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A STUDY ON RELATIONSHIP BETWEEN PROJECT SELECTION CRITERIA AND RISK CATEGORIES W.R.T INFRASTRUCTURE COMPANIES IN PUNE

Dr. Vilas Chopde*

Mr. Arpit Gajbhiye**

Abstract:

Infrastructure is a broad concept linked to every facet of the economy and human life. There is no clear definition of infrastructure according to current usage of the term in India. But it is necessary to narrow down the few definitions and meaning of infrastructure and background.

Infrastructure is basic physical and organizational structures needed for the operation of a society or enterprise or the services and facilities necessary for an economy to function. It is usually considered as public infrastructure that facilitates the economy and society to operate. Economic & urban planners distinguishes two types of infrastructure i.e. economic infrastructure & social infrastructure, infrastructure projects, including those in rural sector, involve huge initial investments, long gestation periods, high incremental capital output ratio, high risk and low rate of returns on investment. All these factors are not conducive for private sector entry into infrastructure. As a result of this, infrastructure services, the world over, are largely provided by the public sector. This study was undertaken to find out relationship between Project selection criteria and risk categories.

Key Words: Infrastructure, Risk, Project selection and Pune

* **Vice-Principal (Commerce), Dr. Ambedkar College, Deekshabhoomi, Nagpur**

** **Researcher**

The infrastructure development in India

The infrastructure development of any country includes both economic infrastructure development that is the development of various sectors and also the social infrastructures. Development of economic infrastructure cannot usher in overall development at the desired level if the social infrastructure is not simultaneously developed. The capacities and technical refinement of the economic infrastructure like roads, sewers, electricity, open spaces, gardens and the evolving requirements of social infrastructures like shopping complexes, restaurants, medical facility zones, schools etc, are clearly delineated. Education, Health, social security, water supply, shelter and sanitation etc, has to be developed to ensure proper social infrastructure. In this sense both economic and social infrastructure are interconnected and interdependent and in these terms and perspectives both economic and social infrastructures are crucial element for development of an economy and even growth is linked to infrastructure as infrastructure is linked to growth. Hence, the development of India is incomplete without social development and that would require focus on the infrastructure strategy for social research in India.

Social infrastructure is defined as building strong communities through the continuing development and delivery of activities, resources and support to strengthen the skills and confidence of people and community groups to enable them to take effective action and leading roles. It is made up of a number of components; community or residents group, grants for startup and development of community and voluntary organizations, community learning or leadership development, and volunteer development.

The term Social sector refers to the factors, which contribute to human capital formation and human development. Social development is recognized not only as a means to economic development, but also an end in itself, in terms of expanded individual opportunities, capabilities and freedom. Improvements in the social sector pave the way for equity and in turn for economic development. In fact, effective human development and economic development itself depend on the development of social infrastructure. Thus importance of social infrastructure hardly needs any elaboration.

In the context of economics, educated and healthy people build a healthy nation with a healthy growth rate. Yet social infrastructure in India is not receiving the much needed attention. Social infrastructure of a nation not only presents the human face of the economic growth process, but represents the very essence of well-rounded progress. Moreover, it reflects how the society cares for the underprivileged and provides hope and opportunities to economically weaker sections of the society in improving the lot of their next generation.

The governments, both at Centre and State, have been increasingly providing public goods in crucial areas such as education, health, sanitation, housing, etc. and also the governments both at centre and state are spending huge amounts on the expansion and development of social infrastructural facilities, which are directly or indirectly associated with the development of the study area.

Components of Infrastructure:

The eminent Indian economist, professor V.K.R.V.Rao has classified the items of infrastructure in to the following nine broad categories.

1.	Transport :	
a.		Railways
b.		Roads
c.		Shipping ports and harbours
d.		Airports
e.		Transport Equipment.
2.	Communication:	
a.		Posts
b.		Telegraphs
c.		Telephones
d.		Radio
e.		Television
f.		Cinema.

3. Energy:

a. Coal

b. Electricity (Hydrel, Thermal, Nuclear)

c. Wind Power

d. Solar power

e. Oil

f. Gas

g. Biogas.

4. Intermediate Goods output:

a. Minerals

b. Steel

c. Metals other than steel

d. Basic Chemicals

e. Fertilizers and Pesticides

f. Machinery and Machine tools.

5. Increasing Productivity of Natural Resources:

a. Reclamation of land

b. Irrigation (Major, Medium and Minor)

c. Drainage

d. Control building and land reshaping

e. Consolidation of holdings

f. High yielding bovine varieties

g. Fishing Boats

h. Fishing equipments and refrigeration

i. Afforestration and development of Commercial Forests.

