

Success Factors In Planning Of Infrastructure Projects And Associated Risks: A Study Of User Perception



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Abstract

Infrastructure broadly comprises facility developments/improvements in the fields of housing and urban development, roads and transportation, utilities, buildings for hosting public facilities public resting and recreation facilities etc. Project management in infrastructure sector has evolved over the years with introduction of newer management tools. However, success rates of infrastructure projects are far from satisfactory and eventual benefit to users from the so created asset is limited. Researchers have studied the various attributes impacting project success from the perspectives of various stakeholders with user perception among the least studied. Studies have given maximum focus on factors during construction phase; Though the relevance of factors in the planning stage is clearly documented by researchers, studies of impact of project planning factors is limited, more so in Indian scenario. This paper details the research methodology proposed for study on identification and analysis of factors affecting infrastructure project planning in the water and sanitation, transportation sectors from the project users' perception and associated risks. The proposed study captures and analyses user perception on planning factors related to success/ failure of infrastructure projects in Thiruvananthapuram.

Keywords: *Infrastructure, Project Management, Success Factor, Project life-cycle, User perception, Planning phase*

1. Introduction

This study carries on the academic and professional researches on factors in planning of urban infrastructure projects, issues and associated risk factors impacting management of these projects. Infrastructure improvement for public use is predominantly developed in the public sector whereas privatization of basic infrastructure has also been carried out in select sectors. Infrastructure development follows a complex process in the light of ever increasing needs combined with limited availability of resources, varying priorities and administrative policies.

Infrastructure caters to the basic human needs in terms of housing, access to safe drinking water, sanitation requirements, water management for flood and draught control, transportation and communication needs, power requirements for variety of uses, and so on. Increase in India's population, changes in life style, urban and rural development have all

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necessitated development of new infrastructure as well as improvements to existing infrastructure in several parts of the country. Infrastructure development is taken up on a large scale throughout the country.

Infrastructure in the broad perspective comprise facility developments/improvements in the fields of housing and urban development, utilities like water supply, sewerage and sanitation, drainage and water management system, roads and transportation including traffic infrastructure and pedestrian needs, electricity, street and area lighting, gas supply, district cooling, communication and signaling, buildings for hosting public facilities like hospitals, schools, public resting and recreation facilities etc. Under this study, infrastructure refers to components as classified under the Infrastructure Statistics Manual (Central Statistics Office, Ministry of Statistics and Programme Implementation, Government of India)

Infrastructure projects are taken up under various Central Government schemes, State Government schemes, local body funds, Government borrowing from internal and external sources and through private sector participation.

Indian Cities are growing fast day by day in terms of their numbers, extent and urban population and as a consequence there is huge necessity for basic infrastructure facilities viz., water supply, sanitation, transportation, solid waste management, communication etc. Improvements in available infrastructure facilities of established cities/towns and necessity for new facilities in new/ emerging cities needs to be catered so as to meet the increased needs. The country is in the process of a major boom in infrastructure development during the current plan period and the future expectations on infrastructure development is very high. Among the above infrastructure components, this study focuses on public sector projects in Water and Sanitation and Transportation sectors for further analysis.

2. Relevance of Research

Infrastructure sector is developing drastically in recent years as more and more projects are taken up throughout the country as part of the overall emphasis on this sectors development. Many times, there are concerns during implementation of projects and performance issues raise questions on planning of infrastructure projects. Questions concerning (i) What are the major factors affecting/deterring performance and success levels of infrastructure projects? (ii) What is the relative importance of these factors in terms of its impact on the project? (iii) When and how do these factors impact the project?. and (iii) What are the precautions to be taken during planning of infrastructure projects?. This study attempts to answer these questions in relation to identification and analysis of factors affecting infrastructure project planning in the water and sanitation, transportation sectors from the project users' perception and associated risks.

Based on studies in infrastructure financing risks in PPP projects, (Schwartz, Ruiz-nuñez, and Chelsky)states that “Risks are usually the highest during the project development phase and tend to decrease as projects move toward the operational phase, as more information becomes available”. Research on construction project risk and project life cycle by (Zou, Zhang, and Wang) identifies construction stage as the most risky phase, followed by the feasibility stage. Another study on variation in success factors over the project life cycle tests the validity of project success factors during the four project stages from conceptualization to termination (Pinto and Prescott). All these studies highlight the importance of studying factors affecting infrastructure projects and risks in the planning stage.

