Ranking the Project Management Success Factors for Construction Project in South India

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Abstract. In Today’s construction industry, to achieve a greater advantage over the firms, success of each project and efficiency is required. Effective Project Management overcomes these types of challenges. This study identifies the success factors which are important for project management in construction project success. From the literature review, 26 factors were found to be critical. Project managers, construction managers, civil engineers, contractors and site engineers were the respondents. After analyzing the data in SPSS software, the dominant factors from the regression analysis are top management support, competent project team, abilities to solve problems, realistic cost and time estimates, information/communication, competency of the project manager are the 6 factors out of 12 in 26 factors. Effective communication between stakeholders got highest priority and client involvement, good leadership, clarity of project goals got second priority. Informal communication gives better results compared to formal communications like written formats. To remove communication barrier with the stakeholders, informal communication like speaking face-to-face with the language this fits for the stakeholders.

1. Introduction
Construction industry of India is the indicator of the development. It is the second largest industry in India after agriculture. Quick development in the construction sector can boosts up other industrial sectors like cement, paints, fitting and fixtures, chemicals and steel industries. Some of the major challenges in the industry are skilled and reliable workers, safety of workers as well as industry and limited time, resource and space constraints. To overcome these and for reducing cost, time and quality challenges in construction, effective project management should be required. Role of project management in construction is more now a day to meet specific constraints [1]. The empirical study about current practice in project management and found critical success factors and explained about the present level of project management in Indian construction industry [2-3]. Private sector using project management better compared to public sector. Defined the project management as use of knowledge, tools, skills and techniques to the project to meet specific project requirements and explained about the application of project management in construction industry [4].

In reality and in scientific view, project management practices are different [5]. Choosing of any work which is advanced in the project, project manager should have a lead role to choose that work[6]. [7-9] Found the difference between project success criteria and project success factors by
using definitions and categorized criteria’s and success factors. Explained about the key success factors of project management and how to overcome problems of project management in practice using these factors were explained in [10]. [11] Described about the relationship between project performance and critical success factors and identified the critical success factors of project success. [12] Explained about the critical success factors of project and project management. In addition to this, Project Excellence Model which is related about linking the project critical success factors with project success criteria was explained.

[13] Enlightened that why projects continued to failing if factors and criteria for success are known. Author proposed a Square Route which eliminates the Type I and Type II errors in project management success criteria. Using critical factors, construction companies change their policies for their project success and these critical success factors differs with respect to project manager, team, organization etc. [14-15]. The variables for project success, combination of four independent subsystems gives project success [16]. Those are strategic, structural, technical and managerial. [17] Explained about the criteria and factors of project management success. What to be achieves describes about the criteria whereas how to achieve describes about factors in project management. [18] Discussed about the best practices in project management. Technical and people oriented themes came into picture for best practices in project management. [19] Explained about the success evaluation factors in construction project management in small and medium Portuguese companies. Factors which are important for project success is complete the project within budget, on schedule, complete according to requirements, customer acceptance. It was shown that superior technology and performance is the major difference between larger and smaller companies. Smaller companies should compete harder in the market and to satisfy customer with innovative ideas. [20] Explained about the complexity of project management in developing countries. Research found that project manager should have ability to understand the complexity of project and their effects of project success. [21] Discussed about the critical success factors needed for effective construction management in Malaysian industry.

2. Problem Statement
Construction industry in all world faces problems of quality, budget and time overrun. Recent technology development in the construction industry reduces the time but failed to expect the perfect estimated time because of onsite and unexpected challenges. Effective project management overcome all these challenges by using knowledge, skills, experience etc. from the conception to completion of project. Finding the critical success factors are important for effective project management. Critical success factors help to find out the areas that should be performed well. These factors act as indicators to measure the organization performance in project management. These factors are measured, monitored and tracked for performance. Improvements in the critical success factors will give better results in the project management success in construction projects.

3. Objective of the study
- Understand the importance of project management in the construction industry.
- To examine the success criteria of project management and find out the critical success factors of project management success in construction project success.
- To rank the critical success factors of project management success.
- To give recommendations for improvements in the practices of critical success factors.

4. Methodology
The methodology is the general research strategy that outlines the way in which research is to be undertaken and identifies the methods to be used in it. Procedure and methods in this research are:

4.1. Study population
The research study consists of respondents in the construction companies specifically in South India.
4.2. Sampling Technique
To select respondents, random sampling method was used. In order to ensure reliability of the data, mostly respondents chosen are the project managers, construction managers.

4.3. Data collection method
To collect the primary data from the respondents, a structured questionnaire was implemented. The primary data collected from the construction professionals in the South Indian construction companies.