6. Science and Technology:

a. Teaching

b. Basic and Applied research

c.		National laboratories
d.		Liaison with production units.
7.	Information system:	
a.		Mass media
b.		Libraries and Museums
c.		Fairs and Exhibitions
d.		Books and Journals.
8.	Finance and Banking:	
a.		Saving Institutions (Public, Private and Cooperative Sectors)
b.		Credit and lending institutions (Public, Private and Co-operative Sector)
d.		Capital Market.
9.	Social Infrastructure:	
a.		Health
b.		Drinking water
c.		Disease eradication
d.		Public hygiene
e.		Family planning
f.		Medical facilities
g.		Education – Literacy
h.		Schools, Colleges and Universities
i.		Professional education
j.		Technical and industrial schools
k.		Development disciplines.

(Source: shodhganga.inflibnet.ac.in/bitstream/10603//7%20chapter%201%20introduction.pdf)

Thus, the scope of infrastructure is growing rapidly over time. The items to be covered in the term infrastructure are rather difficult. They differ from country to country depending on the level of economic development. A country may go in for broader base of infrastructure development as development proceeds over the time periods.

Universe of the Study:

The universe of this study is all the infrastructure manufacturing companies from Nagpur city. Respondents will be selected from the main stakeholders involved in large infrastructure projects in Nagpur, like general contractors, government agencies, consulting firms, and Infrastructure companies

Sampling technique: Simple Random sampling technique

Simple random sampling refers to a sampling method that has the following properties.

- The population consists of N objects.
- The sample consists of n objects.
- All possible samples of n objects are equally likely to occur.

An important benefit of simple random sampling is that it allows researchers to use statistical methods to analyze sample results. For example, given a simple random sample, researchers can use statistical methods to define a confidence interval around a sample mean. Statistical analysis is not appropriate when non-random sampling methods are used.

There are many ways to obtain a simple random sample. One way would be the lottery method. Each of the N population members is assigned a unique number. The numbers are placed in a bowl and thoroughly mixed. Then, a blind-folded researcher selects n numbers. Population members having the selected numbers are included in the sample.

Sample size:

Respondents	**Pune**
General contractors	168
Engineering firms	72
Consulting firms	64
Government Agencies	48
Clients	24
Institutes	8
Suppliers	8
Total	392

Respondents profile:

A web-based survey tool, SurveyMonkey (https://www.surveymonkey.com), is employed in this survey to present the final questionnaire and collect and sort the data. It allows the researcher to conduct the survey with a low budget and tight schedule.

A computerized database of main industry players in Nagpur city was compiled from various sources. Identified industry practitioners are from the main stakeholders in the Nagpur infrastructure management sector, namely general contractors, sub-contractors, specialized contractors, suppliers, designing firms, clients, government agencies, consulting firms, academic institutions, etc., who are the key players in the infrastructure sector and have direct involvement in any given infrastructure project; either as decision-maker or implementer.

Respondents are from various types of organizations and have a good coverage of the main stakeholders in the infrastructure sector. Up to 42.9% of the respondents are from general contractors. Others are from engineering firms, consulting firms and governments agency (18.4%, 16.3% and 12.2%, respectively). There is a slight overlap between engineering firms and consulting firms, as some of the consulting firms provide engineering specialized services. Only 6% of survey respondents considered themselves as infrastructure clients. The main reason is that, in Australia, many infrastructures are state owned or temporarily owned by the private sector thus, some of the clients are hidden within the contractor and government agency category.

So approximately we have decided to keep a sample of 388 for the Nagpur city.

Sampling Method:

Cluster sampling is used in statistics when **natural groups** are present in a population. The whole population is subdivided into clusters, or groups, and random samples are then collected from each group.

Cluster sampling is typically used in market research. It's used when a researcher **can't get information about the population as a whole**, but they can get information about the clusters.

Hypothesis for the study:

H01: There is no significant relationship between Project selection criteria and risk categories.

In this hypothesis Project selection criteria is considered as independent variable and Risk categories is considered as dependent variable.

Dependent variable Risk categories can be measured from the responses gathered on the following statements on 5 point Likert scale (Strongly disagree, disagree, neutral, agree, and strongly agree)

- Design risks - Design errors and omissions, Design process takes longer than, Stakeholders request late changes and Failure to carry out the works in accordance with the contract
- External risks - New stakeholders emerge and request, Public objections, Laws and local standards change and Tax change
- Environmental risks - Environmental analysis incomplete, New alternatives required to avoid, mitigate or minimize environmental impact, Delayed deliveries and Lack of protection on a construction site
- Project management risks - Failure to comply with contractual quality requirements, Scheduling errors, contractor delays and Project team conflicts
- Right of way risks - Expired temporary construction permits and Contradictions in the construction documents
- Construction risks - Construction cost overruns and Technology changes

Independent variable Project selection criteria can be measured from the responses gathered on the following statements on 5 point Likert scale (Strongly disagree, disagree, neutral, agree, and strongly agree)

Policy formulation, Performance evaluation and monitoring, Fiscal Planning, Program optimization and trade-offs, Development of alternatives (for sustaining assets through their life cycle), Impact analysis, Performance-based budgeting, Project selection, Resource allocations, Program delivery/ project implementation, Audit, reporting and communication

This hypothesis is tested using ANOVA and Cronbach's alpha test.

