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# **Evolution of Financing Needs in Indian Infrastructure**

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## **Abstract**

India has emerged as one of the fastest growing economies even in the difficult financial downturn era. In coming years, India will be demanding a large number of infrastructure services to match the demand and keep an upward sloping growth curve. Indian infrastructure including both soft (port services, air and telecom) and hard (road, railways and airways) infrastructure is growing at a fast pace at present. The country also has largest road network (3.34 million km) and second largest rail network of the world.

Requirement for investment in infrastructure projects was expected to increase by 145.6% from Five Year Plan 2002-07 to FYP 2007-11. Part of the investment is expected to come from the various resources as public private partnerships and public investments. Indian government is also trying to experiment with different tools of PPP (public private partnerships) financing such as VGF (viability gap financing), SPV (special purpose vehicle) to decrease the deficits on the accounts of infrastructure.

This paper studies the evolution of financing needs and consequential innovative methodologies in Indian infrastructure. Government has made various efforts to match the growth in infrastructure with country's economy growth. However, Indian infrastructure is still lagging behind globally. This study analyzes existing frameworks available for financing and risk involved in them. India has lot of opportunity to grow using public private partnership model, but still the numbers of project financed are very less. We also have studied project financing model and capital financing model which are used by various competitive countries to India.

A regression analysis has been conducted on a macroeconomic model of investment in infrastructure which takes into account the exogenous variables interest rate, inflation rate, foreign exchange rate (USD/INR) and nominal gross domestic product based on Indian data from 1987-2010. Here we study how changes in any one of the aforementioned factors impact

the infrastructure investment. The paper also tries to find out the correlation between and trends followed by CNX Infra and S&P 500 based on daily time series for both.

A comparative analysis of two South Asian countries namely South Korea and Malaysia has been carried out with respect to India. The objective of this study is to find out what are the similarities and complementarities between the infrastructure investments of these countries and India. This helps in suggesting which ways India can move forward in order to optimize and align its infrastructure development with its continuously burgeoning needs.

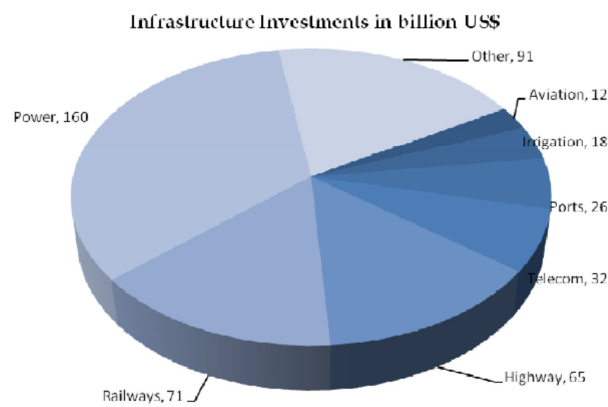
Finally, we have made our recommendation to facilitate infrastructure financing optimally by removing the externalities from the existing system. We also suggest a few innovative ways to finance infrastructure in India which might prove successful.

**Keywords:** Infrastructure financing, PPP (public private partnerships), Risk mitigation, capital financing

**JEL Classification:** H54; O16; P11; P12

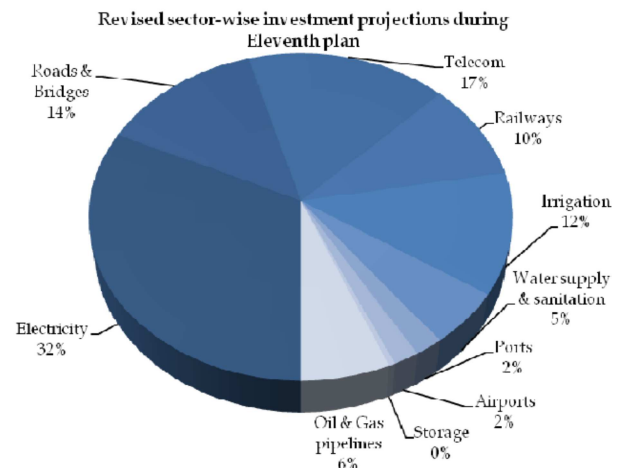
## 1. State of Indian infrastructure

Indian infrastructure is currently under a major overhaul. It is being increasingly noticed that in order to sustain the high growth rates of 8-9 percent achieved by India in the past few years need to be supported by corresponding improvement in infrastructure. Moreover, the financing in Indian infrastructure is gradually moving away from public to private realm. It is expected in the 12<sup>th</sup> Five-Year plan's 50% of investment in infrastructure will come through the private route. According to Goldman Sachs, the country would need investments of more than \$1 trillion in infrastructure from 2010 to 2019, with roads entailing \$427 billion, power \$288 billion and railways \$281 billion (Goldman Sachs). So far, India's success across the sectors has been mixed. Capacity under construction or fully constructed according to the Eleventh Year Plan (Annexure 1) reveals that the only sector on track is the power sector, achieving 100 percent of planned capacity, while ports sector is at 85 percent, the airports sector at 75 percent and the roads sector at 50 percent. The repercussion, India is close to a deficit of USD 150 billion to USD 190 billion.



