

**India's Infrastructure Development and
the lessons from China's experiences**

by

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In fact, because of my previous background and working experience, I came to MIT with strong interests to learn and find the role of infrastructure development in the economic growth, and international collaborations. From the system perspective, infrastructure development is no longer a matter of a single country, but a system of cross national financial & project management. This is why I continue study system engineering management after my MBA study at Sloan. In the post financial crisis era, the infrastructure development also needs an innovative cooperation between countries.

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Abstract

Infrastructure plays an important role in a country's economic development, it is also essential to recover from the financial crisis. The history of developed countries shows that infrastructure contributed a lot in economic development, and maintaining & upgrading infrastructure is also important for running economy smoothly. In developing countries, the quality of infrastructure and its service helps to reduce the production cost, increase the quality of personal life and gain the international competitiveness. India is the third largest country in Asia, it has developed rapidly in the recent years and became more attractive to foreign investment. Since its economic reforms in 1991, The Indian government has been committed to the development of infrastructure and encouraged private sector and foreign direct investment's participation, especially in the recent ten years. Recognizing that the lags of infrastructure development became the bottleneck of its economic growth, the Indian government increased the strength of infrastructure development by more policy and fiscal support. This paper briefly introduces the infrastructure development situation in India and attempts to analyze from infrastructure perspective the advantages and challenges that India has to sustain its economic growth. This research also compares China's rapid economic growth and infrastructure development contribution to it. In examining the successful experience that China has, and problems exposed in its infrastructure development the consequence by performing the massive stimulus financial package in 2008 points out that infrastructure development has positive impact on economic growth, and can directly contribute to the growth. There are limitations to the extent to which infrastructure development can contribute to long term economic stability.

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1. Infrastructure and its impact on economic development

Large-scale, efficient infrastructure is a must-have for any country to function competitively. The strong correlation between infrastructure and economic development has long been studied, and infrastructure is generally defined as a potential agent of economic development.

There are two main types of Infrastructure: the economic infrastructure and the social infrastructure. Energy (electricity, oil and gas), Transportation (road, railway, port and airlines), Telecommunications, Urban infrastructure, rural infrastructure and Special economic zones, etc. all belong to economic infrastructure. Social infrastructure includes education, health and family welfare, Human development and social security, poverty, etc. Economic infrastructure supports the economic activities, and social infrastructure support social development. These two sectors both impact directly on the economic development by increasing productivity and by providing amenities which enhance the quality of life.

First, high quality infrastructure and service such as electricity, water, transportation reduces the cost and raise the profitability on production. Second, the available infrastructure raises the productivity, such as urbanization, automated manufacturing, etc. Both effects contribute to economic growth by stimulating supply and demand. On the other side, not only the existence of infrastructure but also the operation and service from infrastructure has effects on economic growth. Infrastructure service creates more jobs, provides access to education and consumption for other goods.

The developed countries have high qualified infrastructure, even though after the financial crisis, their infrastructure has begun to deteriorate. In developing countries, the relationship between the quality of infrastructure and economic development have been studied a lot and been proved by

the reality. Infrastructure has been a major focus of World bank and Asia Development bank's lending since their founding. Their goal is to ensure the developing countries obtain the full benefit from their substantial investment in infrastructure. This shows the importance that infrastructure contributes to a country's economic development.

2. India's economic reform and its demand for infrastructure and service

Similar with China, India's economic development was centralized planning, government owned basic and key industries before 1980.¹ The government would decide what was produced, how much, at what price and what sources of capital were used. The government also prevented firms from laying off workers or closing factories.² The Industrial Policy Resolution 1948 & 1956 emphasized clearly the responsibility of Government in promoting, assisting and regulating the development of industry in the national interest. The public sector played an active role in heavy and basic industries. But the performance by centralized planning and public sector was not satisfied both in economic and infrastructure development. India's macroeconomic imbalances were increasing, there was high level fiscal deficit, high level current account deficit, increasing external debt, and the pressure on money supply and inflation. In infrastructure the implementation of public sector exposed the deficiencies of the following factors: lack of R&D investment; lack of technology innovation; serious delays in public projects; uncontrolled cost due to delay and over staffing; political interference; inefficient use of current infrastructure facilities and lack of professional project management. These led to the result that infrastructure cannot meet the needs

¹ "Infrastructure Development in India: Post-liberalization initiatives and challenges" by K. Narindar Jetli and Vishal Sethi 2007, page 589

² "Infrastructure Development in India: Post-liberalization initiatives and challenges" by K. Narindar Jetli and Vishal Sethi 2007, page 590

of industrial progress in India. And imbalanced economy also influenced the development of infrastructure.

