Project Appraisal and Measurement of Risk
in Infrastructure Financing
by Indian Banks

Abstract

1. Introduction

Infrastructure is an umbrella term for the manifold activities referred to as “social overhead capital” by economists like Paul Rosenstein-Rodan, Ragan Nurkse and Albert Hirschman. The India Infrastructure Report, 1996, defined infrastructure as: the physical framework of facilities through which goods and services are provided to the public. Infrastructure linkage to the economy is multiple and complex because it directly affects production and consumption, creates negative and positive spill-over effects (externalities) and involves large flow of expenditure. The Reserve Bank of India (RBI) in its Circular dated November 30, 2007 (DBOD No. BP.BC.52/21.04.048/2007-08), defined Infrastructure as: “Developing or developing and operating or developing, operating and maintaining an infrastructure facility in Energy, Logistics and Transportation, Telecom, Urban and Industrial Infrastructure, Agro Processing, Construction for storage of Agro Products, Schools and Hospitals, Pipelines for Oil, Petroleum and Gas, Water and Sanitation.” This definition includes both physical and social infrastructure services. This research, however, focuses only on the issues of financing of the key physical infrastructure services by commercial banks.

The eleventh five year plan envisages stepping up of the gross capital formation in infrastructure from 5% of GDP in 2006-07 to 9% of GDP by end of the plan period in 2011-12, which could be critical for achieving 9% growth. It has estimated an investment requirement of USD 502.88 billion (Rs 20, 11, 521 crores) in infrastructure, around 30% of which is expected to be financed by the private sector. There is consensus among government policy makers and a growing realization by the public that there is a need of increased Public-Private Partnership (PPP) in infrastructure projects and of the necessity of commercialization of infrastructure services.
During the last ten years, infrastructure was being developed through increasing investments by the private sector on a commercial basis under the “private ownership and operation” approach. Under this option, the private entity not only operates the infrastructure, but also owns the allied assets. The various approaches can assume any of the following arrangements, the most important among them being: Build Operate Transfer (BOT); Build Own Operate (BOO); Build Own Operate Transfer (BOOT); Build Operate Lease Transfer (BOLT), Management Contract (MC) and Service Contract (MC).

Due to the necessity of private sector participation and the need for incurring heavy institutional debt, since December 1992 the Reserve Bank of India (RBI) has been encouraging banks to have more exposure to financing infrastructure projects. The RBI has also relaxed individual and group exposure norms from 5 to 10 per cent of banks’ capital funds in the case of lending to infrastructure sector for single and group borrowers respectively. It has also relaxed norms for classification of infrastructure assets as Non Performing Assets (NPA’s). RBI has allowed the banks to use the take out financing mechanism to bridge the asset liability mismatches, issue long term bonds to fund infrastructure, invest in bonds issued by unrated Special Purpose Vehicles (SPV’s) of infrastructure companies, subject to a maximum ceiling of 10% of non SLR investments, keeping the promoters shares in infrastructure SPV’s out of capital market exposure norms and allowing banks to fund promoters equity. Lately, RBI has also demarcated commercial real estate from non commercial real estate based on the source of repayment rather than collaterals. The RBI wants banks to step in to fill up the position vacated by the Development Financial Institutions (DFIs). This makes sense as the DFIs as a class is becoming extinct, except for a few remaining ones. The RBI’s move is to garner the surplus in the banking sector and utilize it for building the nation’s infrastructure assets. As per the RBI’s credit and monetary policy announcements, 2008, the gross disbursement by scheduled commercial banks towards infrastructure stood at Rs 2,02,296 crores in 2007 -08, which is 41.5 per cent year to year growth.

2. Identification of the Problem and the Scope of Research

It is clear from the above discussions that there is a substantial gap between the investments required for the infrastructure sector and the finances available. Given the fact that IDBI and ICICI, the principal Development Financial Institutions (DFIs) have now been restructured as
commercial banks and do not lend only to projects with long gestation periods, commercial banks are required to lend to projects of longer duration. This leads to an undesirable and unhealthy asset liability mismatch. In addition, the combination of high capital costs and low operating costs of infrastructure projects implies that initial financing costs constitute a very large proportion of the total cost. Infrastructure project financing entails a complex and varied mix of financial and contractual arrangements between multiple parties. Apart from this, regulatory uncertainty increases the risk profile of infrastructure projects.

Against the above backdrop, a few questions arise:

- Do Indian banks’ credit officers have the adequate expertise to evaluate and finance infrastructure projects ensuring safety of funds?
- Does the infrastructure appraisal process provide the mechanism to identify and measure the inherent risks with due diligence?

The absence of a straightforward answer to the above questions is itself quite disconcerting. Indian bankers are on a learning curve with regard to the understanding the mechanics of infrastructure financing. For that matter, the project promoters, policy makers and regulators are not better off. The lack of lending expertise exhibits the poor confidence level of lenders, which in turn may be contributing to impeding the growth of infrastructure. This lacuna requires a fresh look at the way projects are being appraised by the bankers. It is apparent that the standard appraisal employed in traditional corporate financing – primarily based on the strength of the promoter, financial viability and the security safeguards – is not able to capture the entire complexities involved in financing infrastructure projects. The present research therefore intends to focus on elaborating and describing the contractual, legal and structural issues involved in the appraisal of infrastructure projects from the perspective of Indian banks. It also lays down a framework for project assessment and risk measurement, which the Indian banking industry can use while determining the viability and bankability of projects.

Infrastructure presents a vast field of study. It can be viewed from different perspectives, particularly its impact on growth and development of the country. However, the present research will focus only on studying it from the point of view of Project Appraisal and Risk Measurement from the bankers’ angle. Since it is not possible to lay down economic and structural features of
all the sectors in a single research work, the researcher restricts his study to the power and road sectors.

