obsolete hardware; acute human resources shortages</td>
<td>Reach 600 m subscribers- 200 m in rural areas; 20 m broadband; 40 m Internet</td>
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Source: Government of India (2008)

Infrastructure development has a crucial role to play, if India is to sustain its high growth, which must become more inclusive as the country matures. There is wide gap
between the potential demand for infrastructure and high growth and the available supply. Table 1.1 represents the current deficit of infrastructure, the ambitious targets of eleventh plan set by government to fill this gap. It is evident from the table that share of national highways in road infrastructure is meager one i.e. two percent of total road network and at the same time these roads handled 40 percent road traffic, thus representing the problem of congestion and over usages. As regard to railways most of routes have got saturated and slow speed of railway put additional constraints on freight movements which are essential for economic growth. Further, airways and ports are suffering from lack of terminals and cargo handling capacities. On the other side the soft infrastructure is suffering from obsolete hardware and lack of market access due to poor physical infrastructure.

Infrastructure development is not only for economic development alone, but also for eradication of mass poverty, unemployment and other socio-economic evils. The infrastructure services are analogous to a ‘run-way’. As an aeroplane cannot take off without a facility of runway, likewise an economy cannot take-off into self-sustained growth without the facilities of infrastructure. Infrastructure refers to the case sectors, which provide fundamental building at supportive continuation to the growth and development to other sectors of the economy (Sivarajan, 2007).

India’s rise in recent years is a most prominent development in the world economy. India has re-emerged as one of the fastest growing economies in the world. India’s growth, particularly in manufacturing and services, has boosted the sentiments, both within country and abroad. With an upsurge in investment and robust macroeconomic fundamentals, the future outlook for India is distinctly upbeat. According to many commentators, India could unleash its full potentials, provided it improves the infrastructure facilities, which are at present not sufficient to meet the growing demand of the economy. Failing to improve the country’s infrastructure will slow down India’s growth process. Therefore, Indian government’s first priority is rising to the challenge of maintaining and managing high growth through investment in infrastructure sector, among others (Government of India, 2007).

India, while stepping up public investment in infrastructure, has been actively engaged in involving private sector to meet the growing demand. The demand for
infrastructure investment during the 11th Five Year Plan (2007-2011) has been estimated to be US$ 492.5 billion (Planning Commission, 2007). To meet this growing demand, Government of India planned to raise the investment in infrastructure from the present 4.7 percent of GDP to around 7.5 to 8 percent of GDP in the 11th Five Year Plan. In general, efforts towards infrastructure development continued to focus on the key areas of physical and social infrastructure.

Hence, a proper planning for infrastructure along with other sectors of the economy is essential. Growth of infrastructure is linked with spillover effects on the economy which are also termed as externalities. Externalities are common in virtually every area of economic activity. They are defined as third party (or spillover) effects arising from the production and/or consumption of goods and services for which no appropriate compensation is paid. Most economic arguments for government intervention are based on the idea that the market place cannot provide public goods or handle externalities. Public health and welfare programs, education, roads, research and development, national and domestic security, and a clean environment all have been labeled public goods.

“Externalities occur when one person’s actions affect another person’s well-being and the relevant costs and benefits are not reflected in market prices.” It is something that, which does not monetarily affect the producer of a good, but does influence the standard of living of society as a whole. Externalities could be either positive or negative.

A positive externality is something that benefits society, but in such a way that the producer cannot fully enjoy profits from the gains made. Examples of positive externalities are environmental clean-up and research. A cleaner environment certainly benefits society, but does not increase profits for the company responsible for it. Likewise, research and new technological developments create gains in a way that the company responsible for them cannot fully capitalize. Governments are generally more concerned with negative externalities than positive ones. As our society has become more densely populated and as the production of energy, chemicals, and other materials increased, negative externalities have grown from little nuisances into major threats.
A negative externality arises when one person’s actions harm others. Pollution is a very common negative externality. A company that pollutes, loses no money in doing so, but society has to pay heavily to take care of the problem. The problem thus created is because of the companies do not fully measure the economic costs of their actions. They do not have to subtract these costs from their revenues, which mean that profits inaccurately portray the company’s actions as positive. This can lead to inefficiency in the allocation of resources. India's ongoing population explosion has placed great strain on the country's environment. Deforestation, soil erosion, water pollution and land degradation continue to worsen and are hindering economic development in rural India, while the rapid industrialization and urbanization in India's booming metropolises are straining the limits of municipal services and causing serious air pollution problems.

