

Assessing the Critical Success Factors for PWD Projects in Rural Area



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Abstract Public sector construction projects are always criticized for issues of time and cost overrun. Many researchers have worked on this problem and came out with a success list of factors for the successful completion of public projects. Public Works Department (PWD) Maharashtra is facing the same challenge, but the organization is executing more projects in the rural area. Therefore, it is necessary to identify success factors for this organization with the context of working in a rural area. To address this, 25 factors were identified, and their degree of importance was determined through a questionnaire survey. Considering 122 valid responses, factors were ranked based on their means and were further checked for the difference of opinion by one way ANOVA, and thereafter, the factor analysis was done. Through factor analysis, all the factors were extracted into 7 components to decide the new factors to lead projects toward success. The critical success factors emerge, which are the client's preparedness, employee training, project manager's competency, contractor's efficiency, project management, external environment, and transparent procurement. The findings of this study will help the practicing managers as well as all the other stakeholders associated with the project. The identified CSF's will provide them a clear insight as to which components they need to address to make a project a successful one.

Keywords PWD · Public construction projects · Project success factors · Public Works Department · Factor analysis

1 Introduction

Public Works Department (PWD) is one of the oldest government organizations in Maharashtra. With a history of over 150 years, PWD has served its roles in serving the needs of people by the construction of roads, bridges, and buildings. It has

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numerous functions that include the construction of roads and bridges; construction of government buildings; carrying out resettlement work in the case of any natural calamity; design, construction, and maintenance of runways, etc. [1]. However, the projects are faced with the continuous issue of time and cost overrun. This issue is witnessed due to improper distribution of risks; lack of trust/limited trust; and not defining the goals and objectives of the project properly beforehand among the contracting parties [2].

Numerous studies have been conducted in the past that focused on determining various success factors for construction projects and the construction industry at large. Some of the factors associated with the success of the project relate to the competency level of the top management along with their experience and performance, being identified by Tripathi and Jha [3]. Similarly, Alias et al. [4] identified management and coordination; quality issues and errors; administration and bureaucracy; decision issues, and waiting as important factors associated with the delay in the projects. But these success factors can't be directly adopted for PWD projects as PWD executes more projects in the rural area of the state. Also, PWD projects need to satisfy various political interests, need to follow various bureaucratic procedures, rules, and laws, and exist in the midst of a public audit.

In this context, it is necessary to identify the critical success factors associated with the projects undertaken by PWD so that these factors will help the PWD engineers to focus on few critical issues for improvement of the project performance. Therefore, this study aimed to identify critical success factors for PWD projects in Maharashtra.

2 Literature Review

Various factors play a pivotal role in the success of any project; however, some specific factors come out to be more important than others. These key factors are termed as critical success factors. The success of any project is defined when it achieves all the set goals and objectives [5]. The expression critical success factor (CSF) was first coined in the construction field by Sanvido et al. [6]. They used CSF's as an element that could help in anticipating project success. Since then, numerous studies have been done that focused on determining various important factors that can lead to the success of projects.

De Silva et al. [7] identified 46 problems encountered by the construction industry in Sri Lanka. They grouped these identified factors into 10 categories, i.e., financial; government policies/practices; technology; management and coordination; research and development; resource; safety; training and development; social and skill. Similarly, in a study conducted by Kazaz et al. [8] to investigate the causes of time overrun in construction projects in Turkey, 34 factors were determined. These factors were categorized into environmental; financial; labor-based; managerial; owner-based; project-based and resource-based factors.

The importance of CSF's for the project success was agreed upon by the project managers and contractors in a study conducted by Garbharran et al. [9] in the South African construction industry. Through their study, they identified 18 CSF's and grouped them under 4 COM's, i.e., comfort, competence, communication, and commitment.

Taking into account the previous literature, a list of 25 CSF's important for the success of PWD projects was prepared. The list of identified CSF's is presented in Table 1.