Source: Industry Research Report on Indian Infrastructure, Hem Securities

**Exhibit 1**



Source: Industry Research Report on Indian Infrastructure, Hem Securities

**Exhibit 2**

The definition of infrastructure as provided by UNESCAP is a term used to refer to the basic architecture of any system, mechanical, social, political or cultural (United Nations Economic and Social Council for Asia and Pacific). The expanded definition of infrastructure includes transport (Roads, Railways, Ports, and Airports), public utilities (Power and Water Supply etc.), public services (Fire Service, Flood Protection, and Police etc.), national services (defense, monetary and postal systems and the legal and regulatory system) along with “soft infrastructure” which denotes institutions that maintain the health and cultural standards of the population. The key reasons to invest in infrastructure in India are as follows:

**1.1 Infrastructure: Major growth driver:** The booming Indian economy combined with the high population growth rate is creating tremendous pressure to modernize, sustain and accelerate investment in country’s infrastructure. This has become more prominent over the past few decades since the investment backlog has exceeded billions.

**1.2 Private Capital Requirements:** The basis of economic activity is infrastructure. India could have grown faster had the investments in infrastructure been commiserate with economic activity. Construction activity has a direct impact on output and all economic sectors benefit from comprehensive infrastructure.

**1.3 Immense Regional Disparities:** Inter-state disparity in per capita income among Indian states has been rising over the last couple of decades. In addition, the inter-state disparities in

economic and social infrastructure facilities too have remained at alarmingly high levels. Hence, investment in infrastructure is required in order to boost inter-state level of development.

*1.4 Managing Institutional Risks:* The big infrastructure opportunities are not without inherent risks like macroeconomic risks associated with emerging markets like India, low degree of liquidity in markets and unsatisfactory transparency of market players and the market itself. Therefore, these risks need to be managed competently for Indian infrastructure to flourish

## **2. Evolution of Financing Needs in Infrastructure**

Post-independence, India became the Mecca for economists over the world. They voted unanimously that India should follow a policy of direct and indirect state intervention, greatly influenced by the erstwhile Soviet Union. Thereby, the Indian government adopted a top-down/state-centric approach towards infrastructure development as well, wherein it was predominantly conceptualized, built, operated, managed and owned by the public sector. This arrangement worked very well in the beginning with regard to broadening access, the inherent nature of infrastructure projects and the inability of private sector to make huge capital investments. However, decades of Hindu Rate of Growth set in, resulting in poor productivity, widening output gaps, low efficiency, high unmet demand for services, low returns on investment and under-development across the sectors.

Faced with increasing fiscal constraints (according to some estimates only 20 percent of investment need in infrastructure projects is being met by Government), the Govt. has sought to attract private investment in the sector since the Post-Liberalization Era to enforce macroeconomic stabilization. The Government has made noteworthy efforts in crafting concession agreements, promoting competitiveness, enhancing transparency, insisting on environmental sustainability, building intelligent and reliable infrastructure at realistic prices, introducing legal reforms, creating a stable environment with stability in rules, policies and guidelines and being considerate of the linkages to the rest of the economy. Due to these efforts, the investments level have been consistently rising but not at the rate required to close the infrastructure gap present in the country; on the contrary the gap between infrastructure needs and actual investment has kept on widening. Thus, PPP continues to be in a nascent stage in

India. The story of the recent evolution of Indian infrastructure is a testimony to the success or otherwise the failure of infusing private sector efficiency in the sector.