3. Concepts and Review of Literature

Review of literature is done in three sections. In Section A, literature review is carried out on the structure of project finance and the way it is being used for financing projects across the world and in India. In Section B, the literature concerning the application of this structure to financing infrastructure projects is discussed. In Section C, studies concerning project appraisal and risk measurement are reviewed. Thereafter, the RBI guidelines as also the Basle II norms, along with the practices adopted by the Indian banks for assessing infrastructure projects are discussed.

The literature survey differentiates between the traditional corporate financing structure and the modern infrastructure projects financing.

To elaborate, in the traditional form of financing, as defined by Mehta (1977), Griffin (1995), Pandey (2002) and Chandra (2005) and commonly known as corporate financing or the balance sheet financing, although the financing is done for a project, the lender looks at the cash flows and assets of the whole company in order to gauge its ability to service the debt and provide security. However, in modern project financing, lenders base their credit appraisals on the projected revenues from the operation of the facility, and also on its assets including any revenue-producing contracts and other potential cash flows as collateral for the debt, rather than on the general assets or the credit (credibility) of the sponsor of the project. In this regard, studies by Adelson (1970), Quirin (1977), McConnell and Muscarella (1985) are important. They termed these (projects) as tactical decisions which demand different perspectives both from the investors and the lenders as they are driven by contractual structures and are able to encash future opportunities. Similar definitions have been given by Finnerty (1996), Nevitt and Fabozzi (2000), Hoffman (2001), Esty and Sesia (2005). Infrastructure in India, as gleaned from the studies by Ghemawat (2000) and Mehta (2001), follows the project financing method. These definitions of project finance highlight some of the basic characteristics of the project financing method such as: (i) the Creation of a Separate Entity, popularly known as Special Purpose Entity or Special Purpose Vehicle (SPE/SPV). The SPV has a defined objective and definite life; (ii) the Equity Holding Pattern which may involve 3 or 4 equity sponsors; (iii) the Non-Recourse Debt, which implies that the debt component provided by lenders is on non-recourse
basis and the lenders have no claim on the equity of sponsors for the repayment of the debt but fully rely on the project’s cash flows for the debt servicing, (iv) **High Leverage**, and the complex (v) **Contractual Structure**.

However, apart from the comprehensive research carried out by Balu (2002), and a few research articles notably by Chandra (2005), Chen (2006) and Modi (2008) and some mention of these issues in various research reports, including those in the India Infrastructure Report, 1996, and Deepak Parekh Committee Report, 2007, extensive and organized research has not been carried out on the structural issues and the impact that various project parties and contracts in this structure has on the appraisal done by Indian bankers. As far as risk measurement in project finance is concerned, studies by Patten, Hahn (2003) and Orgeldinger (2003) are important since they used probability distribution models to measure credit risk in the infrastructure sector. Their research, apart from focusing on stand-alone practices of assessing risk, like sensitivity analysis, scenario analysis, simulation and break-even analysis, also focuses on measuring risk through the credit scoring mechanism. Most of the credit risk models based on discriminant analysis focus on corporate loans rather than on project finance loans.

Therefore, a need is felt for a detailed research that takes into account the entire process of infrastructure project appraisal, which includes methods and techniques for scrutinizing contractual and legal issues and structural aspects of the project, besides the managerial, technical, marketing, construction, financial and economic aspects of appraisal. As banks move from standardized approach to Internal Rating Based (IRB) approach for Basel II compliance, the research into the rating models and the issues therein assumes importance. Literature review points out that research in this area is based on secondary data, and, it is necessary to understand the bankers’ perspective towards appraising and financing infrastructure through primary data.

**4. Research Methodology**

Based on the identification of problems and the knowledge gaps that exist in the literature, the present research has the following objectives:
4.1 Objectives

- To study the Financing of Infrastructure Projects with focus on project appraisal and risk measurement and to extract the best practices of Indian banks.

- To examine the existing framework for appraisal and risk measurement in Power and Road sectors.

- To develop appropriate case studies in order to capture the procedures and critical issues involved in financing infrastructure.

- To analyze and evaluate the credit rating mechanisms that banks use for measurement of risk and to statistically examine the attitude of credit officers towards relative importance of risk variables under each factor used in credit scoring in the power and road sector.

- To draw conclusions from the study on project appraisal and risk measurement practices and survey results, identify gaps and offer suggestions for improving the methods.

- To offer suggestions in order to strengthen bank financing of infrastructure sector in India.

4.2 Research Design

The following flowchart explains the research design.

Step 1: Study the project documents and the appraisal notes of participating banks.

Step 2: Prepare a detailed note on project appraisal and risk measurement practices.

Step 3: Examine the application of the process described above on chosen sectors: power and road and identify the appropriate risk variables.

Step 4: Prepare two case studies which would capture the financing process in the road and power sectors.

Identify gaps in the risk variables and the scores that credit officers assign to them across different sectors.
Step 5: Identify the above risk variables and test the perception of credit officers intra-sector on the credit rating mechanism used by banks by conducting a survey on the officers who have appraised projects in road and power sectors. Transition matrix of the data for five years is created for ratings given by the banks to seek rating migration and PD estimates in the above risk measurement system.

Step 6: Identify the gaps and suggest an alternate project appraisal and risk measurement technique which may be unique to a particular sector.

For steps 1 to 4 the design is essentially descriptive in nature. A single cross-sectional design is used in which one sample of respondents is drawn from the target population and information is obtained from this sample only once. In order to define the problem correctly and to identify the issues pertaining to this field for using in the questionnaire, the researcher undertook qualitative research by studying project documents and appraisal notes of the participating banks. Initially depth interviews were conducted with heads of credit departments of the participating banks, followed by interaction with the officers of the Reserve Bank of India and Ministry of Finance. Depth interviews were conducted with some leading project developers as well. The time taken for each interview was between 30 to 45 minutes.