3 Research Methodology

This study used a quantitative research methodology to achieve the specified objective. An exhaustive literature review was done to determine the critical success factors for PWD projects. The degree of importance of the identified factors was determined by the help of a questionnaire survey. The questionnaire survey used a five-point 'Likert Scale' to obtain the response from the respondents, where '5' represents a strong agreement with the factor and '1' represented the least agreement with the factor. A pilot study was conducted to determine the adequacy of the prepared questionnaire, and necessary changes were made as per the recommendations of the respondents in the pilot study. Two Deputy Engineers and 3 contractors participated in the pilot study. The survey was conducted during April & May 2019. A total number of 255 questionnaires were sent by email for obtaining the responses across the state. Out of that 122 valid responses were obtained back. It represents a response rate of 48% which is considered adequate [19].

The valid responses comprised of 72 responses (59%) from the PWD Engineers and 50 responses (41%) belonged to private contractors who were associated with the PWD projects. The respondents were also categorized based on their experience. Four categories were determined, experience between 0–5 years had 17 responses; 6–10 years had 27; 11–20 years had 42; and more than 20 years' experience accounted for 36 responses. Classification of respondents based on their experience presents the credibility of obtained responses.

4 Analysis and Results

The responses were analyzed using SPSS software. Before factor analysis, the reliability of the five-point scale was determined using Cronbach alpha value. The Cronbach alpha value came out to be 0.877 and was well within the acceptable limits. The means of the factors were determined to rank them based on the obtained responses. Since the responses were obtained by two groups, i.e., the employees of PWD and private contractors working on PWD projects, it became essential to determine the consistency among the two groups of respondents. To

Table 1 Identified critical success factors for project success

S. No.	Factors	Abraham [10]	Kuwaiti et al. [11]	Arslan and Kivrak [12]	Tan and Ghazali [13]	Tabish and Jha [14]	Tripathi and Jha [3]	Yong and Mustaffa [15]	Chen et al. [16]	Chan et al. [17]	Inayat et al. [18]
1	Nature of the client		✓	✓	✓		✓		✓	✓	✓
2	Contractor's reputation			✓	✓	✓	✓		✓		
3	Selection of project					✓					
4	Competent bidding process					✓		✓			
5	Government policies										✓
6	Stable economy			✓			✓	✓		✓	✓
7	Financial capability								✓		✓
8	Political interference	✓	✓			✓		✓	✓	✓	✓
9	Goal setting	✓			✓			✓			
10	Top management support			✓	✓	✓					
11	Transparent procurement process						✓		✓		
12	Project management	✓	✓	✓	✓					✓	
13	Communication and information sharing		✓			✓		✓	✓	✓	✓
14	Commitment within all parties					✓		✓			
15	Effective decision making	✓			✓						
16	Competent project manager				✓	✓		✓			

(continued)

Table 1 (continued)

S. No.	Factors	Abraham [10]	Kuwaiti et al. [11]	Arslan and Kivrak [12]	Tan and Ghazali [13]	Tabish and Jha [14]	Tripathi and Jha [3]	Yong and Mustafa [15]	Chen et al. [16]	Chan et al. [17]	Inayat et al. [18]
17	Competent project team								✓	✓	
18	Training and education	✓		✓							✓
19	Adoption of latest technology	✓	✓	✓	✓				✓	✓	✓
20	Resource management		✓			✓	✓				
21	Quality and safety programs		✓	✓	✓				✓		
22	Employee enhancement	✓	✓			✓					
23	Monitoring and feedback				✓		✓			✓	
24	Demand and variations					✓		✓			
25	Corruptions					✓					✓

carry out this, 'Analysis of Variance', i.e., one-way ANOVA test was done for each factor, taking into account both respondent groups. Two hypotheses were generated for the ANOVA test.

Null Hypothesis (H_0): There is a significant difference in opinion among engineers working in PWD and engineers working in contractor organizations regarding critical success factors of PWD projects.

Alternate Hypothesis (H_a): There is no significant difference in opinion among engineers working in PWD and engineers working in contractor organizations regarding critical success factors of PWD projects.