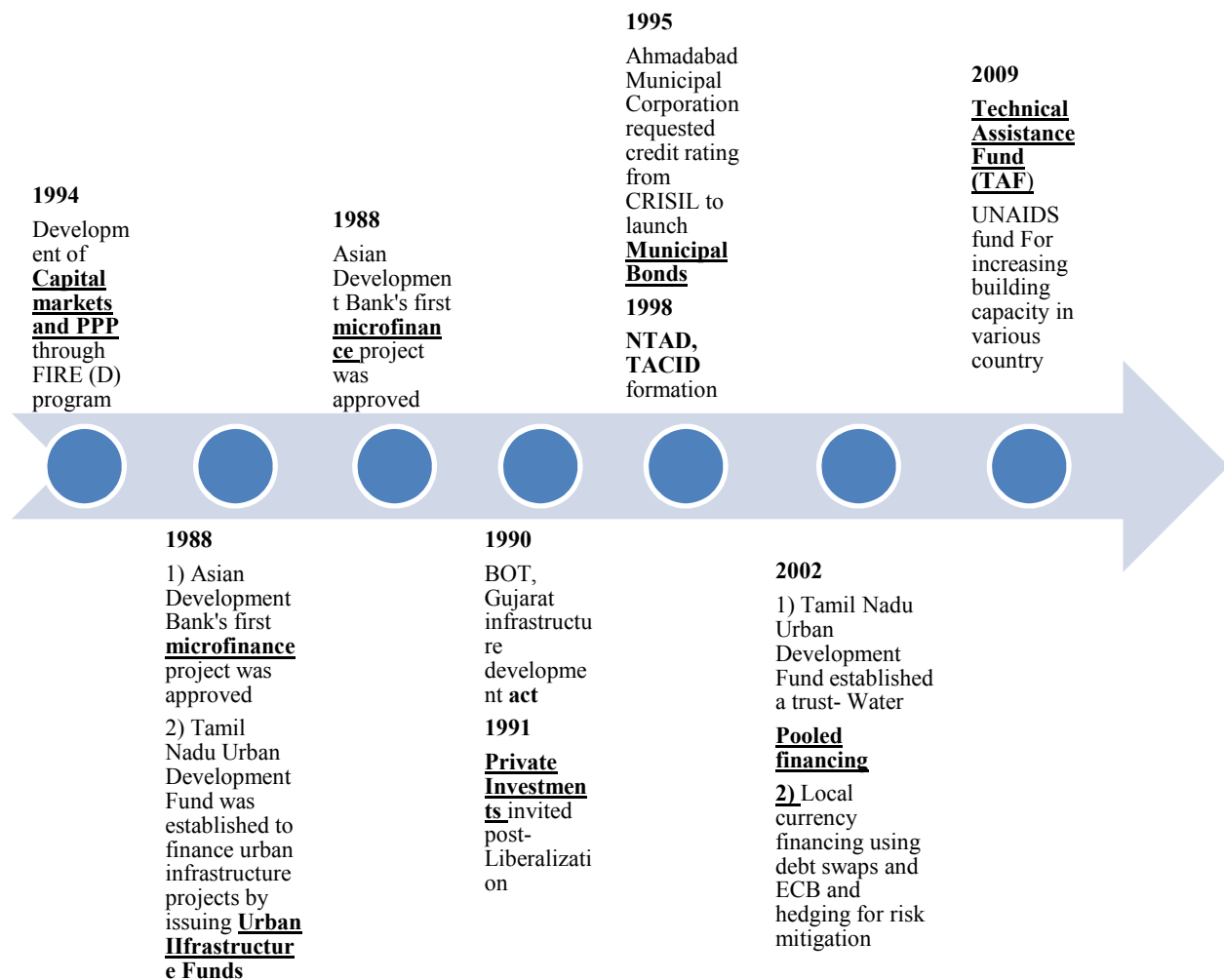


Exhibit 3

### 3. Present scenario: Infrastructure financing methods:

#### 3.1 Municipal bonds:

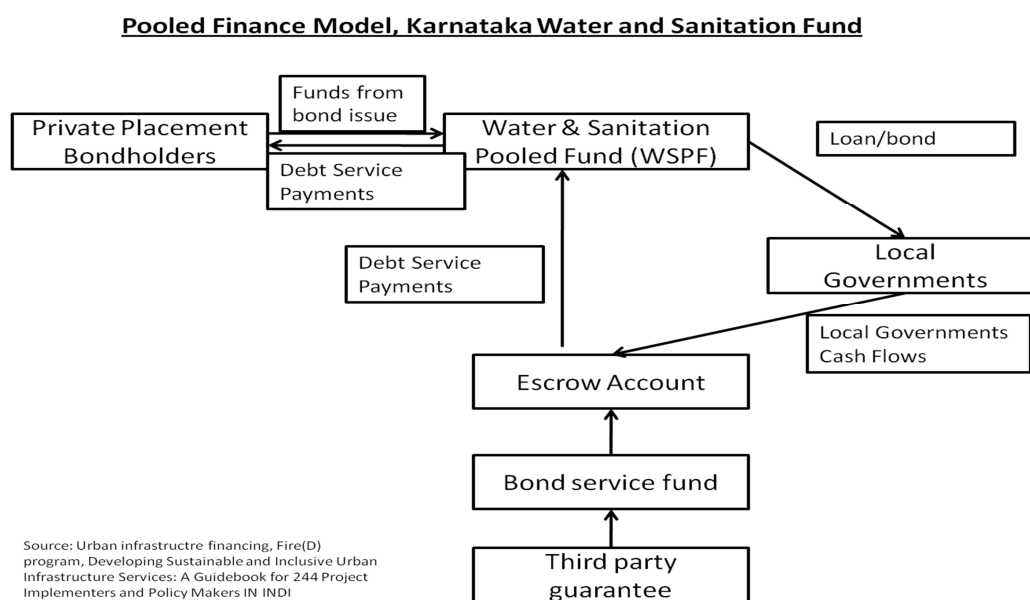
This methodology is an excellent opportunity but is least used to mobilize debt financing. Indian government offers two types of municipal bonds: Revenue Bonds and Government Obligation Bonds. Government has come in association with IL&FS to induce good credit quality and

reliability in debt instrument market. If local government wants to issue municipal bonds, they need to provide financial structure (Type of debt: GO or RO, terms, repayment plan, interest rates), credit rating issued by ICRA or CARE, authorization and approval documents, prospectus (information of potential investors, disclosures), guarantees and transaction costs

### 3.2 Pool Financing:

Due to the budgetary constraints, it was difficult for local small governments to exploit the ‘municipal bond mechanism’ and generate long term financing debt. The other issues with municipal bonds was high fixed issuance cost percentage and availability in less quantity and hence they weren’t able to lure the institutional investors.

Pooling technique is used in order to facilitate a SPV and create the interest of capital market for local small government. Tamil Nadu and Karnataka were the first two states to use this technique in 2002 to issue the bonds of Rs. 130.4 Crore for sanitization and water project in 14 local governments. It used the US based bond bank model which hypothetically form and administer a SPV and also issue the bonds on its own name for the group of local governments. From this hypothetical unit the local government borrows and the repayment of these borrowed funds is done by the pooled government.



**Exhibit 4**

### *3.3 Urban infrastructure funds*

A local government which is inefficient in raising commercial capital on its own due to less credit rating or structural bottlenecks, UIFs is an initiative by government. Four types of funds (Capital fund, project development funds and credit rating enhancement fund, Grant fund) are maintained are managed by the PDC or internal staff. The main objectives of these funds are to provide the access of funds to the incompetent local government, reduce cost of capital, promote PPP and develop urban infrastructure projects.

### *3.4 Microfinance*

This new innovative tool is to facilitate the triple bottom population and provide them opportunities to build infrastructure. India's more than 30% population lives in slum areas and seeing their financial weakness, no commercial bank or municipal bond is accessible. SKS, APS (2004) and other MFIs took the responsibility and provided funds at high interest rates. Even though this tool is to promote more PPP, but interest rates are very high that repayments become default.