The urban population of India has increased rapidly in recent years. Since 1951 the number had gone up to over 217 million, an increase of over 250 percent in present time (Census, 2011). The rural population in India is growing at the rate of 1.6 percent per annum, whereas the urban population increased at the rate of 3.2 percent during the same period. This increased level of urbanization is putting severe strain on the civic services leading to a decline in quality of life. Further, in 1984 Bhopal disaster had a toxic leak from the city's Union Carbide chemical plant which resulted in the deaths of more than 3,000 people. Moreover, three million premature deaths in the world that occur each year due to outdoors and indoor air pollution, the highest number are assessed to occur in India. Data from India’s National Ambient Air Quality Measuring Network show that 14 of the country’s 20 largest cities have air quality that is “dangerous.” Bombay, Delhi, and Madras are among the 10 most polluted cities in the world. In these and three other large Indian cities (Ahmedabad, Kanpur, and Nagpur), the annual average level of total suspended particulates in the atmosphere is at least three times the World Health Organization standards. Industrial water pollution is also a serious problem. The main source is nearly three million small and medium-size enterprises scattered throughout the country. Thus, urbanization, industrialization and pollution have reduced the quality of life in India.

The environmental problems in India are growing rapidly. The increasing economic development and a rapidly growing population that has taken the country from
300 million people in 1947 to more than one billion people today is putting a strain on the environment, infrastructure, and the country’s natural resources (Environment Report of India, 2009). Industrial pollution, soil erosion, deforestation, rapid industrialization, urbanization, and land degradation are all worsening problems. Overexploitation of the country's resources coupled with the industrialization process has resulted in considerable environmental degradation of resources.

1.1 Total Capital Needs for Investments in Infrastructure in India

For an emerging economy like India, with more than a billion people, infrastructure provides essential services, which reflects reliability, assurance, low-cost production, and market competitiveness. The growing needs for infrastructure facilities particularly in urban areas owing to rapidly growing population and rural-urban migration the simultaneous development in infrastructure facilities in terms of modern transport, civic amenities, pollution free life etc. are required to fill the gap between demand and supply. Therefore it is rightly said by some policy planners that public investment in the nation’s infrastructure has been insufficient to fill the demand supply gap and to develop the foundation for long-term growth (Chothani & Mulay, 2009). Therefore, the task of finding such huge amount of funds and thereafter deploying them for gains in efficient and optimum way requires a close partnership between the public and private sectors along with a vital role reserved for foreign capital. The infrastructure sectors in India are expected to draw funds of about US $ 345 billion during the 11th Five Year Plan which may offer investment opportunities. Visible failures are evident in the lack of power and potable water in large parts of India, poor road conditions and cargo handling delays at ports and airports that are managed by government entities. In order to finance this large short fall, a policy of promotion of domestic saving at significant rate is required.