In 1991, an unprecedented external payment crisis happened in India, and the rate of inflation on point-to-point basis reached to 16.7%.³ The reasons of that inflation were the increase of procurement price of the agricultural products for distribution, the increase in the amount of monetized deficit in the budget, increase of import cost and decrease in the rate of currency exchange and Administered price.

In addition to taking measures to stabilize prices, the Indian government launched its market-oriented economic reforms in the areas of industry, public finance, banking and insurance, etc. It contained two parts: the macroeconomic management reform and structural economic reform. It was considered that macro-economic stabilization would provide a sound foundation for medium and long-term structural economic reforms and accelerate the rate of economic growth in a sustained manner. This would be possible by removing distortions created by controls and by improving the competitiveness for Indian goods and services in global markets.

The economic reform in the following sectors that related to and influenced the infrastructure development in India:

Agriculture sector: induce large investment from private and cooperative sectors.

Industrial sector: abolished industrial licenses for all projects except 18 specified industries; removed the asset limits for MRTR (Monopolies and Restrictive Trade Practices) totally⁴. The

³ Economic Reforms in India: Appendix 1 of Infrastructure Development in India by K. Narindar Jetli and Vishal Sethi page 590-591

⁴ Economic Reforms in India: Appendix 1 of Infrastructure Development in India by K. Narindar Jetli and Vishal Sethi page 590-591

MRTR (Monopolies and Restrictive Trade Practices) Act is used for controlling monopolistic trade practices; reduced the list of industries reserved for public sector, etc. Besides of central government's reforms, many state governments also launched reforms to attract private and foreign investment by providing incentive packages. A completed joint study by the World Bank and the Confederation of Indian Industry (Stern, 2001) found that the investment climate varies widely across states and foreign investment was concentrated in what are seen as the more investor-friendly states.

In fact, the reforms in fiscal policies, tax, financial sector, banking system, capital market, insurance sector and external sector, all brought new opportunities in infrastructure development.

As the result of economic reforms, India's economy grew faster than previous period, the rate of GDP increased from 5.4% in the in 80s to 7.9% in 2010, and overtook China in 2015⁵. After the reforms, India became the third largest economy in Asia and the fourth in the world. It became the destination of foreign direct investment. Private sector became active in many areas, service sector has made a remarkable success and contributed a lot to GDP.

Table 1 Growth rate of GDP and Major sectors in India (%)

Plans	GDP	Agriculture	Manufacturing	Service
6 th (80-84)	5.4	5.7	5.1	5.4
7 th (85-89)	5.6	2.8	6.0	6.1
8 th (92-96)	6.6	4.7	9.4	6.8
9 th (97-01)	5.7	2.4	3.3	7.8
10 th (02-06)	7.6	2.4	9.3	10.1
11 th (07-10)	7.9	3.2	7.9	10.0

Source Reserve Bank of India 2012

⁵ Growth rate of GDP and Major sector in India by Bank of India 2012

Table 2 Structure of the Indian Economy (% of GDP)

Plans	Agriculture	Manufacturing	Services
6 th (80-84)	41.0	14.6	37.1
7 th (85-89)	36.6	15.9	40.1
8 th (92-96)	32.3	17.1	43.1
9 th (97-01)	27.5	17.1	47.9
10 th (02-06)	19.6	15.5	52.9
11 th (07-10)	18.1	15.1	54.2