### *3.5 Public Private Partnership:*

The major challenges faced by infrastructure financing are non channelized savings (1/3<sup>rd</sup> of savings are in physical assets), regulated earning, mismatch in asset and liability, immature debt markets, limited resources and also high regulatory constraints. PPP (public private partnership) using various partnership model (BOT, DBB, BOO, BOOT) is to facilitate easy access of capital for infrastructure projects. One of the tools of PPP is VGF (viability gap financing) which had high return but high risk as well. New financing resources need to be developed not only on the debt side but also on the equity side.

### *3.6 NBFC and FIs:*

Even though NBFC institutes have huge potential and growth momentum, many bureaucratic guidelines trap the capital for a long time and hence create undiversified risk. To boost the confidence of these investors and facilitate requirements, asset as well as liability side management needs to be looked into.

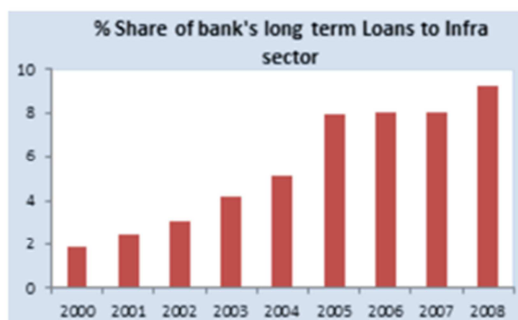
### NBFC's exposure norms:

	Single Borrower limit	Single Borrower limit	Group Borrower limit	% of
	General	Additional with board approval		
NBFC	20%	Nil	35%	Only Tier 1
Source: Prakeh, D. Report (2007)				

On the asset side modifications in securitization norms, underwriting norms and NBFC norms are required. The current NBFC guidelines can be altered by relaxing the limit on single and group borrower and on capital funded. Similarly on the liability side allowing FIs, banks and NBFCs to borrow from foreign institutes, long term hedging using gold and reducing the SLR limits will help banks diversify the constituted risk.

**3.7 Debt financing by Indian commercial banks:** Many Indian banks such as SBI, IDB, and PNB gives loan for infrastructure financing. Indian government has legalized few banks in country to issue debt for infrastructure financing in urban area. These loans are easily available but contain complex procedure, as for banks there are high default risk involves. Moreover one more disadvantage with commercial banks loan is high interest rates which discourage investors to raise money from these resources.

The following figures explain the contribution of banks and Forex in Indian Infrastructure:



Source: IDFC infrastructure financing, 2008-09



Source: RBI

Exhibit: 6

### *3.8 International Debt financing:*

The main resources of international debt financing are international funds, multilateral agencies, equipment suppliers, export credit agencies, bond markets, and commercial banks. Many dedicated funds from world development banks have been given (from \$200 million). Many bilateral agencies also fund infrastructure projects but opportunities are very limited in this aspect.

## **4. Project Financing versus Capital Financing**

Countries across the globe use Project Finance vis-à-vis Corporate Finance in industries like infrastructure where there are large cash flows. Project Finance involves significant costs compare to Corporate Finance however the mitigation of Agency Cost (since certain assets like tangible assets with high cash flows are susceptible to costly agency conflicts) and reduction in the deadweight cost of bankruptcy are primary motivators for using Project Finance (Subramanian, Tung, & Wang, 2007). The creation of a project company provides an opportunity to create asset-specific, new governance systems to address the conflicts between ownership and control. Another feature of Project Companies is that they utilize high leverage and joint ownership to discourage costly agency conflicts.

Two main distinguishing features of Project Finance compared to Corporate Finance are:

- a) Enhanced verifiability of cash flows: Due to contractual agreements possible because of a single, discrete project in legal isolation from the sponsor and the resultant absence of future growth opportunities in the Project Financed Company. Since Corporate Finance involves a multitude of future and current projects the same contractual agreements cannot be effected in Corporate Finance Company, and
- b) Lack of sponsors' assets and cash flows: In case of Corporate Finance the lender has a potentially larger pool of cash flows from which to get paid as compared to Project Finance where the cash flows from the project only are used to pay the investors.

According to some empirical researches, Project Finance is more likely than Corporate Finance in countries where the investor protection against managerial self-dealing is weaker and investor protection is low. This can be better understood in terms of comparison between the neighboring

countries: India and China. India used predominantly Project Financing for Infrastructure Projects while China has started using Capital Finance for its huge infrastructure projects.

## **5. Comparative Analysis**

### **South Korea**

South Korea is amongst one of the most developed South Asian economies and has been successful at catalyzing the private sector investment in infrastructure (Infrastructure Financing: Global Pattern and the Indian Experience: RBI Staff Study, 2011). Infrastructure development has been an important component of Korea's export driven growth strategy. In fact during the 1960s, infrastructure development accounted for nearly one third of gross capital formation (GCF). At this time, Korea's financial system was relatively underdeveloped, so infrastructure finance was heavily dependent upon public and foreign sources. There was rapid growth in infrastructure between 1960s and 1970s. Though the investment in infrastructure as a share of total investment has declined since the 60s, it still accounts for about 11% of gross investments.

As the sophistication of the financial sector increased in Korea in 1990s, the Korean government sought to increase private participation in infrastructure. Some measures included VAT rebates when the project was completed, capped public guarantees, early completion bonuses and permission for excess profit resulting from lower than expected construction costs, compensation for losses occurring due to unfavorable movements of currency etc, even though these measures were still quite limited in size and sectoral coverage. This was hugely successful and ratio of private to public investment in infrastructure increased to 18.4 percent in 2008. The Korean government later also became very active in allowing creation of private equity infrastructure funds which were intended to motivate further private investment in the sector and also improves the pool of management and operation skills by encouraging more active project management.