As we know, traditionally a major portion of the infrastructure was owned and managed by the government, therefore, the development of infrastructure mainly depends upon government empower, its priorities and finally on state exchequer. Recognizing that growth in infrastructure will be inhibited if the Government of India has to rely only on state funds, it now involves the private sector in infrastructure development and marketing through agreements known as concession agreements that grant private entities
the right to build, own, and/or operate an infrastructure service and to receive revenues generated, though the ownership of assets vest with the government (Chothani & Mulay, 2009). The public private partnership helps the government in two ways: Firstly, the private sector provides finance and resources to deficient government sector and secondly, the government acts as facilitator rather than creator which results in proper policy formulation and its execution with the help of private sectors. Since India adopted measures to liberalize its economy and encourage Foreign Direct Investment (FDI) in the country in 1991, there have been several measures to improve India’s infrastructure. Hence, FDI may prove to be the prime substitute. But a sustained FDI inflow would call for the creation of a fair, open and rational tariff structure. Besides, the availability of critical infrastructure base is also becoming an essential precondition. The projected net foreign investment inflow includes both foreign direct and portfolio inflows. IIR's expectation is that about 40 percent of external capital inflows could flow into the infrastructure sector. This is indeed a very ambitious target. The sustained inflow of such volumes of external capital would require an open foreign investment regime. Simultaneously, attention should also be paid towards keeping the macro-economic conditions stable. Therefore, a close balance between policy formulation regarding FDI inflows and its spatial distribution for overall balanced development is needed.

As Indian economy is growing at nearly 7 percent per annum with the aim to achieve double digit growth, therefore, increase in demand for infrastructure services are inevitable along with the population growth which is expected to pose additional pressure on existing infrastructure facilities. Therefore, addressing these challenges will be essential if the infrastructure sector is to continue fostering economic growth rather than becoming a constraint. In other words, a failure to respond to this demand will cause bottlenecks to growth and hamper poverty alleviation efforts. According to an expert panel, headed by Deepak Parekh in 2010, on Infrastructure, a significant amount of infrastructure investment is required to sustain a high GDP growth rate in the medium term. It has stressed on the need to revise the target of infrastructure spending over the next five years. The earlier estimate had projected that power sector alone would require $130 billion (Rs 616,500 crore), followed by railways ($66 billion or Rs 300,000 crore), highways ($49 billion or Rs 220,000 crore), ports ($11 billion or Rs 50,000 crore) and
civil aviation ($9 billion or Rs 40,000 crore). Another $55 billion (Rs 223,500 crore) would be required for other infrastructural support system like telecom, SEZs, supporting urban infrastructure, water, sanitation, rural roads and pipelines. Commenting upon the need for an upward revision of infrastructure spending, the committee observed on the basis of government projections that “the investment in infrastructure would rise gradually from 4.7 percent of GDP in 2005-06 to 8 percent by 2011-12, the last year of the Eleventh Plan.”

The expert panel has pointed out that the government would face a major challenge in meeting the infrastructural financing gap of $162 billion (for 2007-12) at current prices. It has said that “the financing system, in its current form, will constrain the economy from achieving the target, because of its limited ability to meet the specific requirements of infrastructure investment, such as long-term funds, a certain kind of risk appetite on the part of investors and large and lumpy investment.” It, therefore, suggests a prescription. Accordingly, most important task in front of the government is to develop a domestic debt capital market, tapping the potential of insurance sector, enhancing participation of banks, Financial Institutions (FIs) and large NBFCs in infrastructural financing, facilitating equity flows into infrastructure, inducting foreign investments, utilizing forex reserves and attracting investments through some fiscal reforms (Parekh, 2007).

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<tbody>
<tr>
<td>Electricity</td>
<td>70.5</td>
<td>150.4</td>
<td>211.3</td>
</tr>
<tr>
<td>Roads and bridges</td>
<td>31.7</td>
<td>76.1</td>
<td>240.1</td>
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<td>Telecom</td>
<td>22.5</td>
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<td>Railways</td>
<td>20.3</td>
<td>62.2</td>
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<tr>
<td>Irrigation</td>
<td>32.1</td>
<td>53.1</td>
<td>165.4</td>
</tr>
<tr>
<td>Water and sanitation</td>
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<td>48.6</td>
<td>311.5</td>
</tr>
<tr>
<td>Ports</td>
<td>1.3</td>
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<td>8.5</td>
<td>404.8</td>
</tr>
<tr>
<td>Storage</td>
<td>2.3</td>
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<td>Gas</td>
<td>2.1</td>
<td>5.0</td>
<td>238.1</td>
</tr>
<tr>
<td>Total</td>
<td>200.5</td>
<td>492.5</td>
<td>245.6</td>
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</table>