The researcher uses structured observation method in natural setting and carries out detailed content analysis of the project files of the participating banks. In all 50 loan files were studied, of which 20 were of road sector and 20 were of power sector. The balance 10 files included projects on port, telecommunications, renewable energy, inland container depots, and container freight stations. The study includes scrutiny of detailed project reports by borrowers and sanction notes prepared by the bankers. Only those proposals which were sanctioned prior to 2004 (2002 onwards) were covered since the files already contained the follow-up and monitoring remarks from 2002 - 2008. The detailed project appraisal and risk analysis process are drawn out after the descriptive study. This is substantiated by developing two case studies: one on road sector and the other on power sector. Once the case studies are developed, then conclusive research design is used. During this phase, the researcher attempted the testing of the two sets of hypotheses:
Hypothesis 1

For Project appraisal and risk analysis, hypothesis testing is related to differences between the mean of two samples – credit officers who have appraised projects in the Road Sector and the Power Sector.

- H0 = Attitude of credit officers towards relative importance of credit scoring sub-variables on the overall credit score of each element of risk, as used in credit rating mechanism, is not different from sector to sector while appraising projects in the chosen sectors of road and power.

- H1 = Attitude of credit officers towards relative importance of credit scoring sub-variables on the overall credit score of each element of risk, as used in credit rating mechanism, depends on inherent risks unique to the sector and status of the promoter.

Hypothesis 2

For the structural differences between corporate and project finance, hypothesis testing is related to differences between mean of the two samples, that is credit officers who have appraised projects in infrastructure sector as well as in traditional projects started by corporate sponsor.

- H0 = Banks are using 'with recourse' structure to fund infrastructure projects, which is not different from financing corporate projects.

- H1 = Banks are using project finance structure to fund infrastructure projects with 'no or limited recourse', which is different from financing corporate projects.

For the survey, a structured questionnaire was used for collecting data. Both metric and non-metric data were collected. The structured questionnaire is divided into three sections. In Section A, appraising officers were asked to give their opinions on the relative importance that they give to each variable under identified elements of project assessment such as Management Quality, Market Potential (including demand and pricing issues), Technical issues, Construction issues, Operations Issues, Legal Issues, Force Majeure issues and Funding issues (which includes factors and critical ratios). A five-point scale (from least important to the most important) was used and each broad element was further divided in five risk sub-variables which together make
up an entire element. Similar scale and questions had been used in a research conducted by Balu for the Reserve bank of India study in 2002. Often a similar credit scoring model with similar risk variables is used by banks to rate a particular project. The rating class to which the project belongs signifies the level of risk and the factors that affect the pricing. In Section B, managers were asked questions about specific risks which affect both the sectors. These questions were based on checklists (Data collected on nominal scale). In Section C, managers were asked questions on their appreciation of structural issues as well as the creation of security in infrastructure projects. These questions were based on a five-point scale as well as on the checklists. Primary scales used in the questionnaire were nominal and interval scale and non comparative scaling techniques and itemized rating scale in particular based on five point Likert scale was used. Similar scales and rating parameters were used by Bhaskar (1996), V. Nirmala (1998) and Deshpande (2006) while studying the corporate loans. **Coefficient Alpha** which is a measure of internal reliability of the scale items was 0.78. It tended to increase with the increase in number of scale items during the pre-test. Since the scales were pre-tested on a sample size of 30, an adequately positive opinion on the content validity of the scale was found.

### 4.3 Sampling Frame

#### 4.3.1 Population: For drawing out the process of project appraisal and risk analysis, the sample population consists of all the Indian Banks, that include Public Sector Banks (27), Other Scheduled Commercial Banks (23) and Foreign Banks (28) and Credit Officers who are part of the bank syndicate or the lead banker to infrastructure financing projects. The sample population also includes development financial institutions (DFI’s) – Industrial Finance Corporation of India (IFCI), Industrial Development Finance Corporation (IDFC), and India Infrastructure Finance Company Limited (IIFCL). For creation of transition matrix for projects rated by CRISIL Risk Assessment model, 1289 project vehicles rated between the years 2004 and 2008 were considered.

#### 4.3.2 Sample: The study included collection of data from 26 public sector banks, 6 other scheduled commercial banks including private banks and 5 financial institutions and central banking institutions like the Reserve Bank of India and the National Bank for Agriculture and Rural Development (NABARD). Exposure by other scheduled commercial banks (Rs 22,539 crores, 15%) and foreign banks (Rs. 5,755 crores, 5%) to infrastructure is minimal on account of
their lesser volume of operations. Therefore, the data is drawn largely from the public sector banks. Further, a sample of 70 credit officers was picked for the attitude survey from the above sample. In a similar research done by Balu (2002), a sample size of 70 was taken. As infrastructure financing is comparatively a new area, which in fact has grown in prominence only since 2002, officers who have handled major projects independently are few in the Indian banking system.

Non-Probability sampling technique, particularly Quota sampling, was used. The control factors for selecting banks were: (i) they should have had exposure to infrastructure projects in the current year, and (ii) they should have set a target for disbursement to infrastructure sector in their loan policy documents. If either of the two conditions was not met, a bank was eliminated from the sample. Similarly, for selecting appraisal officers the control characteristics were: (a) the number of years of experience in project appraisal – which was set at 10 years – and (b) they should have handled projects in road and power sectors besides brownfield corporate projects. Those who had not appraised projects in both the sectors were excluded in the final sample.

Forty-eight projects which had achieved financial closure, and, those banks in the sample that had rated projects using the CRISIL RAM model for financing were selected for creating a transition matrix. The rating migration was captured for the years 2004 to 2008. Some of the selected projects had already achieved the commencement stage of operations during this period.