3. Research Objective

The following are the broad research objectives proposed for detailed research under this study:

- To identify the factors in the planning stage that affect infrastructure projects under the water and sanitation and transport sectors based on user perception.
- Validation of the factors affecting infrastructure projects from the planners' perspective.
- To study the behavior of these factors during execution of projects and to assess the associated risks.

4. Scope of Research

This study identifies its geographical limit of scope to users of infrastructure projects in Thiruvananthapuram city. Under the broad sector of infrastructure, the study limits its scope to projects in the two sectors viz., Water & sanitation and Transportation. Categorization and details of subsectors follows category 1.Transport and category 3.Water and sanitation as per Infrastructure Statistics Manual (Central Statistics Office, Ministry of Statistics and Programme Implementation, Government of India).

5. Literature Review

Documentation of Literature Reviewed

| S. No | Literature Reviewed | Literature Type | Author/s | Publishing Year | Gist of Points gained | Linkage to own research/ Remarks |
|-------|--|-----------------|-----------------|-----------------|---|---|
| 1. | Project success: Definition and Measurement Techniques. <i>Project Management Journal</i> , 19(3), 67–73 | Research paper | Pinto & Slevin, | 1988 | <p>The notion during early years was that if the project finished on time, near the budget cost and performed as envisaged, it was considered successful. Considerations like client satisfaction came into picture later.</p> <p>Project management mostly focuses on performance of internal factors as success measure whereas project success depends on both internal and external factors.</p> <p>Periodic measurement of project success in project organization and client throughout the project life cycle.</p> | Basic concepts on project success and its evolution |

| S. No | Literature Reviewed | Literature Type | Author/s | Publishing Year | Gist of Points gained | Linkage to own research/ Remarks |
|-------|---|-----------------|------------------------|-----------------|---|--|
| 2. | Variations in Critical Success Factors Over the Stages in the Project Life Cycle. <i>Journal of Management, 14(1), 5–18.</i> | Research paper | Pinto & Prescott, | 1988 | Importance of project critical success factors across four stages in the project life cycle - Conceptualization, planning, execution, termination. A total of 408 project managers/team members Ridge regression analysis on initially derived ten critical success factors. | Project life cycle phases Risks identified as dominant during the conceptualization and planning phases are project mission, top management support, client consultation and client acceptance. |
| 3. | What is Project Success : A Literature Review. <i>International Journal of Business and Management, 3(9), 3–10</i> | Research paper | Guru Prakash Prabhakar | 2008 | Review and categorization of project success factors from literature. Project manager is an important factor leading to project success and leadership style has profound impact in success. | Project success definitions and concepts from literature |

| S. No | Literature Reviewed | Literature Type | Author/s | Publishing Year | Gist of Points gained | Linkage to own research/ Remarks |
|-------|--|-----------------|-----------------|-----------------|---|--------------------------------------|
| 4. | The “real” success factors on projects. <i>International Journal of Project Management</i> , 20(3), 185–190. | Research paper | Cooke-Davies, T | 2002 | <p>Success criteria as measures of success/ failure of projects and success factors as those inputs to management system that lead directly/ indirectly to the success of project/ business.</p> <p>Benefits are not realized by the project manager/ project team, close cooperation between the project team and sponsor/ customer reqd.</p> <p>Delivering project success is more difficult than delivering project management success. Goals and methods are liable to change whereas project management success is based on predetermined goals.</p> | Critical success factors in projects |

| S. No | Literature Reviewed | Literature Type | Author/s | Publishing Year | Gist of Points gained | Linkage to own research/ Remarks |
|-------|--|-----------------|-------------------------|-----------------|--|---|
| 5. | Project management: cost time and quality two best guesses and a phenomenon, it's time to accept other success criteria. <i>International Journal of Project Management</i> , 17(6), 337–342 | Research paper | Roger Atkinson | 1999 | Time and cost are guesses estimated at a point when least is known about the project, quality as a phenomenon changes over the project life cycle Type I and Type II errors Need to look for long term benefits Stakeholders post implementation The square route - Iron triangle, the information system, benefits(organisation), benefits(stakeholder community) | Study specifies factors and criteria which are of serious interest in current study |
| 6. | Critical Factors Affecting Schedule Performance: Evidence from Indian Construction Projects. <i>Journal of Construction Engineering and Management</i> , 132(November 2016), 871–881. | Research paper | Kumar. Neeraj. Jha&Iyer | 2006 | Success of the project measured in terms of its performance on schedule, cost, quality and no-dispute of which schedule performance attributes studied in detail. | Measurement of project success |