Macquarie Korean Infrastructure Fund (KIF), one of the largest private equity infrastructure funds currently in existence has nearly US\$ 1.7 billion under management, and is listed in Seoul and London. Institutional investors comprise 62 percent of shareholders, with domestic (12 percent) and foreign retail (26 percent) investors holding the remaining shares. Establishing the legal and regulatory framework for these funds was not easy, however the Korean government has been fairly successful in removing these bottlenecks and therefore these funds have become more active. Korea has also been able to encourage foreign companies to invest in publicly

guaranteed infrastructure funds. By the end of 2009, a total of US\$76 billion in privately executed projects was underway in Korea. In contrast, the participation of private players and creation of an efficient bonds market for infrastructure funds is still quite low as compared to the potential of both in the Indian context. An environment- legal and regulatory environment which is conducive to attracting investors needs to be implemented successfully in India.

## **Malaysia**

Malaysia's economic progress over the past four decades has been accompanied by a considerable amount of investment in infrastructure development. The Malaysian Government has played a major role in developing infrastructure such as airports, seaports, highways, power, water and sewage. The public expenditure in infrastructure is a total of RM98.8 billion during 1986-2005 period. The private sector has also been participating enthusiastically in infrastructure financing.

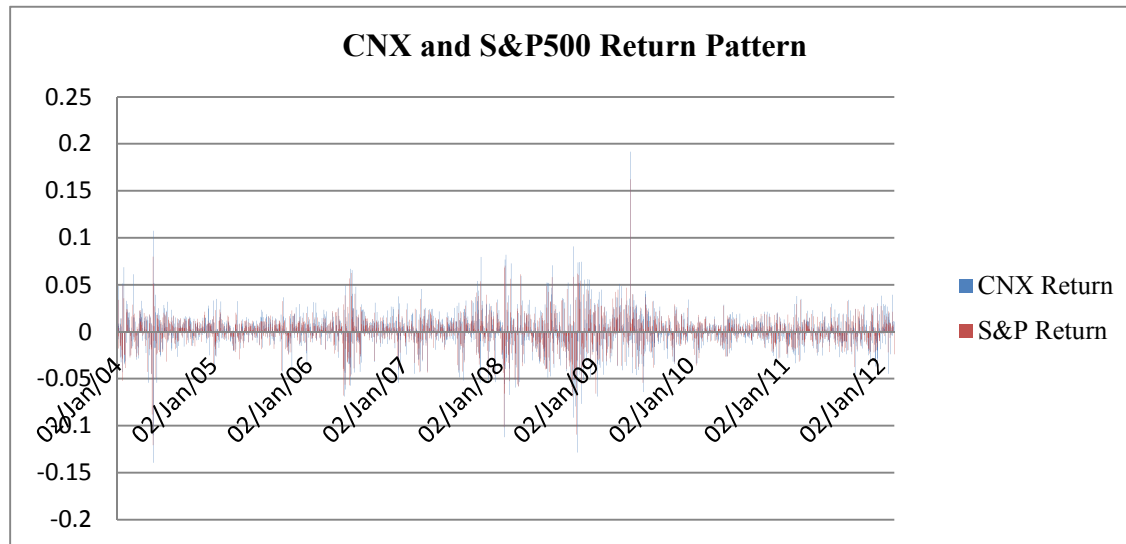
Given the nature of infrastructure projects that normally require large scale and long-term financial in local currency, vast amount of attention has been paid to infrastructure bonds that securitize the future cash flows from infrastructure projects. A bulk of private finance for infrastructure which complements the public sector financing is raised from the domestic Malaysian bonds market which is quite vibrant. The total value of bonds issued by the infrastructure sector, amounting to RM108.4 billion, represents a sizeable 72% of the RM150.3 billion invested in infrastructure by the private sector (Report on Infrastructure Financing and Bond Issuance in Malaysia). There has been a continuous change in the role of Public and Private sectors, with the latter shouldering an increasingly significant responsibility has been seen in Malaysia. However this trend is yet to be seen and optimised in India due to limitations of sound legal and regulatory environment for the smooth functioning and deepening of the domestic bond market.

## **6. Model:**

### **Data description:**

We have considered time series data (per year) for infrastructure investment in public sector (agriculture and allied services, rural development, irrigation and flood control, energy, industry

and minerals, transport, education including medical and others), , inflation rate and gross domestic product from 1987 to 2010. We also have taken daily time series data for CNX infra and S&P 500 in Indian context and have studies the trend followed by them.



The trend shows the moving pattern in tandem. It means that S&P 500 indices and CNX indices are highly correlated. Before using the data, four assumption of normality, auto-correlated, constant volatility (Hetrosecdascticty) and stationary of the series have been tested. To do so JB test, LM test, white test and unit root test has been taken place respectively. The historical return on CNX infra and S&P has been taken for daily changes to capture the volatility.

### Methodology:

Investment needs estimates are derived here from econometric models based on historic relationships between primary macroeconomic factors, GDP and investment in infrastructure. The purpose of the study is to examine the relation between primary macroeconomic factors (Interest rate, inflation rate, and foreign exchange rate of respective countries with respect to US dollar), gross domestic product and investment in infrastructure of India, South Korea and Malaysia. We have studied how changes in one of the factor impact investment related to infrastructure. Thus, this study uses regression analysis to estimate the effects of change in factors on infrastructure investment. . The regression model uses cross-sectional time-series data, with a fixed-effects estimator to control for omitted variables -such as prices- that differ between countries but are constant over time. The optimal results are those for which the highest explanatory power (R-squared) was obtained. As such, the results of the regressions do not reflect drivers or inhibitors of investment.