4.3 Hypothesis Testing In the present research, since the alternate hypothesis lacks direction, two-tailed tests were used for testing the differences in the hypothesis.

Both parametric and non-parametric tests were used. As data for corporate and infrastructure projects as well as road and power sectors were drawn from the same group of respondents, it was considered as paired data, and, therefore, the researcher adopted the paired sample t test. For data which is collected on the nominal scale, an important non-parametric test called the Wilcoxin matched-pairs single ranks test is conducted. The test statistic z is computed from positive and negative rank sums. The level of significance was fixed at 5 per cent or 0.05 because an intolerably high level of significance would have increased the Type II errors.

The risk sub-variables, selected under each factor of the credit scoring model which is used for attitude surveys, should be able to distinguish the critical risk drivers for the two sectors under
focus — that is road and power. A statistical test for examining the difference among means for two or more populations is termed as Analysis of Variances (ANOVA). Since the researcher is doing the test for each risk sub-variable under each factor, the one-way analysis of variance is done.

4.4 Scheme of Chapterization The report is organized into seven chapters. The challenging need for developing a strong infrastructure for an emerging economy like India, and the necessity of providing bank finance have been examined in Chapter 1. Chapter 2 defines the key concepts, reviews the research literature and identifies the gaps in research. Chapter 3 studies the Indian banks’ practices in project appraisal and risk measurement techniques. Concepts and Research methodology are discussed in Chapter 4. Chapter 5 shows the application of these practices in appraising the projects in the road and power sectors. This chapter also contains the two case studies — on road and power sectors — developed for crystallizing these practices. Results of the sample survey, statistical analysis and its interpretations are presented in Chapter 6. Based on descriptive and statistical research, recommendations and suggestions, also on generic issues and organizational preparedness, for improving bank financing of infrastructure are given in Chapter 7.

5. Results and Interpretation of Qualitative Research

Infrastructure project financing in India follows the project finance structure which means that lenders are advancing funds essentially on a “non-recourse” or “limited-recourse” basis as explained in the literature review. Therefore, bankers are required to ensure appropriate risk allocation through a robust legal, contractual and structural framework as the promoters have legally and structurally separated their balance sheet from project vehicle.

The key project players include the: Sponsors, Government, the Special Purpose Vehicle, lenders, Engineering Procurement and Construction Contractor (EPC), Operations and Management Contractor, Suppliers and Customers (Off-takers).

Project appraisal includes: appraisal of management, technical, construction, market, legal and force majeure (regulatory/political) issues. The collateral support, equity pledge, corporate and personal guarantees being minimal and the ownership of the asset financed generally remaining with the government, there is hardly any tangible security for mortgage and hypothecation.
Therefore, lenders reinforce the security structure through mix of contracts and agreements. The most important of these are (i) the Concession Agreement which gives the private party the right to develop the infrastructure asset and also provides the terms and conditions which ensure compensation under political and non-political *force majeure* clauses; (ii) the Shareholders’ Agreement, which binds the shareholders; (iii) the Fuel Supply and Transport Agreement which binds suppliers in the case of power project; (iv) the Agreement with the Government for ensuring state/centre support; (v) the Engineering Procurement and Construction (EPC) contract with construction contractor for a fixed time fixed price in order to prevent cost and time overruns; (vi) Operations and Management Contract (O&M) with a reputed contractor; (vii) the Substitution Contract to mitigate distress; (viii) the Power Purchase Agreement (PPA) with the off-takers (State Electricity Boards); (ix) the Escrow Charge on the off-takers account; and (x) the Trust and Retention Account with appropriate waterfall mechanism which taps all cash flows of the borrower. All these agreements, contracts and charges are assigned to the banker as security with the prescribed *ad valorem* stamp duty. All the project documents, financing documents along with the key contract agreements listed above are called “Transaction Documents”. The strength of the transaction documents forms the basis of the Project Appraisal by the bankers. The reports of the Lender’s Independent Engineer (LIE) and Lender’s Legal Counsel (LLC) therefore become important. If all the project parties are bound by iron-clad contracts at this stage and all the potential risks and loopholes are plugged, then there is little chance of the project not being successful. The key transaction documents across sectors are identified in the research.

Risk assessment is generally made with the help of stand-alone risk measurement ratios for the calculation and assessment of borrower’s requirements. The most important being the Debt Service Coverage Ratio (DSCR) and the Loan to Value (LTV) calculations. Sensitivity and Scenario analyses are performed on the cash flows and generally a pessimistic view is taken. Using a standardized rating model, risk scoring is done which leads to rating the ‘class’ of the borrower. This would reveal the probability of default through an appropriate balancing exercise. Thus, risk measurement is taken and its mitigation taken care of through effective and standardized tools so as to bring in a level of tolerance in cash flow projections, thus the lenders ensure security of the loan, and remove uncertainty of lending. Various elements of risk such as sponsor risk, demand and price risk, cost and time overrun risk, legal and contractual risk,
operational risk, funding risk, force majeure risk, which includes political risk, environmental and social risks are identified at all the stages of the project; in short the entire gamut of development, construction and operation comes under the lender's hawk-eye.

The researcher then evaluates the applicability of the above-discussed procedure for project appraisal and risk mitigation to the road and power sectors and traces out the sector-wise adaptations that bankers use when they move from general to sector-specific appraisals. It is observed that though the broader elements of appraisal remain the same as described above, there are subtle issues which are purely sectoral, which creep in when project appraisal takes place in individual sectors.

Two case studies developed during the research, one on road sector (Case on Bharatpur-Mahua Toll Road) and the other on power sector (Case on Southern Energy Limited) are then discussed. These cases bring out the differences in the appraisal procedure more sharply. The case files studied are in the form of appraisal notes that are prepared by banks while they evaluate the projects. It becomes quite clear from the case studies that management and financial appraisal is done on almost similar parameters in both the sectors. Risk measurement uses the same parameters and sensitivity analysis in done in both the sectors. However, the economic and structural drivers across the two sectors are different. These drivers are identified in the research.