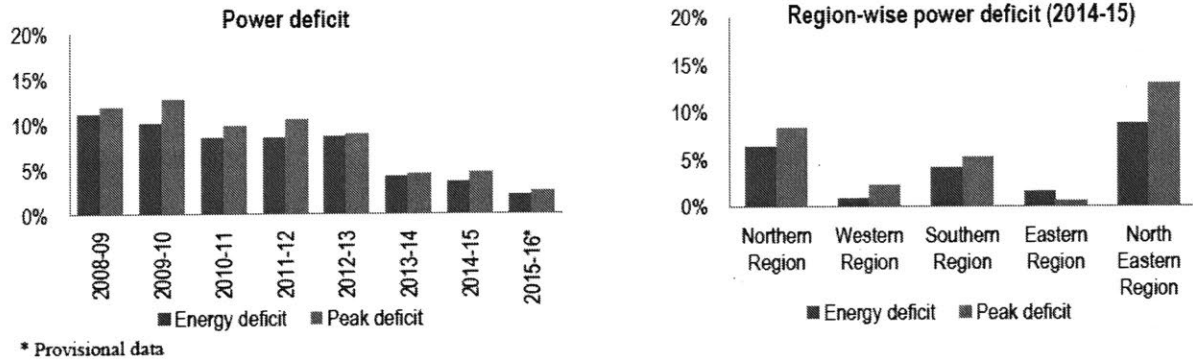
Source Reserve Bank of India 2012

From the above tables we can see that the economic structure of India has changed through the reform, the share of agriculture in GDP declined, and services sector made the greatest contribution to GDP which is a unique feature of India's economic development compare with the other Asian countries. We also found that the manufacturing sector still has much room for development, and the infrastructure is the necessary condition for the development of the manufacturing sector.

3. Overview India's economic infrastructure in different sectors

1) **Electricity:** Power shortage was always a problem in India since its independence, despite the government has given the priority to power sector by inducing a variety of policies to encourage investment in power, but power generation, transmission and distribution is still not keep up with the speed of economic development, demand supply mismatch continued until 2014. In the recent years the gap between demand supply is gradually reduced, while the regional imbalance is increasing seriously. Below is the chart that shows the trend and gap in power supply demand.

Source from Wikipedia



In fact, in 2013, India became the third largest electricity producer in the world sharing 4.8% in the global market⁶. And along with the electricity consumption fell down in global market, by the end of calendar year 2015, despite poor hydro electricity generation, India has become power surplus country with huge power generation capacity. Though few regions are still facing energy shortage. Till July 2016, the total capacity of power supply in India is 304.761GW, among which 28%⁷ is renewable power plants and the rest is non-renewable power plants. Coal, oil, gas and hydroelectric fuel are mainstream conventional resources for power plant in India, and 64% of the coal output is consumed in power generation. Besides, wind and solar power stations are also developed rapidly in the recent years.

Energy and power sector in India was used to controlled by central government and implemented by public sectors. After the reforms in 1991, it was started to be opened to private

⁶ Wikipedia: the electricity sector in India

⁷ Wikipedia: the electricity sector in India

sector and the government made new policies and regulations to attract private investment & FDI (Foreign Direct Investment), encouraged competition in the sector. The government's role changed from leading and planning to promoting and supporting. Along with the privatization of some power generation & distribution, it has gradually formed a demand driven electricity market in India.

Although the power generation and transmission capacity is increasing fast, there are still 300 million people in India have no access to electricity. Power distribution to rural areas is the big challenge in India. Besides it, there are following problems in electricity infrastructure:

- a. High transmission, distribution and consumer-level losses
- b. Imbalances between power generation, transmission and distribution development
- c. Imbalances power development between regions
- d. Less incentive to the private investment in power distribution
- e. Imbalances in nature resources: India is the third largest country for coal reserve in the world, but 80% of its reserve is in north-west part of India. Besides, the nature fuel value of coal in India is poor, which means it is high ash and low calorific contents and will cause air pollution as fuel.

2) **Transportation Sector:**

- a. **Railways:** Railways is the principle tool for transportation in India for bulk freight and long distance passenger. India's railway is the fourth largest railway network in the world with a total length of 64,460km. It has a long history of development; the first railway was built in 1836 as an experiment line in Madras Presidency. By 1859, the first passenger railway line was opened in North India between Allahabad and Kanpur. By 2014, Indian

Railway has the capacity of transporting 8.397 billion passengers and over 106 million tons of freight annually, its operations cover 28 states and three union territories, also connects with Pakistan, Nepal and Bangladesh, plays a key role in integration of social and economic development of the country. Indian railway operated by the state owned company call “Indian Railways” under Ministry of railways, besides, there are also few private railways operated for special purposes, such as for sugar mills, ports, mines and plantations, etc.