Note: All figures are given in terms of United States Dollar ($)

Source: Government of India (2007)
Further, in order to sustain 9 percent growth, the Government of India has estimated an investment of over US$ 492.5 billion during the 11th Five Year Plan (2007-2012). The infrastructure investment has increased in the past few years, driven by government initiatives and private participation, but that needs to be escalated in coming years. Some of the important infrastructure investments are given in Table 1.2.

According to the Committee on Infrastructure, headed by the Indian Prime Minister, these investments were achieved through a combination of public investment, Public-Private-Partnerships (PPPs) and exclusive private investments, wherever feasible. To sum up, the Indian infrastructure space has gained much importance in the past few years, and provides immense opportunities for growth and development. Therefore, it is clear that there are substantial infrastructure needs in infrastructure sector in India, which, in other words, also offer large investment opportunities. Many of the new investments (such as gas pipelines) seem to be viable on commercial terms and should be suitable for partnership with private investors. For many other infrastructure investments also Public-Private-Partnership (PPP) is emerging as the preferred instrument, where the private sector gets its normal financial rates of return while the public sector partner provides concessional funding based on the long-term direct and indirect benefits to the economy. New instruments such as Viability Gap Funding (VGF) through a Special Purpose Vehicle (SPV) set up recently by the Government of India to fund mega infrastructure projects may be relevant for other Asian countries as well.

1.2 Profile of India’s Physical Infrastructure

Performance of physical infrastructure in Indian economy in last one and half decades has been mixed and uneven. It has been observed that over the years, India’s soft infrastructure grew much faster than the hard infrastructure. For example, India’s rising trade has been reflected in growing container port traffic, which increased from less than a million in 1991 to about 5 million in 2005 with an annual growth rate of about 266 percent since 1991. In contrast, hardware components, like railways, roadways and airways, witnessed little expansion in last one and half decades. In general, performance of these sectors (hardware) is nevertheless poor, when counted their densities in terms of country’s surface area or population. Densities in terms of access or spread of rail and road length
clearly indicate that road sector has been successful, compared to railways, in spreading the network as well as providing an access in the economy.

It has also been observed that the software part of India’s physical infrastructure (like telecom, air and port services) performed well, which not only helped the country to maintain a faster growth but also integrated the economy with the world market at a faster pace. At the same time, the hardware component of the country’s physical infrastructure (e.g. road, rail, power) comparatively grew slowly, which negated the country’s development process.

Therefore, in order to unleash India’s full potentials, development of hardware component of India’s physical infrastructure perhaps deserves utmost attention. This also indirectly indicates high investment potentials in roadways, railways, power and the associated components in India. Further, a close scan of sub-components of physical infrastructure in India reveals that the transportation which is considered to be bloodline for economic and industrial growth has shown a remarkable progress in last two decades. The various projects like NHDP, Golden Quadrilateral, PMGSY, etc. not only increased the road network in India but also have spillover on the rural and socio-economic development in India.

1.2.1 Transport
Transport, often considered as nerves of any geographical region includes roads, railways, waterways and airways. It facilitates swifter, reliable and safer movement of men and material sought by the society. Growth in transportation requirements has been largely met through increase in the number of road vehicles as the infrastructure development for other means of surface transport, e.g., urban railways has not kept pace with the demand due to their high initial cost. A high growth in road vehicle population has brought in several undesirable side effects like air and noise pollution, accidents, congestion, etc., which is evident everywhere in the cities of developing countries. Global warming via carbon dioxide emissions is another issue of concern. Urban air pollution and traffic congestion lead to enormous losses in human health, time and economic growth. An increasing number of national and international programmes are being undertaken to address these problems (Pundir, 2001).
1.2.1 (i) Roads