This study estimates the following basic model using ordinary least square regression:

$$Y = \alpha_1 + \alpha_2 * GDP\ PER\ CAPITA + \alpha_3 * FOREIGN\ EXCHANGE\ RATE \left( \frac{USD}{Domestic\ Currency} \right) + \alpha_4 * INFLATION$$

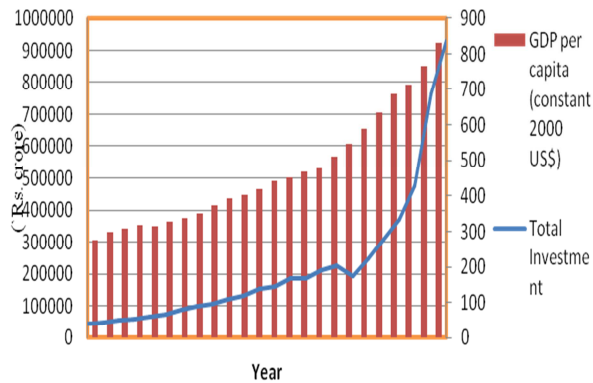
Where Y is the investment in public sector infrastructure, and  $\alpha_i$  is the factors to define the relationship.

Variable	Korea			Malaysia			India		
	Coeff.	Std. Error*	Prob	Coeff.	Std. Error*	Prob	Coeff	Std. Error*	Prob
$\hat{\alpha}$	0.027421	0.02344	0.263	-0.0449	0.021658	0.0582	-0.04554	0.0725	0.5378
$\Delta GDP_t$	1.137689	0.39866	0.013	2.47283	1.179153	0.0238	2.898263	1.1791	0.0238
$\Delta INFLATION_t$	-0.00103	0.01592	0.949	0.03700	0.088021	0.0276	0.209943	0.0880	0.0276
$\Delta EXCHNAGE\ RATE_t$	0.074278	0.10663	0.498	0.42004	0.335744	0.0341	0.766797	0.3357	0.0341
LOG LIKELIHOOD	34.44656			33.1732			1.507113		
DURBIN-WATSON STAT	1.278999			1.51097			23.00380		

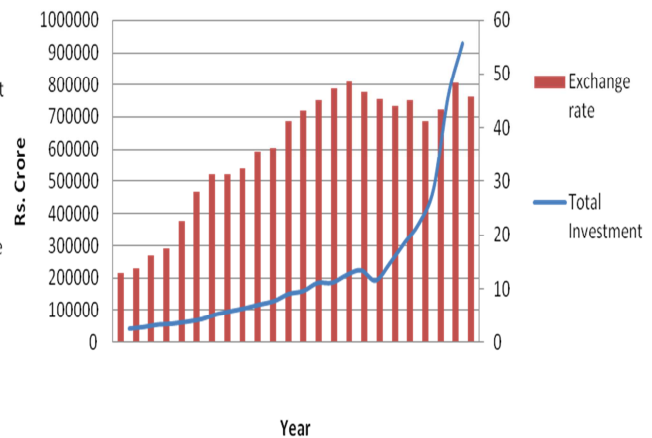
\* Standard Error is at 5% level of confidence, values are significant

From the results we can say that each macroeconomic factor is significant for all the three countries and will impact investment in public sector infrastructure outlay. At 5% level of significance for all the countries, GDP per capita is significant and positively correlated to infrastructure investment. As mentioned by Engel (1987), slowdown in infrastructure sweeps away 2% GDP it is evident to have positive correlation between these two factors. Considering the foreign exchange rate and investment, we have found out positive correlation, the changes in investment abruptly are impacted by changes in exchange rate. Exchange rate is major factor which effect investments in a country a lot. India has set up lot of trade channels with developed countries and hence any positive change in foreign currency, negatively impact Indian currency. South Korea too has been hugely successful in mobilizing private foreign investment in infrastructure. In 2004-05, when the currency appreciated, many foreign investors pulled out their investment and hence the outflow happened, where as in 2009-10, due to the depreciation in Indian currency, investors again invested in India which resulted huge investment (762465 Rs crore) in infrastructure. Malaysia has emerged as one of the countries which have been successful in promoting FDI flows in the infrastructure sector and hence the positive movement of Malaysian currency signifies flow of foreign capital into infrastructure.

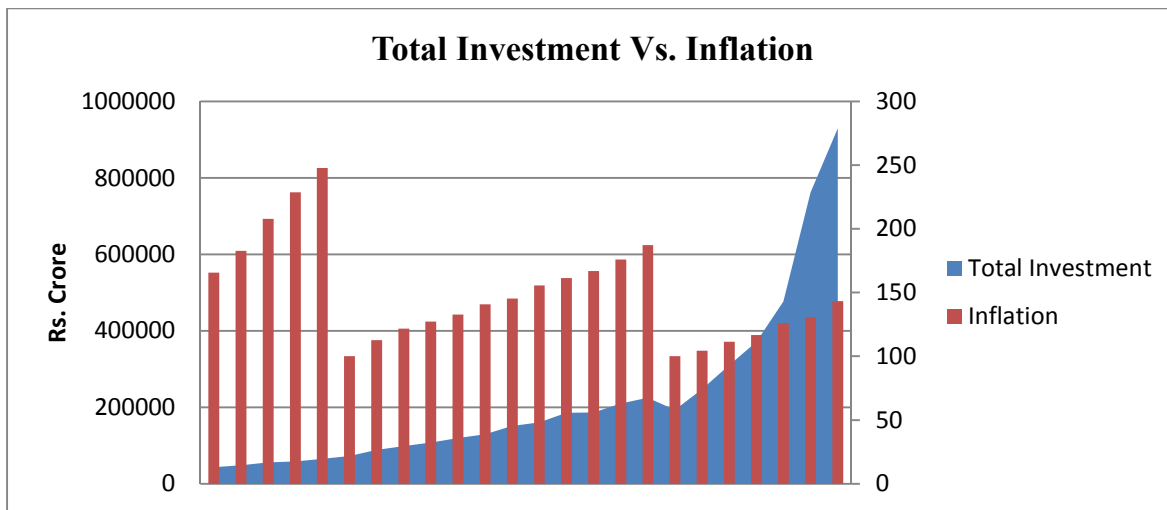
**Total Investment in public outlay vs. GDP per capita**