However, the dilemma is that when risk assessment is made by means of a credit scoring model, it is done on the same factors and sub-variables across both the sectors. Many a time managers give scores based on their personal perceptions. Using the factors and dividing them into sub-variables, based on descriptive research, an attitude survey was done on the appraising officers with the help of a structured questionnaire. The key results are discussed as below:

6. Testing of Hypothesis and Interpretation of Results

6.1 Results and Interpretation of Attitude Survey

The summary of results of the survey conducted on rating parameters for road and power sectors is given below.
Table 1: Summary of Statistics: Project Appraisal and Risk Measurement

(Paired Sample t Test)

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>Comparative Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Difference of mean</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Road-Power</td>
</tr>
<tr>
<td>1.</td>
<td>Management Quality</td>
<td>-1.77</td>
</tr>
<tr>
<td>2.</td>
<td>Market Potential - Demand Issues</td>
<td>-2.84</td>
</tr>
<tr>
<td>3.</td>
<td>Market Potential - Price Issues</td>
<td>-5.64</td>
</tr>
<tr>
<td>4.</td>
<td>Technological Issues</td>
<td>-5.51</td>
</tr>
<tr>
<td>5.</td>
<td>Construction Issues</td>
<td>-3.86</td>
</tr>
<tr>
<td>6.</td>
<td>Operational Issues</td>
<td>-2.62</td>
</tr>
<tr>
<td>7.</td>
<td>Legal Issues</td>
<td>-3.10</td>
</tr>
<tr>
<td>8.</td>
<td>Force Majeure Issues</td>
<td>-4.70</td>
</tr>
<tr>
<td>9.</td>
<td>Funding Issues</td>
<td>-2.50</td>
</tr>
</tbody>
</table>

The paired sample t test results clearly demonstrate that there is a statistically significant difference in the credit officers’ attitude towards various sub-variables used for rating factors such as: management quality, market potential, technology, construction, operation, legal, force majeure and funding issues regarding both road and power sectors. Similarly, in risk identification, which was done on nominal scales using checklists and the Wilcoxin matched pairs sign rank test, a significant difference was found in the attitude of credit officers across the sectors.
Table 2: On-way Analysis of Variances

(Only factors not statistically significant are listed)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Mean Road</th>
<th>Mean Power</th>
<th>ANOVA Statistics</th>
<th>F Value</th>
<th>P Value at 0.05 Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Management Quality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sponsors’ Track record</td>
<td>4.27</td>
<td>4.28</td>
<td>DF=1, MS =0.007</td>
<td>0.010</td>
<td>0.918</td>
</tr>
<tr>
<td>Sponsors Financial Prudence</td>
<td>4.63</td>
<td>4.65</td>
<td>DF=1, MS =0.028</td>
<td>0.070</td>
<td>0.791</td>
</tr>
<tr>
<td><strong>Market Potential – Demand Issues</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competition from New Entrants</td>
<td>3.19</td>
<td>3.10</td>
<td>DF=1, MS = 0.25</td>
<td>0.58</td>
<td>0.446</td>
</tr>
<tr>
<td><strong>Technical Issues</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LIE Opinion on Aggressiveness</td>
<td>3.66</td>
<td>3.83</td>
<td>DF=1, MS = 1.02</td>
<td>1.82</td>
<td>0.178</td>
</tr>
<tr>
<td><strong>Construction Issues</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquidated Damages</td>
<td>3.86</td>
<td>3.81</td>
<td>DF=1, MS = 0.064</td>
<td>0.11</td>
<td>0.735</td>
</tr>
<tr>
<td><strong>Operational Issues</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track Record of O&amp;M Contractor</td>
<td>3.77</td>
<td>3.87</td>
<td>DF=1, MS= 0.35</td>
<td>0.96</td>
<td>0.328</td>
</tr>
<tr>
<td>Defining Events of Default</td>
<td>4.59</td>
<td>4.46</td>
<td>DF=1, MS=0.573</td>
<td>0.903</td>
<td>0.343</td>
</tr>
<tr>
<td><strong>Legal Issues</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enforceability of Rights / Remedies</td>
<td>4.53</td>
<td>4.59</td>
<td>DF=1, MS = 0.114</td>
<td>0.230</td>
<td>0.631</td>
</tr>
<tr>
<td><strong>Funding Issues</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stability of Cash Flows</td>
<td>4.63</td>
<td>4.50</td>
<td>DF=1, MS = 0.57</td>
<td>2.00</td>
<td>0.159</td>
</tr>
<tr>
<td>Reasonableness of Capital Costs</td>
<td>3.80</td>
<td>4.39</td>
<td>DF=1, MS=0.114</td>
<td>0.230</td>
<td>0.631</td>
</tr>
<tr>
<td>Viability &amp; Bankability of Project</td>
<td>4.24</td>
<td>3.93</td>
<td>DF=1, MS=0.345</td>
<td>6.86</td>
<td>0.090</td>
</tr>
</tbody>
</table>

However, when the one-way ANOVA test was conducted across all sub-variables under each category of appraisal, it was found that the results are not statistically significant, indicating that the credit officers’ attitude does not change for these sub-variables across the sectors with respect to the following factors – Sponsors’ track record, Financial strength of borrowers, Prudence in management appraisal; Importance of lenders’ independent engineer’s report on technological issues; Importance of liquidated damages in construction issues; Track record of O&M contractor in operational issues; Legal enforceability of contracts in legal and *force majeure* issues. In fact, credit officers place high importance on stability of cash flows, reasonableness of capital costs and viability and bankability of projects.