6. Problem Statement

Planning and management in infrastructure projects is a vibrant research field in the recent years and several researchers have studied the risks in infrastructure projects in different parts of the world. Analysis of Public Private Partnership (PPP) projects has been widely studied to identify critical success factors (CSF). Majority of these PPP CSF studies have focused on few countries like Australia, the UK, China and Hongkong (Osei-Kyei and Chan). Some studies on risks in infrastructure projects was from the point of view of Project Manager (Elkington and Smallman) while others focused on the Contractors' (Shen, Wu and Ng) and owner viewpoint (Pawar, Jain and Patil). Studies in an end-user perspective is comparatively less. In India researches on infrastructure projects have focused on factors in the project execution stage and relate to contract management. Many studies have identified critical risks like project delays and focused on associated cost-overrun. Researches on planning stage factors in infrastructure projects are relatively less altogether whereas studies on the same in Indian context were not found. Moreover comparative study of risks in different infrastructure sectors is rare.

On the basis of review of related literature and involvement of users in projects in the state, the researcher is convinced of influence of users in the success of infrastructure projects and of the necessity to explore project factors and associated risks in planning infrastructure from a user perspective.

The present study focuses on factors affecting infrastructure projects in the planning stage and associated risks based on the perception of users of Water & Sanitation and Transportation projects located in Thiruvananthapuram city in Kerala to identify associated risks.

7. Hypotheses

Null Hypothesis H1₀ - Major planning risks affecting success of water and sanitation projects and transportation projects in Thiruvananthapuram are the same.

Alternate Hypothesis H1₁ - Major planning risks affecting success of water & sanitation projects and transportation projects in Thiruvananthapuram are different.

Null Hypothesis H2₀ – Impact of the same risk on water & sanitation projects and transportation projects are substantially different.

Alternate Hypothesis H2₁ - Impact of the same risk on water & sanitation projects and transportation projects are relatively similar.

8. Methodology Proposed

Identification of Project Factors

Comprehensive literature study related to project management, infrastructure sector and risk analysis will be conducted in order to identify different factors that affect the progress and success levels of infrastructure projects during the various project stages. Among the various factors, planning stage factors will be segregated and the same will be used for the study. In

addition, a pilot survey is proposed to be undertaken with the intention of identifying additional factors for the study area, if any.

Rationale for City selection

Infrastructure development in Kerala is happening predominantly in the urban areas of which major/ high value projects are being taken up in the cities/ municipal corporations. Researchers have opined that risk analysis and management is of more applicable in higher value projects (Raz, Shenhar and Divr). Of the total infrastructure investment on major projects in Kerala under the selected sectors for the period since 2000, substantial investment is on projects in the three major cities viz., Thiruvananthapuram, Kochi and Kozhikode. Among the three major cities, Thiruvananthapuram is the capital city and biggest among the three in terms of area coverage and population. Moreover, being the state capital, most of the project planning and investment planning activities are being carried out in Thiruvananthapuram. A major fraction of population in Thiruvananthapuram city comprise Government officials which is more in comparison to other cities in Kerala and it is presumed that this factor would help in obtaining better responses related to project planning activities from users in the city. Taking this fact into consideration, the present study focuses on users in Thiruvananthapuram. In other words, analysis of project planning issues and risks in the Water & Sanitation and Transportation sector projects at Thiruvananthapuram is subjected to analysis under this study.

Identification of Stakeholders

Studies on project management by various researchers have identified stakeholders for infrastructure projects.

Important stakeholders identified for infrastructure projects are:

- Client/ Employer/ Developer
- Contractor/ Concessionaire
- Engineer/ Consultant
- A fourth and important stakeholder is the user or affected persons. – In most cases of infrastructure projects, it can be seen that users comprise people from all the other three strata of stakeholders also.
- Questionnaire survey will be administered on the users. Among the respondents, users fitting into one or more of the other stakeholder categories will be identified. It is proposed to assign weightages for such responses where respondents fall in more than one category of stakeholder.

Sampling Method.