ANOVA- The one-way analysis of variance (ANOVA) is used to determine whether there are any statistically significant differences between the means of three or more independent (unrelated) groups. This guide will provide a brief introduction to the one-way ANOVA, including the assumptions of the test and when you should use this test.

Cronbach's alpha- It is the most common measure of internal consistency ("reliability"). It is most commonly used when you have multiple Likert questions in a survey/questionnaire that form a scale and you wish to determine if the scale is reliable.

ANOVA Table

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Design Risk	Between Groups	191.819	4	47.955	37.184	.000
	Within Groups	996.900	388	1.290		
	Total	1188.720	390			
External risks	Between Groups	146.438	4	36.609	25.853	.000
	Within Groups	1094.621	388	1.416		
	Total	1241.059	390			
Environmental risks	Between Groups	112.825	4	28.206	19.524	.000
	Within Groups	1116.764	388	1.445		
	Total	1229.589	390			
Organizational risks	Between Groups	225.938	4	56.484	46.462	.000

	Within Groups	939.755	388	1.216		
	Total	1165.693	390			
Project management risks	Between Groups	75.385	4	18.846	12.759	.000
	Within Groups	1141.778	388	1.477		
	Total	1217.163	390			
Right of way risks	Between Groups	65.640	4	16.410	11.023	.000
	Within Groups	1150.824	388	1.489		
	Total	1216.464	390			
Construction risks	Between Groups	55.478	4	13.870	9.647	.000
	Within Groups	1111.372	388	1.438		
	Total	1166.850	390			

This is the table that shows the output of the ANOVA analysis and whether there is a statistically significant difference between our group means. We can see that the significance value is 0.000 (i.e., p = .000), which is below 0.05 therefore, there is a statistically significant difference in the mean of Risk categories and Project selection criteria. Thus, we can reject Null Hypothesis H5: There is no significant relationship between Project selection criteria and risk categories and accept Alternate hypothesis H5: There exists significant relationship between Project selection criteria and risk categories.

Cronbach's alpha i.e. reliability test

Cronbach's alpha (or *coefficient alpha*), developed by Lee Cronbach in 1951, is a way to measure reliability, or internal consistency of a psychometric instrument.

"Reliability" is how well a test consistently measures what it is supposed to measure. Reliability tests, like Cronbach's alpha, are most commonly used to see if questionnaires with multiple Likert scale questions are reliable. These questions are designed to measure latent variables. A latent variable is a hidden or unobservable variable, like a person's conscientiousness, neurosis or openness. These variables are notoriously difficult to actually measure; Cronbach's alpha will tell you if the test you have designed is accurately measuring the latent variable you are interested in.

Cronbach's Alpha Formula

The formula for Cronbach's alpha is:

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N-1) \cdot \bar{c}}$$

Where:

N = the number of items,

$\bar{c}$ = average covariance between item-pairs, and

$\bar{v}$ = average variance.

In this case the researcher has used SPSS to calculate alpha value

A rule of thumb for interpreting alpha for dichotomous questions (i.e. questions with two possible answers) or Likert scale questions is:

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

In general, a score of more than 0.7 is considered acceptable although some authors suggest higher values of 0.90-0.95 should be the norm.

(Source: http://www.statisticshowto.com/cronbachs-alpha-spss/)

SPSS Statistics Output for Cronbach's Alpha of Risk categories

SPSS Statistics produces many different tables. The first important table is the **Reliability Statistics** table that provides the actual value for **Cronbach's alpha**, as shown below:

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.820	.819	7

From this, we can see that Cronbach's alpha is **0.820**, which indicates a good level of internal consistency for our scale with this specific sample.

SPSS Statistics Output for Cronbach's Alpha project selection criteria

SPSS Statistics produces many different tables. The first important table is the **Reliability Statistics** table that provides the actual value for **Cronbach's alpha**, as shown below:

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.954	.953	13

From this, we can see that Cronbach's alpha is **0.954**, which indicates an excellent level of internal consistency for our scale with this specific sample.

Conclusion:

A number of key risks required to be taken into consideration as well. These risks will need to be assigned and accomplished to safeguard the fruitful funding of the project. The organization that

is best engaged to cope up with these risks in a cost effective way may not essentially always be the private sector. Nevertheless, there are a number of mechanisms products existing in the market for project sponsors, lenders and governments to moderate some of the project risks, such as: Hedging and futures contracts; insurance; and risk mitigation products provided by international finance institutions.

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