**Total Investment Vs. Exchange rate**



Inflation rate and investment shares a negative correlation for India, which is evident from the trend graph below. Initially when base year was 1993-94 and inflation was very high, the investment was very low in infrastructure. This trend further impacted growth of country and hence few majors were taken to change this trend. After changing the base year for inflation targeting to 2002-03, and changes in economy such as high disposable income, high technological growth, less unemployment rate, high interest rate etc. brought down the inflation below. This trend impacted investment positively and hence the total investment in public outlay took a huge jump and grew by 381%. The infrastructure is the bone of economy and is major contributor to enhanced economic growth. In any growing economy, inflation is always balanced with the help of benchmark and high inflation always hampers the growth. Hence investment in infrastructure and inflation grow negatively. This holds true for Malaysia as well, however since South Korea has had a predominantly export-led growth strategy, the relationship between inflation and investment in infrastructure turns out to be insignificant, thereby the investment statistics being greatly affected by the movements in domestic currency against dollar.



From the correlation matrix as well, we can verify the results of our model. It shows that GDP per capita growth is negatively correlated to exchange rate and inflation. This means that changes in any of these factors impacts the GDP (positive/ negative). Similarly, exchange rate and inflation is also negative correlated. Reason for this trend is that as the inflation increase, the home currency tends to get depreciated and hence investment outflow takes place.

Correlation Matrix				
	Investment in infrastructure	GDP per capita	Exchange rate	Inflation
Investment in infrastructure	1	0.2535486	0.080898109	0.298898117
GDP per capita	0.2535486	1	-0.607586874	-0.02867181
Exchange rate	0.080898109	-0.607586874	1	-0.156500879
Inflation	0.298898117	-0.02867181	-0.156500879	1

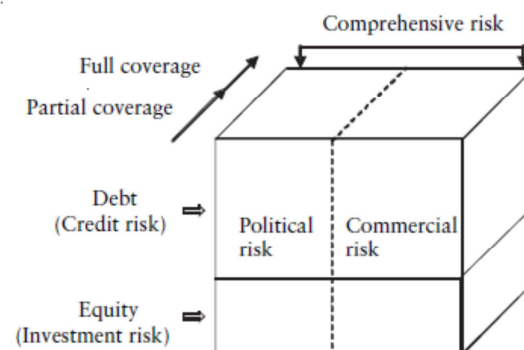
## 6. Risk Management in Infrastructure Projects

The raising of debt and equity capital needed to fulfill the financing needs of infrastructure in developing countries continues to remain a challenge. Over the last couple of decades there has been a growing interest in using risk mitigation instruments to facilitate mobilization of private capital to finance public and private infrastructure projects. Risk Mitigation Instruments are financial instruments that transfer certain defined risks from project financiers (lenders and

equity investors) to creditworthy third parties (guarantors and investors) that have a better capacity to deal with such risks. These instruments are extremely helpful for the governments of developing countries that have low credit ratings or insufficient track record in the eyes of the private investors to be able to attract private capital. For India, risk management is crucial as this has been a major roadblock in attracting the required private investment in the infrastructure sector.

The advantages of risk mitigation for India are many:

- India would be able to mobilize international and domestic private capital for development of infrastructure and as a supplement to limited public resources.
- When risk mitigation instruments cover the excessive risks or practically unmanageable risks as perceived by the investors, then private investors would be interested in investing in the sector.
- It becomes easier for the Government to share the risks of infrastructure development using its limited financial resources when it is tendered help by the private sector; thereby leading to greater increase in infrastructural development.
- Government can upgrade its own credit as borrower or as a guarantor for public and private projects by using risk mitigation instruments of more creditworthy institutions which can significantly lower the cost of capital for the infrastructure project.
- Risk mitigation instruments facilitate the creation of commercial and sustainable financing mechanisms for infrastructure development and efficiency in the flow of international and local private capital.



### Exhibit 5: Key Parameters of Risk Coverage<sup>1</sup>

The major risks cited by private investors are as follows:

**Regulatory Risk:** Risk of losses as a result of adverse regulatory actions by the host government and its agencies

**Foreign Exchange Risk:** Risk of losses arising from unfavorable movement of currency exchange rates (for example devaluation of local currency adversely impacts infrastructure projects that earn revenues in local currency while the accounting of expenses, costs and financing is mostly done in foreign currency)

**Sovereign Risk:** Risk of losses which are a result of repudiation or breach of contracts or non-performance by the host government or sub-national host government.