As one of the important basic infrastructure, India railway is relatively backward in upgrading its system compare to other sectors. It also need to improve the quality of service so that to expand the market share in transportation. Privatization in this sector is not as much as the other infrastructure sectors.

b. Roads and Road transport

India has the second largest road network in the world with over 4.68 million km distance. It divided into 5 different categories: national highways, state highways, district roads, rural roads and special purpose roads (for use by military, ports etc.). The responsibility for the development and maintenance of national highway is on the central government, and the other roads are responsible by the state government. National Highway Authority of India(NHAI) is the only agency that develops, maintains and manages national highway. Central government is responsible for planning, budgeting and financing national highway projects. Due to the road development projects are money intense, central and local government created the Central Road Fund to finance the road projects which was an innovation in infrastructure development in India. Private sector is actively involved in the maintenance of the roads.

c. Ports

In order to strengthen India's position in international trade, India started to upgrade and expand its ports facilities since 1991. There are 12 major ports and 184 minor & intermediate ports in India, and the central government takes the primary responsibility to develop and manage them. Local government is responsible for the minor ports and intermediate ports. The key problem with India ports is low productivity and lags far behind those efficient ports in Asia such as Singapore and Hong Kong. Private sector can participate in the port operation and management in some areas which has identified by the government.

d. Civil Aviation

Civil aviation has the advantage of time saving compare to other transportation method. The developmental, operational and infrastructural service of civil aviation sector are provided by three different organizations that owned by the government. In 1994, the amendment of Air Corporation Act approved foreign equity's participation. Since, private sector and foreign investment participated in the development in a large scale.

3) Telecommunication sector:

India has the second largest telecommunication network in the world in terms of total number of users, it also has the second largest mobile phone users and second largest internet users in the world. India has a diversified communication system which includes telephone, internet, radio, television and satellite. The tariff of Indian telecommunication is also one the lowest in the world due to wide range network and strong competition. Market liberalization and fast growth since 1990 made Indian telecommunication sector competitive globally. Unlike the other infrastructure

sectors, Indian government played an important role in the development of telecommunication infrastructure. It has a continuous process of reforms since 1991, foreign companies and private sector are gradually attracted to enter into the telecom sector.

4) Special economic zones (SEZs)

India has the first SEZ in Asia which was set up in 1965 at Kandla (Gujarat) in order to promote export. At the beginning, the SEZ in India was more like Export Processing Zones (EPZs), but it wasn't able to perform its expected function well due to multiplicity controls, lack of international manufacturer and unstable fiscal policy. Then Indian government started to introduce more comprehensive and liberal SEZ concept, established a series of SEZs to promote value addition component in exports, create more jobs. These SEZs are located in various parts of the country in the private sector or by the State government. SEZs in India contributed in the economic growth, especially in the export, technology innovation and job creation. Sometimes there is conflict interests of SEZs and local residents and it is resistant by local protectors.

5) Urban and rural infrastructure

Urban infrastructure refers to drinking water, sanitation, sewage system, electricity and gas distribution, transportation, primary health services and environmental regulation. Urbanization is an indicator of a country's economic development. By the 2008, there is one third population live in urban area and cities. India government has introduced a series of policies to encourage private investment enter into the development of urban infrastructure. There are still need to improve the finance and functional efficiency in urbanization.

Rural infrastructure development is mainly relying on the government efforts and international financial institutions. India government has set up the Ministry of Panchayati Raj to execute rural infrastructure development program.

4. India infrastructure SWOT analysis

Strength:

- Policy stability: The Indian government always give priority to infrastructure development since 1991 the economic reform
- The Indian government is keen to attract private sector and foreign investment into infrastructure development & management.
- Rapid and continuous economic growth
- Attractive destination for foreign direct investment

Weakness:

- Demand driven model led to imbalanced development of infrastructure
- Lack of planning and supervision authority
- Conflict interests by central government and local government
- Imbalanced allocation of nature resources
- Imbalanced regional economic growth
- Lack of technology innovation and professional management

Opportunity:

- Continuous economic growth requires the improvement on infrastructure
- Big room for the development of infrastructure
- Innovation of financing model on infrastructure
- Privatization scale and foreign investment participation

- Urbanization

Threats:

- Inefficient and less professional project management
- Corruption and bureaucracy
- Local protectionism
- Insufficient funds for large infrastructure projects

5. India's 12th Five-year Plan and infrastructure development Trends

1) The indicators of infrastructure development in the 12th Five Year plan⁸

1. Increase investment in infrastructure to 9% of GDP by the end of Twelfth Five Year Plan.
2. Increase the Gross Irrigated Area from 90 million hectare to 103 million hectare by the end of Twelfth Five Year Plan.
3. Provide electricity to all villages and reduce AT&C losses to 20% by the end of Twelfth Five Year Plan.
4. Connect all villages with all-weather roads by the end of Twelfth Five Year Plan.
5. Upgrade national and state highways to the minimum two-lane standard by the end of Twelfth Five Year Plan.
6. Complete Eastern and Western Dedicated Freight Corridors by the end of Twelfth Five Year Plan.
7. Increase rural tele-density to 70% by the end of Twelfth Five Year Plan.