4.4. Questionnaire Design
A questionnaire was developed by finding out the common critical success factors from the literature review. 25 factors were found important from literature review and those were used in the questionnaire. Construction industry employees (project manager, construction manager, site engineer, contractor and civil engineer) have more knowledge on project management are the targeted group of respondents. In primary data, two sections which deals about the respondents' demographic profile and critical success factors of project management. This primary data was collected from the respondents through the mail and face-to-face interviews. Out of 150, 116 respondents gave their opinion. Five-point Likert scale was used to take the opinion of the respondents on factors in the questionnaire. This scale ranges from 1=strongly disagree to 5=strongly agree. Refer Appendix for detailed questionnaire.

4.5. Data analysis tool
Analysis of the data was done by using Statistical Package for the Social Sciences (SPSS). For finding out the internal consistency of the data Reliability analysis was used. Frequency Analysis was done for the demographic profile data to know the frequency of occurrence of a variable. Regression Analysis was used to find the significant variables in the factors. Critical success factors are ranked according to the highest mean of the given variables.

5. Results and Discussions
To analyse the data, first step is to check the reliability. It refers the degree to which it is error-free. It gives the consistency of a measuring test and tells that confidence of a researcher placed on the questionnaire to give same numeric value when the measurement is repeated on the same question. Cronbach’s Alpha is used to find the reliability. Normally Cronbach’s Alpha reliability coefficient ranges from 0 to 1. Lower limit is not there to the coefficient. Closer the coefficient value to 1, greater is the internal consistency of the data. In below table 1.Cronbach’s Alpha coefficient is 0.815. Found Cronbach’s Alpha coefficient >0.8 is a reasonable goal[22]. So, all items are approved for the subsequent data analysis.

| Cronbach's Alpha | N of Items |
|------------------|------------|
| 0.815            | 26         |

To transfer the raw data into grouped data, frequency distribution is used. Frequency distribution tells about the frequency of values or ranges of values for a variable. Here variable related to the respondents demographic profile. From the below table 2, it was shown that highest range of age of the respondents in this survey are 26-35 with percentage 41.4 followed by 18-25 with percentage
28.4. In this survey, most of the respondents are male with percentage 75.9 followed by female with percentage 24.1. 61.2% of the respondents completed graduate and 13.3% of respondents completed post graduate. Mostly 36.2% of the respondents are having 2-6 years of experience in their field. 20.7% of respondents having less than 1 year experience. Most of the survey was taken in urban construction companies. 62.9% from urban, 27.6% from semi-urban and 9.5% from rural. 40.5% of projects having budget of 26-50 and 25% of projects having budget of 51-75.

**Table 2. Demographic profile of the respondents**

| S.No | Variables                  | Description       | Majority wise first | Majority wise second | Majority wise third | Majority wise fourth |
|------|----------------------------|-------------------|---------------------|----------------------|---------------------|----------------------|
| 1    | Age                        | Category          | 26-35               | 18-25                | 36-45               | Above 55             |
|      |                            | Percentage value  | 41.4                | 28.4                 | 21.6                | 6                    |
| 2    | Gender                     | Category          | Male                | Female               |                     |                      |
|      |                            | Percentage value  | 75.9                | 24.1                 |                     |                      |
| 3    | Education Qualification    | Category          | Graduate            | Post Graduate        | Diploma             |                      |
|      |                            | Percentage value  | 61.2                | 26.7                 | 12.1                |                      |
| 4    | Number of projects handled | Category          | Less than 5         | 6-10                 | 7-11                | 12-16                |
|      |                            | Percentage value  | 43.1                | 26.7                 | 22.4                | 7.8                  |
| 5    | Experience in years        | Category          | 2-6                 | Less than 1          | Above 16            | 7-11                 |
|      |                            | Percentage value  | 36.2                | 20.7                 | 19.0                | 17.2                 |
| 6    | Location                   | Category          | Urban               | Semi Urban           | Rural               |                      |
|      |                            | Percentage value  | 62.9                | 27.6                 | 9.5                 |                      |
| 7    | Average budget of the project | Category       | 26-50               | 51-75                | Less than 25        | 76-100               |
|      |                            | Percentage value  | 40.5                | 25                   | 13.8                | 11.2                 |