The significance level was set at 0.05 to check the obtained data for agreement between the respondents. 17 factors out of the identified 25 factors had a significance of above 0.05, and hence, these factors failed to reject the null hypothesis. Table 2 presents the ranking of factors along with the results of the ANOVA test.

From the above results, it can be seen that the respondents from PWD and contractor organizations disagreed on 17 factors out of a total of 25 factors, thus, showing a significant difference of opinion.

With the help of factor analysis, the identified CSF's were grouped into different components. Factor analysis used principal component analysis as it explains maximum variance by the minimum number of underlying factors [20]. Only the factors with a mean value above 4 were considered in factor analysis as it represents that the respondents emphatically concur with its significance for executing PWD projects. These 7 components accounted to explain 66.37% of the total variance. Table 3 presents the factors under their respective components with their factor loadings.

5 Discussion

The identified success factors were extracted into 7 components that present an important tool for the success of PWD projects. Client-related factors were the most important component as it explained 11.85% of the total variance. It was followed by training-related factors (11.057%); project manager-related factors accounting for 10.46% of the variance; contractor-related factors (10.04%); project-related factors (9.62%); external environmental factors (7.08%); and procurement-related factors (6.27%). The seven identified critical success factors are discussed below.

5.1 *Client's Preparedness*

Monitoring and feedback were the highest-ranked factor in this component. It was followed by the nature of the client; employee's enhancement; demands and variations and stable economy. The factors in this component emphasized the role

Table 2 Ranking of factors and ANOVA test significance values

S. No.	Factors	Mean	Rank	ANOVA significance
1	Nature of the client	4.69	8	0.466
2	Contractor's reputation	4.13	24	0.017
3	Selection of project	4.64	10	0.714
4	Competent bidding process	4.6	14	0.213
5	Government policies	3.5	25	0.03
6	Stable economy	4.22	22	0.763
7	Financial capability	4.7	7	0.369
8	Political interference	4.8	4	0.023
9	Goal setting	4.53	15	0.182
10	Top management support	4.35	20	0.031
11	Transparent procurement process	4.14	23	0.023
12	Project management	4.61	13	0.515
13	Communication and information sharing	4.86	3	0.109
14	Commitment within all parties	4.62	12	0.867
15	Effective decision making	4.87	2	0.436
16	Competent project manager	4.92	1	0.205
17	Competent project team	4.71	6	0.792
18	Training and education	4.42	19	0.321
19	Adoption of latest technology	4.32	21	0.028
20	Resource management	4.68	9	0.007
21	Quality and safety programs	4.46	17	0.334
22	Employee enhancement	4.63	11	0.872
23	Monitoring and feedback	4.73	5	0.83
24	Demand and variations	4.45	18	0.388
25	Corruption	4.48	16	0

of the client in managing a project and in turn leading it to be a successful one. The client should be proactive in planning as the work needs to avoid too many variations. In PWD projects, local political leaders interfere mostly during the execution of the work which leads to a change of scope of work and invites variations. These are unavoidable situations and cannot be overlooked as powers of development have been precipitated to the village level through Panchayat Raj System in India [21]. Monitoring is an important factor in maintaining the quality of work. But, due to a lack of Junior Engineers in PWD Maharashtra, a single junior engineer has to look after many sites simultaneously. In this situation, he has to depend on the contractor's engineer for maintaining the quality of work. Another important factor is the stable economy of the country. After demonetization and implementation of new Goods and Service Tax (GST) rules, the economy has been shattered due to which contractors faced financial problems.

5.2 *Employee Training*

Training and education were ranked as the most important factor in this component. The two other factors are quality and safety programs and the adoption of the latest technologies. Proper training of the project participants will make them aware of new technologies, lead them in developing safe working conditions on-site and make them aware of the importance of maintaining the overall quality of construction work by designing a quality assurance program. Though PWD arranges many training programs for its engineers, contractors are always reluctant to spend money on training. PWD Maharashtra should take lead in arranging combined training programs for own engineers and contractors' engineers to develop a highly skilled workforce. This will also help them to develop co-operative relationships and motivate them toward developing problem-solving skills by themselves [22]. Also, on rural projects, many unskilled laborers work on-site who are not aware of quality and safety procedures related to construction. The culture of training needs to be developed so that unskilled laborers also learn the standardized procedures in construction.