⁸ India's 12th Five Year Plan, Part 1

8. Ensure 50% of rural population has access to 40 lpcd piped drinking water supply, and 50% gram panchayats achieve Nirmal Gram Status by the end of Twelfth Five Year Plan.

2) The investment strategy of infrastructure development in 12th Five Year Plan

India's 12th Five Year Plan encourages private sector participation directly as well as through various forms of PPPs, wherever desirable and feasible. The share of private sector in infrastructure investment will have to rise substantially from about 36.61% in the Eleventh Plan to about 48% by the end of 12th Five Year Plan⁹.

3) Trends of India's infrastructure development

- a. Total investment in infrastructure will increase
- b. Private sector and foreign investment participation will increase
- c. Widely adoption of PPP mode in energy, transport, telecommunication and water supply sectors
- d. The growth rate of infrastructure development continues increasing

6. Lessons from China

1) Brief introduction of China's infrastructure development

China's economic growth has been driven by a series of reforms since 1978. It was started with agriculture and service sector, then followed by rapid expansion in industry and manufacturing. The average GDP growth rate of China was over 9% annually during 1980-2008¹⁰. It has slowed down since 2008 due to global financial crisis and its over-reliance

⁹ India's 12th Five Year Plan

¹⁰ "China Energy – A Guide for the Perplexed" by Daniel H Rosen and Trevor Houser, 2007

on export and investment driven development model. According to World Bank, China's investment has contributed to 43% of GDP, in contrast to the world average of 22%. Most of the investment flowed to heavy industry and energy intensive product manufacturing. China's share of such products grew up sharply. In 1996, China accounted for 13% of world total crude steel production together with USA. After 13 years, in 2009, China's GDP is account for 5.5% of world total GDP, but the steel and cement consumption is accounted for 45% and 55% of the world total consumption.¹¹ Infrastructure development played a key role in China's economic growth.

Table 3: Infrastructure Spending in China (% of GDP)

	1998	2006
Power and Gas	2.3	3.6
Transport	2.4	5.2
Drinking Water	0.2	0.3
Irrigation	0.4	3.5
Telecom	0.4	0.8
Other rural spending	-	1.0
Total	5.7	14.4

Source: China Statistical Yearbook various issues and "Infrastructure development and economic growth in China" by Pravakar Sahoo, Ranjan Kumar Dash and Geethanjali Nataraj, October 2010, Page 29

2) In China government's role in infrastructure development is essential

¹¹ "Growth of Economy" world Bank: http://www.worldbank.org/depweb/beyond/beyondco/beg_09.pdf

Along with China’s economic reforms, infrastructure development in China experienced two periods. From 1978-1990, Chinese government adopted policies to encourage the development of agriculture and light industries. Infrastructure was in the period of lagged development. From 1991 till now, heavy industry, manufacturing and urbanization are emphasized by the government and infrastructure development is in the accelerate period accordingly. Investment in infrastructure increased markedly. (see table 3) The sources of infrastructure investment are mainly from central and local government, state-owned banks and foreign investment, but in the recent years the percentage of foreign direct investment in infrastructure declined. The reason is because the government financing increased. In the recent years China has sought to transform its economy development model from investment driven to consumption driven. In line with this, the 13th Five Year Plan focused on technology innovation, IT and ecological living. Infrastructure development still plays a key role in regional development, reducing energy intensity and poverty reduction.

Table 4: Sources of China’s infrastructure investment financing (%)

	1995	2006
State Budget Allocations	3	4
Domestic Loans	20	20
Self-raised funds & other	66	72
Foreign Funds	11	4
Total	100	100

Source: China Statistical yearbook 2007 and State Statistical bureau and "Infrastructure development and economic growth in China" by Partaker Sahoo, Ranjan Kumar Dash and Geethanjali Nataraj, October 2010, Page 30

On the other side, the nature of infrastructure determined that it is capital intensive and requires long term planning. Generally, infrastructure projects have a long construction period and require large amount of capital in the beginning, while project return is not as high as the other project. Market oriented investment cannot meet the requirement of economic development for future infrastructure. At this point Chinese government's forward planning for infrastructure has positively contributed to its economic development.