Multi stage random sampling method will be adopted. Thiruvananthapuram city has a total area of about 215 square kilometers with a total population of about 10 lakh residents and the same is divided into 100 wards (as on date) on the basis of resident population in each ward. Geographical boundaries of wards are clearly delineated in the ward map.

Selection of Sample Size

Population size for the survey comprises users in the infrastructure sectors of water and sanitation and transportation and comprises the entire city population of 10 lakh persons.

A confidence level of 95% is used for the survey.

Sample size is computed using the formula proposed by Cochran (Israel) for large populations as shown below

$$n_0 = \frac{Z^2 pq}{e^2}$$

Where n_0 is the sample size, Z is the abscissa of the normal curve that cuts off an area α at the tails, $1-\alpha$ is the confidence level, e is the desired level of precision, p is the estimated proportion of an attribute that is present in the population and q is $1-p$.

For a precision level of 5%, the sample size obtained is 385 whereas for a precision level of 3%, the sample size obtained is 1067.

An alternate method for sample size determination as proposed by Yamane (Israel), which assumes 95% confidence level and $p = 0.5$ and is expressed as

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is population and e is the level of precision

The sample size computed for $e = 5\%$ and 3% are 400 and 1111 respectively.

A sample size of 600 is chosen for the study which will give a precision range of about 4%. It is also proposed to conduct a pilot survey to test the questionnaire and to identify any specific additional risk elements for which 10% of the sample will be additionally surveyed. Thus the total sample size will be 660. Sampling method for multi-stage random sampling is presented in the figure below:

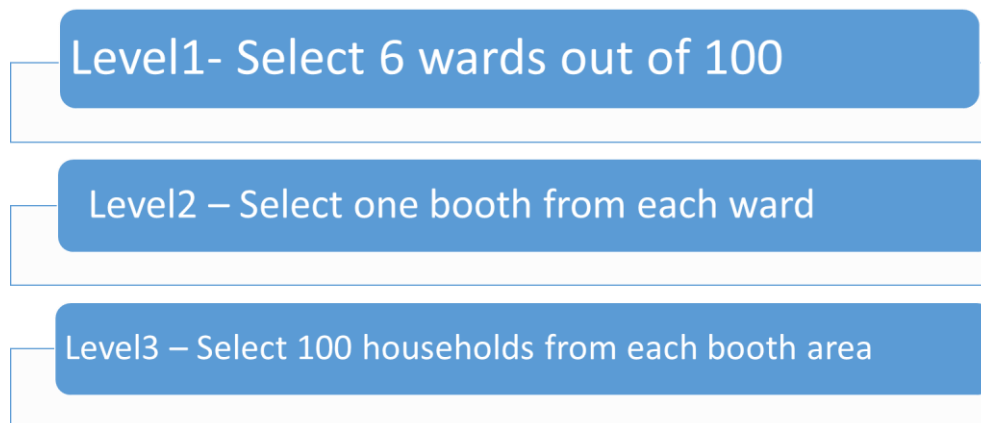


Figure 1: Multi-stage sampling for selection of respondents

9. Data Collection and Analysis plan

- Collection of project documents from planning department to obtain details of infrastructure projects in the selected sectors since 2000.
- Collection of secondary data like ward geography data, ward map, population details etc. for Thiruvananthapuram Corporation.

- Pilot survey of users in Thiruvananthapuram to identify any additional project planning risks and to test the questionnaire.
- Questionnaire based interview survey of project users in Thiruvananthapuram to prioritize critical planning risks and identify impact of critical risk factors on project success.

Factor analysis is proposed to be performed to derive a relation between the levels of critical planning risk factors on the project success. As per initial plan, it is proposed to identify the four most critical planning risks in each sector to influence project success and quantify their impact on respective sector projects.

A validation of the resulting model using project data from each sector is also envisaged.

10. Relevance of Projected Findings

The experience on infrastructure development projects in Kerala is that though many projects have been envisaged and taken up for implementation, many projects have not been completed and many others had been abandoned midway which points towards issues in project planning and management.

Relevance of risk management in planning of infrastructure projects is increasing since more and more infrastructure projects are planned in Kerala in recent years. A project risk management approach and policy is lacking in the Kerala infrastructure sector. In such a context, identification and analysis of planning risks and its impact on infrastructure project risks receives increased significance.

Risk assessment and risk impact analysis for infrastructure projects will help enhance better planning at the project level both during planning and implementation. Precautions necessary in each type of project could be formulated for efficient project risk management.

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