Thus, based on the above tests, the null hypothesis:
• "H0 = Attitude of credit officers towards relative importance of credit scoring sub-
variables on the over-all credit score of each element of risk, as used in credit rating
mechanism, is not different from sector to sector while appraising projects in the
above chosen sectors", can be rejected

and, the alternate hypothesis:

• "H1 = Attitude of credit officers towards relative importance of credit scoring
variables on the over-all credit score of each element of risk, as used in credit rating
mechanism, depends on inherent risks unique to the sector and status of a
promoter", can be accepted.

Summary statistics of the survey conducted to find out the credit officers’ attitude on structure of
infrastructure projects as against corporate projects are summarized in Table 5.

Table 3: Summary of Statistics: Project Structure (Paired Sample t test)

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th></th>
<th>Comparative statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Corp. Projects)</td>
<td>(Infra Projects)</td>
</tr>
<tr>
<td>1.</td>
<td>Sponsors’ track record/ Financial</td>
<td>4.84</td>
<td>4.86</td>
</tr>
<tr>
<td></td>
<td>support to project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Repayment dependence only on project</td>
<td>3.81</td>
<td>4.81</td>
</tr>
<tr>
<td></td>
<td>cash flows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Recourse to balance sheet of sponsor</td>
<td>4.43</td>
<td>2.79</td>
</tr>
<tr>
<td>4.</td>
<td>Legal/Contractual dependence</td>
<td>2.74</td>
<td>4.64</td>
</tr>
<tr>
<td>5.</td>
<td>Ideal/Acceptable financial ratios</td>
<td>4.79</td>
<td>3.07</td>
</tr>
</tbody>
</table>

There is no statistical difference in how the credit officers view the track record and financial
strength of sponsors while appraising infrastructure or corporate projects. However, one of the
elements that clearly differentiates corporate finance from project finance is in the practice of
having recourse to the balance sheet or absolute dependence on sponsors’ cash flows as in the
case of the former rather than on project cash flows as in the case of the latter. Dependence on
legal and contractual structure and preset range of appraising ratios is uniform across the sectors, there are significant statistical differences in the attitudes of appraising officers between corporate and infrastructure projects. This is further substantiated by data which was collected on nominal scale and tested by Wilcoxin Matched Pairs signed ranks test.

Therefore, the null hypothesis which says that:

- "Banks are using ‘with recourse’ structure to fund Infrastructure Projects which is not different from financing corporate projects" is rejected,

and, the alternate hypothesis which says that:

- "Banks are using Project Finance structure to fund Infrastructure Projects with ‘no or limited recourse’ which is different from financing corporate projects" was accepted.

In addition, the following key facts were revealed by the survey vis a vis banks’ appraisal and risk identification methodology.

- **Management Appraisal/Quality:** Very high importance is given to the transparent shareholders’ agreement, sponsors’ track record and sponsors’ financial prudence by the appraising officers. Though the t test (p value = 0.000 at 0.05 significance) shows that there is a significant difference in the attitude of credit officers on relative importance of all factors contributing to the management appraisal in road and power sectors, the analysis of variance results shows that the difference is not significant in factors like sponsors’ track record (p value =0.918 at significance level of 0.05) and financial prudence (p value of 0.791 at significance level of 0.05).

- **Market Potential /Risk, Demand and Price Issues:** In demand issues, high importance is given by the lender’ appraising officers to the long-term demand gap (often given by the willingness to pay survey, origin destination surveys conducted by lenders’ independent engineers) and alternate routes in the road sector. In pricing issues for the road sector, toll rates and their escalation clauses are given high importance by the appraising officers. In the power sector, contractual agreement with the buyer (power purchase agreement and its terms and conditions) is given the highest importance by the
appraising officers. High importance is also given to factors like long term demand-supply gap or presence of a contingent buyer. In pricing issues a very high importance is given by the appraising officers to the bid amount given by the borrower and as to whether the same will be able to service the costs. Also the highest importance is given to factors like off-taker’s (State Electricity Board) ability to service payments and whether any contractual agreement like Take or Pay is signed with them. However, the t test results show (p value =0.000 at a significance level of 0.05) that there is a significant difference in attitude towards both the demand and pricing issues across sectors. The analysis of variance results also show a significant difference across all factors in demand and pricing issues except for competition from new entrants (p value 0.446 at significance level of 0.05) in case of demand issues.

- **Technology Issues/ Risk:** In technological issues, great importance is given to lenders’ independent engineer’s report with regard to the road sector (right of way) as also the design and land acquisition issues. In the power sector the highest importance is given to technological and operational risks involved since plant’s load factors depend on technologies and many a times bids are dependant on efficiencies of super-critical technologies. Also in the power sector testing and commissioning are given very high importance because power purchase agreement is often linked to it. Clearances from the government agencies like Pollution Control Board, Ministries of Environment and Finance are also given high importance as many power projects depend on satisfactory resolution of these issues. However, the t test results show (p value =0.000 at a significance level of 0.05) that there is a significant difference in the attitude towards technological issues across sectors. The analyses of variance results also show a significant difference across all factors in technological issues except that of lender’s independent engineer’s report (p value 0.178 at significance level of 0.05).

- **Construction Issues / Risk:** In the road sector, great importance is given to the ‘Fixed time - Fixed price’ EPC contract, and also to ensure that it is benchmarked against similar contracts with adequate liquidated damages. In the case of power sector, the highest importance is given to all these issues and also to the engineer’s comments on aggressiveness of the EPC contract. The parent company’s guarantees are also sought particularly against cost overrun. Regarding time overruns, it is often sought to be
protected by liquidated damages, though it is capped at 20 per cent. However, the t test results show (p value = 0.000 at a significance level of 0.05) that there is a significant difference in the attitude towards construction issues across sectors. The analysis of variance results also shows a significant difference across all factors in construction issues except for liquidated damages (p value 0.735 at significance level of 0.05), which is a part of all EPC contracts and is independent of the sector. Time and cost overruns and implementation issues are given the highest scores by bankers.