Table 5: Physical Indicators of infrastructure: China and India

	China	India
Consumption per capita (KWH 2006)	2041	503
Road network (thousand kms) 200-2006	3357	3316
Coastal Ports-ports container traffic (TEU) 2006	84686	6190
Civil Aviation registered carrier departures worldwide (000) 2006	1543	454
Railways (000kms)2000-2006	62.2	63.46

Source: China Statistical Yearbook various issues and China Highway and Water Transport Statistical Yearbook 2006 and Infrastructure development and economic growth in China" by Pravakar Sahoo, Ranjan Kumar Dash and Geethanjali Nataraj, October 2010, Page 30

3) Rapid growth in GDP is not the only goal, it must be inclusive and sustainable

In 2008, Chinese government announced a stimulus package of RMB 4 trillion to support its economic growth. This massive package is used for upgrading manufacturing, developing infrastructure and improving education. Among which, RMB 1.5 trillion was used for public infrastructure, RMB 1 trillion was used for social welfare, RMB370 billion

for rural development.¹² The stimulus package positively impacted on China's economic development and helped government achieved its goal of development. But it also raised concerns of over-reliance on investment driven and infrastructure development driven economic growth. In fact, after 2009, the growth rate of Chinese economy started to decline for 7 years. Infrastructure development as a driven to economic growth became weak and there are many problems exposed. First, it is not sustainable due to the increasing labor cost and overcapacity manufacturing. Second, lack of technology innovation and inefficiency operation led to serious pollutions. Third, imbalanced regional development is still a challenge. Fourth, social infrastructure, especially social security system such as health care and pension system, didn't get the same attention as the physical infrastructure. In a country with increasing aging population, this is a big issue that will slow down the economic development. Fifth, the shrinking of private investment and foreign direct investment in infrastructure is not good for improving project management level and efficiency.

7. Conclusion

As the third largest country in Asia, India's rapid economic development in recent years is remarkable. Similar to China, India has a large amount of population and huge size of domestic market, both are the advantages for economic development. At the same time, India's unique IT services and relatively better financial system are also advantages for infrastructure development. Currently, its infrastructure doesn't meet the requirement of

¹² China National Development and Reforms Commission, March 2009 & sohu.com, May 2009 “四万亿投资账单公布 民生和基础设施建设占大头 “

its economic growth, there is a lot of space for India to improve its infrastructure. The government should take more responsibilities in planning and financing the infrastructure developing projects. The private sector and the foreign investment should be attracted by more open and supportive policies. Learning from China's experiences, proved that infrastructure is not only for upgrading heavy industry and manufacturing, but also for improving social welfare. Rural and urban infrastructure development should be emphasized equally, in consideration of the contribution infrastructure to economic growth, I believe that there is more space for India to develop its infrastructure as well as its economy sustainably.

References:

1. Infrastructure Development in India: Post-liberalization initiatives and challenges by K.Narindar Jetli and Vishal Sethi 2007
2. India infrastructure report 2016 and 2015
3. Economic Reforms in India since 1991: Has Gradualism Worked? by Montek S. Ahluwalia*
4. The Economic Impact of Infrastructure and Public-Private Partnerships: Literature Review World Bank Group
5. The Contributions of Infrastructure to Economic Development: A Review of Experience and Policy Implications by Christine Kessides (World Bank discussion paper 1993)
6. Which Infrastructure Matters More for Growth: Economic or Social? Evidence from Indian States during 2001-2010
7. Infrastructure development: a public-private partnership in India
Authors: Sarangi, Debendranath
8. India's 12th Five Year Plan by Planning Commission, Government of India
9. Infrastructure in China: Foundation for Growth by KPMG 2009
10. China's Infrastructure Development and Supply-Side Structural Reforms by Pengfei, Li. China Economist 11.4 (Jul/Aug 2016): 84-103.
11. Infrastructure, Growth, and Poverty Reduction in China by Dong Yan, Fan Hua, Institute of Comprehensive Transportation National Development and Reform Commission, Jia 11 Muxidibeili, Beijing 100038

12. Infrastructure development and economic growth in China by Pravakar Sahoo, Ranjan Kumar Dash and Geethanjali Nataraj, October 2010