5.3 *Project Manager's Competency*

Communication and information sharing were the most important factor under this group followed by effective decision making and competency of project manager for the success of the project. These factors emphasize the importance of communication and the effective decision-making process for the swift resolution of conflicts and disputes [22]. Deputy Engineer acts as a project manager in PWD projects. The project manager's competency in handling the human resources on site is very important as qualified engineers are reluctant to stay at the site in the rural area. The project manager should motivate these engineers to work on sites in the rural area. Arranging the material on time is a major task in rural areas due to the long travel time. The project manager should plan material procurement so that the scarcity of material may not arise. Project managers need to maintain cordial relations with village people so that they can cooperate during project execution. He must communicate effectively with higher authorities from time to time as well as local political leaders to acquaint them about the project progress and difficulties.

5.4 *Contractor's Efficiency*

The competent bidding process was the highest-ranked factor among this group. It was followed by the reputation of the contractor, project management, commitment between all parties, and a competent project team. PWD has established an

electronic tendering system to ensure a transparent contractor selection process. But the real problem starts with tremendous competition among the local contractors to win a bid. The local contractors quote bid prices too low, many times less than 20% below than tendered cost. Due to this, reputed contractors hesitate to take part in the bidding process in PWD projects in the rural area. If work is allotted to the reputed contractor, then PWD engineers need not worry more about quality of work as they are always committed to good project management practices to deliver quality projects so that their reputation in the market does not hamper [23].

5.5 Project Management

The factor associated with the selection of projects was ranked the highest under this group. This was followed by financial capability, goal setting, and support from top management for the success of the project. If a reputed contractor is working on the project, then he works in good coordination with client engineers to meet the time-bound goals of the project. Also, his financial capacity is more to maintain the progress of the work. But most of the time, local contractors win the bids of PWD projects in rural areas who do not have a proper project management system and always depend on payment from clients to maintain the progress of work. Many times funds may not available from the government for timely payment and the common public criticizes PWD engineers.

5.6 External Environment

These factors may not come as direct influencing factors but play an important role in the success of projects. Political interference was ranked as the most important followed by resource management and corruption that may result in the failure of the project. Many times the local politicians or politically motivated people try disturbing the project implementation by raising new demands related project's scope that results in the delay of projects. This also sometimes results in the violation of rules and law for the sake of personal gains and may lead to cost overrun in the projects. PWD engineers need to tackle such situations very carefully so that projects can be completed within cost and time.

5.7 Transparent Procurement

The last component is associated with the procurement-related factor and has only one-factor transparent procurement process under it. An effective and transparent procurement process needs to be established to allow proper competition among the

participants so that the quality of material along with the completed work is at the top quality and in optimized cost. As mentioned earlier, PWD has established an electronic tendering system to ensure a transparent contractor selection process. This has prevented cartel formation by contractors which was a major problem faced by PWD engineers prior to the implementation of E-Tendering.

6 Conclusion

This study aimed to determine various critical success factors associated with the PWD project in Maharashtra. The identified factors are categorized into seven components, i.e., client's preparedness, employee training, project manager's competency, contractor's efficiency, project management, external environment, and transparent procurement. These factors emphasize the communication between the associated project stakeholders and the competency of the project manager. These are deemed as important because, in any event of a dispute, it will help in its swift resolution if there exists a proper and efficient decision-making mechanism. The findings of this work also stressed on the eradication of corruption and extensive political interference from the work to make it a successful one. These critical success factors are discussed with problems faced by PWD which will be helpful for this organization to design specific organizational strategies to overcome their problems. However, the study is based on a small sample size that is also one geographic area Maharashtra which may result in the generalization of results over a vast geographic area of the country. Still, within the limitations, this study provides general guidelines for project success in rural areas.

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