- **Operations Issues/Risk:** In the road contract, the track record and pricing of O&M contract are given the highest importance. If the O&M contractor is good, the banker is assured of adequate flow of funds into the TRA account, consequently, the task if surveillance and monitoring also becomes easier. As far as power is concerned, the highest importance is given to supply/input linkages as many a power projects fail when these are not properly secured. Contracts like fuel supply and transport agreements are also entered into. Rest of the factors described above in the case of road is also given high importance, and, in the case of power, clause for quick replacement, if suboptimal performance is noticed, it is to be included. However, the t test results show (p value = 0.000 at a significance level of 0.05) that there is a significant difference in the attitude towards operational issues across sectors. The analysis of variance results also show a significant difference across all factors regarding operational issues except for track record of O&M contractor (p value 0.328 at significance level of 0.05) and for defining events of default and bonuses (p value 0.343 at a significance level of 0.05), which are independent of the sectors and also part of the normal due diligence to be exercised by the lenders.

- **Legal Issues/Risk:** In the case of road sector, the appraising officers give the highest importance to enforceability of rights and remedies as well as legal opinion on documentation and dispute redressal mechanism. In the case of power, apart from these factors, trustee and inter-creditor issues are also given sufficiently high importance. However, the t test results show (p value = 0.000 at a significance level of 0.05) that there is a significant difference in the attitude of bankers towards legal issues across sectors. The analysis of variance results also shows a significant difference across all factors in
legal issues except for enforceability of contracts (p value 0.631 at significance level of 0.05).

- **Force Majeure Issues/Risk**: *Force majeure* issues are of two kinds, political and non-political. In both the sectors high importance is given to identification of issues and termination of benefits which help protect the banker in times of crisis. Insurance and coverage of supply default is given high importance in the case of power sector. However, the t test results show (p value =0.000 at a significance level of 0.05) that there is a significant difference in the attitude towards *force majeure* issues across sectors. The analysis of variance results also shows a significant difference across all factors in *force majeure* issues.

- **Funding Issues/Risks**: Bankability and viability of projects and stability of cash flows and have been considered as the most important factors by bankers for the road sector, whereas for power, in addition to these factors, equity commitment from sponsors and reasonableness of capital costs are also considered very important. As the projects are financed on non-recourse basis, stability of cash flows is important for both the sectors. Bankers generally apply diligence to project costs, means of finance and projected cash flows given by the borrower and these are assessed for both the sectors. Tenor of loans and building a reasonable cushion between the tenor of loan and tenor of concession agreement are also crucial.

As both the null hypothesis are rejected, it can be inferred that for appraisal and risk identification, the issues involved in each of the sectors are significantly different, except for the evaluation of the promoter. Hence, each project and each sector is unique in itself. Each sub-sector of the infrastructure is also inherently unique in terms of its administrative and organizational structures, the regulatory framework governing their operations, the sophistication of technologies adopted, and the degree of commercialization. This being true, then, it can naturally be inferred that if banks are using the same credit scoring model across sectors, it will lead to deficiency in assessment of risk rating and also inappropriate pricing decision as the attitude of credit officers towards factors of appraisal are (statistically) significantly different across sectors. Therefore, in infrastructure projects, where it is inferred that each project in each
sector is unique, bankers need a unique credit rating mechanism, with detailed sector-specific guidelines.

6.2 Results of Analysis of Credit Risk Model: Measurement of Risk

The survey results on risk measurement techniques points out that almost all banks use CRISIL Risk Assessment Model for measuring risk in infrastructure projects. Data was collected for all project special purpose vehicle ratings done by CRISIL for the period from 2004 to 2008. The total number of project vehicles rated were 1289. Out of these, 351 (27%) projects were BBB rated and 290 (23%) projects were BB rated. It means that 50 per cent of projects rated on CRISIL model were rated BBB and BB.

The calculation of counter-party credit risk, according to Basel II capital accord, involves estimation of probability of default that could be derived from corresponding transition matrix.

The transition matrix represents rating migration from one rating level to another within the selected rating system and during the time period of one year. The last column of transition matrix represents probabilities of default. Forty-eight projects which had achieved financial closure and where banks in the sample category have rated and financed using CRISIL RAM model were selected for creating a transition matrix. The rating migration was noted for each of the years from 2004 to 2008. Some of the projects had in fact commenced operations during this period.

The result of the transition matrix is given in Table 4.
Table 4: Transition Matrix (N=48) 2004-08

(Figures in percentage)

<table>
<thead>
<tr>
<th></th>
<th>AAA</th>
<th>AA</th>
<th>A</th>
<th>BBB</th>
<th>BB</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>97.00</td>
<td>3.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>AA</td>
<td>8.00</td>
<td>92.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>A</td>
<td>0.00</td>
<td>4.50</td>
<td>90.00</td>
<td>5.50</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>BBB</td>
<td>0.00</td>
<td>0.00</td>
<td>8.00</td>
<td>89.00</td>
<td>3.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>BB</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>3.00</td>
<td>88.00</td>
<td>6.00</td>
<td>0.00</td>
<td>3.00</td>
</tr>
<tr>
<td>B</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>3.00</td>
<td>8.00</td>
<td>83.00</td>
<td>3.00</td>
<td>3.00</td>
</tr>
<tr>
<td>C</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>10.00</td>
<td>0.00</td>
<td>50.00</td>
<td>40.00</td>
</tr>
<tr>
<td>D</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