The most distinct part of India’s physical infrastructure development in recent years is the development of road network across the country which place India on second position in terms of road network aggregating over 3.34 million kilometers (km). The country’s road network consists of Expressways, National Highways, State Highways, Major District Roads, Other District Roads and Village Roads. The road network, as on December 2007, comprises 66,590 km of National Highways, 128,000 km of State Highways, 470,000 km of Major District Roads and about 2.65 million km of other District and Rural Roads. National Highways comprise only about 2 percent of the total length of roads and carry about 40 percent of the total traffic across the length and breadth of the country. Out of the total length of National Highways, 32 percent is single lane/intermediate lane, 56 percent is 2-lane standard and the balance of 12 percent is 4-lane standard or more (Infrastructure Report of India, 2008).

The government has announced several incentives to attract private sector participation for the further overall development of roads which includes:

1. Government to bear the cost of the project feasibility study, land for the right of way and way side amenities, shifting of utilities, environment clearance, cutting of trees, etc.;
2. Foreign Direct Investment up to 100 percent in road sector;
3. Provision of subsidy up to 40 percent of project cost to make projects viable. The quantum of subsidy to be decided on a case-to-case basis;
4. 100 percent tax exemption in any consecutive 10 years out of 20 years after commissioning of the project;
5. Duty free import of high capacity and modern road construction equipments;
6. Declaration of the road sector as an industry;
7. Easier external commercial borrowing norms;
8. Right to retain toll;
9. The Ministry of Road Transport and Highways, with a view to expediting the progress of the NHDP, has set a target of completion of 20 km of national highways per day, which translates to 35,000 km at the rate of 7,000 km per year during the next five years (2009-14).
The development of roads cannot be possible without sufficient amount of funds. The paucity of funds poses serious constraints for the development of road network in India. In order to tide over the shortage of funds, the road transport and highways ministry has proposed priority sector status for road development, allowing private highway developers more funds from banks.

1.2.1 (ii) Railways

The development of roads cannot be fruitful unless a country has good railway transit system. As roads and railways are complementary to each other because the former provides movement of men and material over short distance whereas later facilitate faster and safe movement of both men and material over a distant places in the country. India being the seventh largest country in the world with a vast area and diverse geographical regions, therefore, railway could have immense potential in Indian economic development by moving raw material from resource base to industrial cluster and vice-versa for finished goods. Indian Railways, world’s second largest rail network under a single management, has been contributing to the development of the country’s industrial and economic landscape for over 150 years. Of the two main segments of the Indian Railways, freight and passenger, the freight segment accounts for roughly two-thirds of revenues. Within the freight segment, bulk traffic accounts for nearly 95 percent, of which more than 44 percent is coal. Improved resource management, inter alia, through increased wagon load, faster turnaround time and a more rational pricing policy has led to an improvement in the performance of the railways during the last two years. Rationalization of classification is aimed at securing eventual elimination of cross-subsidies in fares and freight, and evolving a more transparent and cost-based tariff regime. This process necessarily requires increase in freight rates for commodities being transported below cost and lowering the freight charges for commodities being moved at abnormally high rates. In the freight segment, the number of commodities in goods tariff has been reduced from 4,000 commodities to 80 main commodity groups in 2005-06, and further to 27 groups in 2006-07. The high-density network connecting the four metropolitan cities of Chennai, Delhi, Kolkata and Mumbai, including its diagonals, popularly called the Golden Quadrilateral has got saturated at most of the locations. Given the present growth scenario, the Railways expect to carry 95 million tonnes
incremental traffic per year and about 1,100 million tonnes revenue earning freight traffic by the end of the Eleventh Five Year Plan. This entails large investment for capacity augmentation. (Infrastructure Report of India, 2008)

According to the Department of Industrial Policy and Promotion (DIPP), the foreign direct investment (FDI) inflow into railways related components has been US$ 109.56 million between April 2000 and March 2010. The performance of Indian railways reveals that it have generated US$ 13 billion of revenue earnings from commodity wise freight traffic during financial year 2009-10 as compared to US$ 12 billion during the corresponding period last year, registering an increase of 8.39 percent. Railways carried 887.99 MT of freight traffic during April 2009-March 2010 as compared to 833.31 MT carried during the corresponding period last year, registering an increase of 65.6 percent according to a release by Press Information Bureau (PIB) dated 19 April, 2010.