**Table 1. Broad Category of the Availability of Instruments<sup>2</sup>**

	Credit guarantee	Export credit guarantee or insurance	Political risk guarantee or insurance
<b>Sovereign debt</b>			
Political risk	X	X	X
Commercial risk		X	
<b>Corporate debt</b>			
Political risk	X	X	X
Commercial risk		X	
<b>Equity investment</b>			
Political risk			X
Commercial risk			

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<sup>1</sup> Source: The World Bank, Public-Private Infrastructure Advisory Facility, Review of Risk Mitigation Instruments for Infrastructure Financing and Recent Trends and Developments

<sup>2</sup> Source: The World Bank, Public-Private Infrastructure Advisory Facility, Review of Risk Mitigation Instruments for Infrastructure Financing and Recent Trends and Developments

## 6. Future financing needs and Recommendations

Indian infrastructure even after several decades is one of the obstacles in the path of high economic growth. In current scenario when every country is progressing in a multitude of sectors, India is struggling to raise debt from free markets. Predominant reasons for this can be listed as follows:

- i. **Corruption and bribery:** In India, during the bidding process, cash outflow happens in backend. Due to which project goes to the highest bidder without seeing if the bidder can fulfill the requirements of project effectively or not.
- ii. **Bureaucratic structure:** The navigation of the financing of complex project has a long procedure to follow in order to get the financing under state ownership. Hence the time value of money and project is lost or greatly reduced.
- iii. **Inefficient maintenance:** Even after complex procedures and high corruption, if infrastructure projects commence, operation and maintenance of the same are very inefficient.

On account of current financing needs and methodologies we would make our recommendations for following techniques which can fulfill the demand of financing efficiently:

- a) **Issue stocks with options:** The infrastructure projects should be put in for IPOs and government should issue stocks. Using this technique not only will promote public private relationship but as well as would grab capital market opportunities by eliminating corruption. For investors trust either issue “protective put” or CVRs (Contingent value rights) (Chen, 2002). These two options will hedge returns from downside risk and appreciation in upside.

Payoff from Protective put and CVR:

- i) Maximum profit: Unlimited,  
Profit: Price of stock- premium paid- purchase cost of stock

$$\text{ii) } \text{CVR} = \text{Put (Target price)} - \text{Put (Base price)} = \text{Max}(\text{Strike price}_{TP} - S_0, 0) - \text{Max}(\text{Strike price}_{BP} - S_0, 0)^3$$

- b) **Tax free project bonds**: These can be offered as option covered call. The valuation of the same can be done using Black Scholes formula. In such calculation, when variance increase, risk increases and hence the return will be adjusted accordingly. Moreover giving tax free bonds will lure the private investors and help in raising funds by mitigating the future event risks.
- c) **Increase take out finance and rationalize the cap for investors**: Due to mismatch in asset and liability, banks create problem in disbursing loans. Moreover current institution investor's cap is 10% of investable funds. Hence to overcome these issues, small institutions like IDFC should take active part in loan distribution and also investors' caps should increase to tap the potential of pension funds and insurance sector.
- d) **Performance-based Bond Strategy**: Instead of issuing long term bonds the private firms could issue short-term bonds for a specific stage of the project. The investors can then reinvest their money in the bond issued for the next stage of the project if they find it satisfactory. This would reduce the risk investors associate with sunk costs.

## 6. Conclusions

India today stands on the brink of a revolution in infrastructure facilities, which is not to be missed at any cost. It has been amply demonstrated that in order to sustain and accelerate a high GDP growth rate in the coming years, significant amount of infrastructure improvement will be required. An investment target of this magnitude poses significant challenge from the perspective of availability of financial resources. A judicious mix of political, economic, legal and social environment needs to be created that balances the twin objectives of growth and stability. The key here is to ensure that the financial system is in a position to effectively extend a large amount of public and private investments. At the same time foreign investments should also be given prime importance. All the players involved in the investment financing space for infrastructure should be developed to their full potential and extended full support by the Government.

The huge investments required in infrastructure cannot be met by the Government alone in an optimum manner, thus there is a need to engage more investors for meeting these needs. Even though the Indian Financial System faces no problems of liquidity, still the risk-averse nature of Indian investors, the comparatively small capitalization of various financial intermediaries requires revisiting the current financial models and adopting innovative financial structures. There are two types of risk capital involved in the infrastructure sector: (a) Explicit Capital, which is brought by the project sponsors as equity, and (b) Implicit Capital, which is provided by the project lenders. Greater flow of Explicit Risk Capital can be ensured by removing the controllable uncertainties in the policy environment and making the benefits of risk diversification available through alternate mechanisms. Also, various regulatory initiatives and market reforms are required to capacitate the commercial banking system to participate more effectively for fulfilling the financing needs of Indian infrastructure.

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## Annexure:

Requirement of infrastructure investment in India during fifth financial plan (2007-2011):

Sectors	Anticipated investment in 10 <sup>th</sup> FYP (2002-2007) (In \$US billion)	Projected investment in 11 <sup>th</sup> FYP (2007-2011) (In \$US billion)	Percentage change (%)
Electricity	70.5	150.4	111.3
Roads and bridges	31.7	76.1	140.1
Telecom	22.5	65.1	189.3
Railways	20.3	62.2	206.4
Irrigation	32.1	53.1	65.4
Water and Sanitation	15.6	48.6	211.5
Ports	1.3	18.0	1284.6
Airports	2.1	8.5	304.8
Storage	2.3	5.5	139.1
Gas	2.1	5.0	138.1
Total	200.5	492.5	145.6
Source: GOI (2007)			

### **Annexure 2: Investment needs in Infrastructure:**

Rs. Billion	GDP at current prices	Growth rate	5% need
FY2002	20815	8.3%	1041
FY2003	22549	11.7%	1127
FY2004	25198	12.6%	1260
FY2005	28381	12.5%	1419
FY2006	31929	12.5%	1596
FY2007	35920	12.5%	1796
FY2008	40410	12.5%	2020
FY2009	45461	12.5%	2273
FY2010	51143	12.5%	2557

FY2011	57536	12.5%	2877
Total			17967
Source: Economic survey 2004-05			