The transition matrix clearly shows certain aspects about the CRISIL Risk Assessment Model. The first is that it provides enough granularity among the rating classes. It is evident that the rating is quite stable in all grades, which may be termed as Investment Grade AAA (97.00%) (indicating that 97.00 per cent of the rated projects continued with the same grade year after year, over a one-year horizon, during the five-year period); similarly AA (92.00%), A (90.00%) and BBB (89.00%). Thereafter for speculative rating like BB, B and C, the stability declines from 88 to 50 per cent, indicating that migration across each rating grade has increased. The migration to default is 3 per cent in BB, 3.00 per cent in B, 40 per cent in C grades. That means, the lower rating is able to capture defaults quite well. This is remarkably true for C grade though the rating grade looks quite unstable. As shown by the data in Table 6, the percentage of loans being rated BBB is quite high. However, it becomes clear that BBB loans show a zero probability of default and a remarkable upward migration, which may be due to projects reaching commencement of operation date in between the observation periods. Reaching commencement of operations drastically reduces project risks. In fact, the biggest risk that projects in India face is implementation risk because many projects do not commence operations on the scheduled date. This shows that both A and BBB grades which attract PLR + pricing may be reviewed along with the risk mitigants since a very significant percentage of projects shows an upward migration.
The high percentage of upward migration in BBB rating grades suggest that banks are conservative in rating infrastructure loans till the time the project starts earning revenues. However, if the sector-specific rating mechanism along with the effect of risk mitigants is used, it may have an effect on the rating of loans and subsequently on their pricing.

7. Recommendations and Suggestions

7.1. Depending on the credit risk that a particular project faces, the bank has to make adequate provision for capital against it. **Expected Credit Risk Loss (EL)** is intended to provide reserve requirements for doubtful accounts, help calculate PLR (default premium), price the credit risky instruments (bonds and exotic options), and project the risk-adjusted profitability (e.g. RAROC). The bank may suffer greater loss than what was expected, say, during economic downturns. These losses are called **Unexpected Losses (UL)** or uncertain losses. Strong capital base is required to absorb the unexpected losses as and when they occur. Credit ratings represent an objective opinion of a company’s or a credit instrument’s inherent financial strength which can project a summary of the diverse risk factors indicating either the financial health or the default probability of the borrower. Accordingly, capital provisioning has to be done in direct relation to the overall risk rating of the credit portfolio. With the advent of Basel II, the capital requirements have increased and are the maximum (22%) in the case of project loans. Besides, if the bankers, trained and accustomed to decades of security-backed lending, rate the project loans on the basis of non-recourse/limited recourse at a higher level, without regard to legal and contractual structure, the capital provisioning requirement for these loans is likely to shoot up, thus increasing the pricing. Consequently, this would make it costly for project developers and will directly impact on the viability of many of the projects. Similar results have been obtained by the transition matrix created for the loan ratings done by the CRISIL Risk Assessment Model.

As Indian commercial banks start appreciating the need for a structured credit risk management framework, it is imperative for them to incorporate some mechanism that will comprehensively and objectively capture and evaluate the credit-worthiness of infrastructure project developers against the perspective of the changing scenario. Therefore, it is suggested that the credit rating officer at the branch/corporate credit department initiate the process of rating exercise. It is also imperative to obtain the industry rating from the economic cell, which should also specify
critical contracts and regulations for a particular sector as well as set sector specific benchmarks so as to avoid perceptual errors.

A conceptual framework is discussed in the research which breaks down the process of risk measurement into four steps: 1. Identification of sources of risk; 2. Modeling for uncertainty which includes the measuring uncertainties in their dimensions: (a) Impact of risk drivers, (b) Likelihood of risk driver happening, and (c) Risk concentration; 3. Aggregating risk concentration scores with their respective weights; and 4. Aggregating scores leading to credit risk rating. Each rating grade needs to be higher than the hurdle rate used by the banker for that particular rating class. If the appraising officer can give the likelihood and impact scores along with risk mitigant scores, a better rating exercise can be done for the project which will keep its dynamic nature intact. The raw scores can then be modeled by the credit risk department to arrive at the risk rating of the project.

Corresponding to the rating, the research report suggests an appraisal format which takes into account all the eight factors used in the survey and the most important sub-variables already identified by the statistical research. It is suggested, however, that the benchmarks need to be changed from sector to sector so as to retain the dynamic content of the model, and, simultaneously the appraising officers also should be advised. It is expected that this model will automatically lead to the exact calculation or measurement of the inherent risk, because the credit officers will be able simultaneously to give scores on the likelihood impact and mitigants as suggested in the conceptual framework.

This appraisal format, as it takes the score of risk mitigants and appropriate hair-cuts into effect and the sub-variables selected are on the basis of primary data, is expected to improve the existing risk assessment model. However, quantitative validation on bank’s data needs to be carried out.

7.2 Suggestions and Strategies for Improving Bank Finance to Infrastructure Sector

The research concludes with detailed discussion on various generic strategies to improve flow of credit to infrastructure sector, which include means to Facilitating Equity Financing; removal of Interest Rate Caps on ECBs; encouraging the take out financing method; particularly in the light of the recent announcement in Union Budget 2009-10 where the government has decided that
IIFCL will refinance 60 per cent of the commercial banks' loans for PPP projects in critical sectors over the next 15 to 18 months; Strategies to develop a Longer-term Corporate Bond Market and streamlining regulations.

8. Conclusion

The role of social sciences to study the future developments in banking and infrastructure finance in particular has been acknowledged by senior bankers. Infrastructure development will set India on its path to become a superpower. Especially post-financial meltdown, there is bound to be a tremendous thrust for infrastructure development because investment in infrastructure is seen to be counter-cyclical and recession-proof. Because the Indian banks have been mandated to boost the infrastructure growth, the research on project appraisal and risk measurement in infrastructure financing was undertaken, keeping in view the larger role they have to play in the nation's over-all development. Towards this end, the present study attempts to strengthen the efforts of banks to step up the credit flow to the various infrastructure sectors of the Indian economy.