In order to enhance the efficiency and performance in Indian railways the following initiatives were undertaken by the Government of India:

1. Introduction of new passenger trains for better mobility of public along with extension in routes of some passenger trains;
2. Passenger safety has been given top most priority in last couple of years;
3. Women RPF personnel for the security of women passengers;
4. Introduction of double-decker coaches to ease off passenger rush;
5. Electrification of 1,000 km by 2011;
6. 94 stations to be upgraded to Adarsh stations;
7. Introduction of stainless steel coaches and high speed corridors for speedy movement of passengers;
8. US$ 281.3 million to improve passenger amenities;
9. Special Task Force to clear investment proposals within 100 days;
10. Multi-level parking complexes through public private partnership (PPP) route;
11. Creation of National High Speed Rail Authority;
12. Master plan for the Northeast region;
13. Private operators allowed to run special freight trains;
14. 25,000 km of rail lines to be completed by 2020;
15. Setting up of dedicated freight and passenger corridors (i.e. Delhi-Mumbai Industrial corridor, Eastern freight corridor).

1.2.2 Industry

India is among the 10 most industrialized countries in the world. It has the world’s eighth largest economy. Stimulated by a program of economic liberalization beginning in 1991, India’s economy grew by 5 percent a year, on average, during 1992–97. It is instrumental in development of industry by affecting the cost structure in two ways. First, larger quantity and better quality of infrastructure will shift the cost per unit downwards and second, the firms will adjust their production decisions regarding other factors, if services provided by infrastructure are substitutes for or complements of their own factors of production (Feltenstein and Ha, 1995). It not only stimulates industrial production but also reduces economic costs in the economy due to economies of infrastructure, thus enabling and inducing the manufacturers to produce more output in order to optimally utilize the existing ‘infrastructural provisions’. It has been estimated that one percent increase in stock of infrastructure is associated with one percent increase in GDP across all countries (World Bank, 1994). Relative composition of infrastructure changes, as the country develops. When a country moves from low income to middle category, the relative share of power, telecoms and roads tends to increase, value added by infrastructural services tends to increase to 6.5 percent for low income countries, to 9 percent for middle income countries and 11 percent for high income countries (Mohan, 1997). Infrastructure lays down the basic framework within which directly productive activities function and create investment opportunities in other industries also, and for this reason it is also known as ‘unpaid’ factor of production.

1.2.3 Power

Economic growth and living standards depend upon availability of adequate and reliable power at an affordable price. The dynamics of industrial-economic growth can be effectively sustained only through the achievement of adequate and reliable supply of commercial energy, especially of electricity. The share of commercial energy in India’s energy-mix was only about 25 percent at the time of independence. Since then, thanks largely to massive electrification efforts by the state sector, it has come up to about 60
percent. Yet, it is much lower than the global average of over 88 percent. Greater use of commercial energy and greater development of effective energy forms like electricity, hold the key to rapid industrial-economic development (Singh, 2001). As per the Economic Survey 2009-10, the Eleventh Five Year Plan envisaged an additional capacity of 78,700 MW of which 19.9 percent was hydro, 75.8 percent thermal and the rest was nuclear.

Public sector power major National Thermal Power Corporation (NTPC) is planning to scale up its capacity from the present 30,000 MW to 75,000 MW by 2017. India has launched its ambitious solar energy mission which aims to generate 20,000 MW of solar power by 2022. According to the Department of Industrial Policy and Promotion (DIPP), the power sector has attracted foreign direct investment (FDI) worth US$ 1.34 billion during April to February 2009-10. Further, the cumulative FDI received by the power sector between April 2000 and February 2010 was US$4.53 billion.

As the power sector in India is moving towards maturity therefore, it requires policy reforms along with certain proactive steps. In this regard, the government has opened the sector for private players in order to realize the full potential of power sectors. Besides this, the government has undertaken the following initiatives to boost the power sector:

1. Introduction of the Electricity Act 2003 and the notification of the National Electricity Policy 2005;
2. Constitution of Independent State Electricity Regulatory Commissions in the states;
3. Providing income tax holiday for a block of 10 years in the first 15 years of operation and waiver of capital goods import duties on mega power projects (above 1,000 MW generation capacity);
4. 100 percent FDI is permitted under the automatic route for generation and transmission of electric energy produced in hydro-electric, coal/lignite-based thermal plants, oil-based thermal plants and gas-based thermal plants; non-conventional energy generation and distribution, distribution of electric energy to households, industrial commercial and other users; and power trading;
5. The government has also taken up some ambitious programmes like the Ultra Mega Power Projects (UMPP), Rajiv Gandhi Grameen Vidhyutikaran Yojana (RGGVY), Accelerated Rural Electrification Programme and the goal of Power for All by 2012 among others, to rapidly increase the installed capacity.

The Ministry of Power and Central Electricity Authority (CEA) have projected a total investment of US$4.3 billion for renovation and modernization, as well as extending the life span of various old power plants during 11th and 12th Five-Year Plans. Of this, US$ 1.5 billion was planned for the 11th plan and US$ 3 billion for the 12th plan.

1.2.4 Ports

Ports have been playing a crucial role in facilitating India’s international trade and also in generating economic activity in their surroundings and hinterland. India’s coastline of 7,517 km. is added with 12 major ports and 187 non-major ports. Of the non-major ports, around 60 are handling traffic. The total traffic carried by both the major and minor ports during 2005-06 was estimated at around 570 million tonnes. The 12 major ports carry about 3/4th of the total traffic, whereas Vishakhapatnam (on the eastern coast) is the largest port in India. Despite having adequate capacity and modern handling facilities, average turnaround time is 3.5 days as compared with 10 hours in Hong Kong, which undermines the competitiveness of Indian ports. Congestion is due primarily to the slow evacuation of cargo rather than a lack of handling capacity, since ports are not adequately linked to the hinterland. To this end, all port trusts have set up groups with representatives from NHAI, the Railways, and State governments to prepare comprehensive plans aimed at improving road-rail connectivity of ports. An efficient multimodal system, which uses the most efficient mode of transport from origin to destination, is a prerequisite for the smooth functioning of any port. It involves coordinating rail and road networks to ensure good connectivity between port and hinterland.

In 2006-07, up to October 2006, cargo handled by major ports registered growth of 6.6 percent, down from 10.4 percent observed in the corresponding seven months of 2005-06. About 80 percent of total volume of ports’ traffic handled was in the form of dry and liquid bulk, with the residual consisting of general cargo, including containerized cargo (Infrastructure Report of India, 2008). The major ports in India handled 45.8
million tones cargo in February 2010, as compared to 45.2 million tonnes in February 2009. The cargo growth during April-February 2010 registered an increase of 5.5 percent as compared to the corresponding period in the 2009 fiscal, as per data released by the Indian Ports Association (IPA).

For the development of ports and to increase the cargo handling capacity along with the faster evacuations, the government has allowed hundred percent foreign direct investment under the automatic route for:

1. Leasing of existing assets of ports
2. Construction/creation and maintenance of assets such as – container terminals, bulk/break bulk/multipurpose and specialized cargo berths, warehousing, container freight stations, storage facilities and tank farms, carnage/ handling equipment, setting up of captive power plants, dry docking and ship repair facilities
3. Leasing of equipment for port handling and leasing of floating crafts
4. Captive facilities for port based industries

1.3 Foreign Direct Investment and Infrastructure in India

The causal relationship between infrastructure and foreign direct investment is a debatable issue in recent times. A lot of research studies have been conducted by researchers to examine the relationship between the two. Some studies (Wheeler & Mody, (1992), Coughlin et. al. (1991), Globerman and Shapiro (2002), Ranade (2001)) have shown that a critical level of infrastructure coupled with liberalized policy is a prerequisite condition to attract the FDI. Whereas some contrary studies state that the use of FDI to develop infrastructure have positive spillover on the productivity and output. Moreover, the development of infrastructure caused by FDI also has favourable impacts on further investments for fostering the economic growth of a country. Whatever be the generic relationship between infrastructure and FDI, it is true that for overall economic development over a long term, corresponding growth in infrastructure is required. Infrastructure in India has consistently lagged behind both in terms of demand-supply ratio and quality. In India the Government has explicitly indicated that it accords priority to attracting FDI in infrastructure along with the export sector as compared to other sectors.
According to World Development Report 1994 on “Infrastructure for Development” published by the World Bank, developing countries should invest 4 percent of their national output and a fifth of their total investment in new infrastructure. The result has been a dramatic increase in infrastructure services for transport, power, water, telecommunication and irrigation. The Government is taking several steps to strengthen the infrastructure base in each state and hence after the economic liberalization the largest share of investment is devoted towards the same. Private participation in developing infrastructure is encouraged under the new policy.

A research study (Ranade, 2001) has shown that after the commencement of construction activities of Konkan Railway, a major infrastructure project and several other infrastructure projects were also taken up on the western coast. FDI rushed in for a variety of infrastructure projects in areas benefitted by Konkan Railway due to improved access. Maharashtra which is regarded as adobe of foreign investments has a major investment proposal by Mauritius for development of container terminal facilities at Neva Sheva Port. Another proposal is for liquefied natural gas infrastructure associated with power plants and industrial customers put forth by Enron Co. of USA with association of Gas Authority of India Ltd. (GAIL).

In Goa, the FDI proposals in infrastructure sector include the one for providing world-class shipping and logistic services to Indian customers with the collaboration of Panama. A Power project was completed at Sqn Coale (Goa) in July 1999. Karnataka coast has attracted two major proposals from Mauritius- one is for setting up a large and mounted power of 170 MW. It involves 100 percent foreign equity with an investment of MINR 2565 in Dakshin Kannada district. Another one involves an investment of MINR 3300 for setting up a coke oven-cum-regeneration power plant based on imported coal in Uttar kannada district.

This way infrastructure of any country is considered as its backbone. It affects the efficiency of industrial sector of any country, attracts the foreign direct investment and affects the environment of the country as well. Moreover, economic growth of any country is completely related to availability of infrastructure in that country. Quality as well as quantity of infrastructure also makes a lot of difference. There are many studies highlighting the extent of available infrastructure in India. A few studies are there to
analyze how this infrastructure has affected the efficiency of industrial sector of India, foreign direct investment in India, economic growth of India and how infrastructure is related to environmental quality of India.

Therefore present study is also an attempt in this direction to workout infrastructure development and its externalities (i.e. both positive and negative), with the following specific objectives:

1. To analyse the growth performance of infrastructure in India.
2. To measure the impact of infrastructure on industrial performance.
3. To analyse the relationship between infrastructure, growth of foreign direct investment and gross capital formation.
4. To study the impact of infrastructure on economic growth of India.
5. To study the impact of infrastructure on environment degradation in India.
6. To draw some conclusions and policy implications from the study.

Plan of the Study

The study has been organized in seven chapters including the present one. The second chapter reviews the available literature in the area of study. Third chapter is devoted to data base and methodology used for the present study. Fourth chapter examines the relationship between industrial performance and infrastructure development in India. Fifth chapter concentrates on the relationship between foreign direct investment and infrastructure. Sixth chapter attempts to discuss the nexus between economic growth, infrastructure and environment degradation in India. The last chapter summarizes the findings along with the necessary policy implications.