Relationship between dependent and independent variable comes by using regression analysis. In below table 3 shows the significant value of the independent variables with respect to dependent variable. This significant value tells about how much relationship exist with dependent variable. In this table, T comes from coefficient (B) divided by the standard error (Std. Error). B is called unstandardized coefficient and Beta is called standardized coefficient. Unstandardized coefficient tells about amount which dependent variable changes by changing one unit of independent variable keeping other independent variable constant. Standardized coefficient calculated using standard deviation.
| S.NO | Model                              | Unstandardized Coefficients | Standard Coefficients | T      | Sig.  |
|------|-----------------------------------|----------------------------|-----------------------|--------|-------|
|      |                                   | B             | Std. Error           | Beta   |       |
| (Constant) |                                   | .024         | 0.705                | -0.034 | 0.973 |
| 1    | Top management support             | -0.238       | 0.082                | -0.235 | -2.892 | 0.005 |
| 2    | Monitor performance and feedback   | -0.052       | 0.086                | -0.059 | -0.611 | 0.543 |
| 3    | Competent project team             | 0.219        | 0.091                | 0.191  | 2.416  | 0.018 |
| 4    | Problem solving abilities          | 0.309        | 0.106                | 0.221  | 2.925  | 0.004 |
| 5    | Realistic cost and time estimate   | 0.211        | 0.091                | 0.238  | 2.336  | 0.022 |
| 6    | Management of risk                 | 0.050        | 0.106                | 0.041  | 0.469  | 0.640 |
| 7    | Information/Communication          | 0.274        | 0.082                | 0.258  | 3.328  | 0.001 |
| 8    | Detail plan in design and         | 0.002        | 0.099                | 0.021  | 0.225  | 0.822 |
|      | construction                       |              |                      |        |       |
| 9    | Participation/involvement of the   | -0.051       | 0.093                | -0.049 | -0.542 | 0.589 |
|      | client                             |              |                      |        |       |
| 10   | Understanding of the project       | 0.028        | 0.084                | 0.027  | 0.329  | 0.743 |
| 11   | Project Manager competency         | 0.389        | 0.098                | 0.343  | 3.977  | 0.000 |
| 12   | Clarity of project goals           | 0.069        | 0.135                | 0.049  | 0.513  | 0.610 |
| 13   | Effective communication between     | 0.075        | 0.091                | 0.065  | 0.825  | 0.412 |
|      | stakeholders                       |              |                      |        |       |
| 14   | Schedule performance               | 0.263        | 0.100                | 0.229  | 2.642  | 0.010 |
| 15   | Sufficient financial budget        | -0.070       | 0.095                | -0.064 | -0.735 | 0.464 |
| 16   | Technical capability of the project manager | -0.0185     | 0.082                | -0.178 | -2.241 | 0.028 |
| 17   | Commitment of all project          | 0.282        | 0.094                | 0.248  | 3.009  | 0.003 |
|      | participants                       |              |                      |        |       |
| 18   | Well-laid out specifications       | 0.061        | 0.089                | 0.059  | 0.692  | 0.491 |
| 19   | Good Leadership                    | -0.239       | 0.106                | -0.188 | -2.247 | 0.027 |
| 20   | Clear and realistic goals          | -0.133       | 0.100                | -0.118 | -1.335 | 0.185 |
| 21   | Past experience of project         | -0.269       | 0.095                | -0.243 | -2.837 | 0.006 |
|      | management technology and tools    |              |                      |        |       |
| 22   | Complete the project according to  | 0.056        | 0.088                | 0.053  | .635   | .527  |
requirements

23 Use of superior and appropriate technology

Dependent Variable: Overall employee acceptance for usage of project management in project success.

\[ Y = 0.024 + 0.235x_1 + 0.059x_2 + 0.191x_3 + 0.221x_4 + 0.238x_5 + 0.041x_6 + 0.258x_6 + 0.021x_7 + (-0.049)x_8 + 0.027x_9 + 0.343x_{10} + 0.049x_{11} + 0.065x_{12} + 0.0229x_{13} + (-0.064)x_{14} + 0.178x_{15} + 0.248x_{16} + 0.059x_{17} + 0.188x_{18} + 0.118x_{19} + 0.243x_{20} + 0.053x_{21} + 0.053x_{22} + (-0.053)x_{23} \]  

(1)

Y is the overall usage of project management in project success. Above equation states that impact of project management variables on overall employee acceptance for usage of project management in project success. The result of t test disclose about the calculated significance of the regression coefficient (-0.235, 0.191, 0.221, 0.238, 0.041, 0.258, 0.021, -0.049, 0.027, 0.343, 0.049, 0.065, 0.0229, -0.064, 0.178, 0.248, 0.059, 0.188, 0.118, 0.243, 0.053, 0.053, -0.053) are having 0 and 5 percent respectively. From the above coefficient table it is concluded that variables of project management success in construction project success are top management support, competent project team, problem solving abilities, realistic cost and time estimates, communication, project manager competency, schedule performance, project manager technical capabilities, commitment of all project participants, good leadership, past experience of project management technology and tools, use of superior and appropriate technology. The top management support, project team, information/communication have direct impact on project success[23]. The top management involvement shows major differences of project management in the construction industry and software sectors [24-25]. Time and quality is important but not considered as a critical success criteria for project success.

Factor analysis is used to group the factors which explain same information. It is useful to summarize the data into a small number of factors by considering a large number of factors. Below Table 4 reduced the 26 factors into 9 factors.

Eigen value which is shown in the above table 4 explains about measure of variance of the observed variables a factor explains. An Eigen value >=1 having more variance than a single observed variable. In this table, total 9 factors got Eigen value >=1. So, 26 factors are reduced to 9 factors.

1. Planning, estimation and monitoring
2. Time and cost management,
3. Client participation with definite objectives
4. Capability of project manager towards particular project
5. Competent team work with satisfaction
6. Communication towards reaching objectives
7. Management support and participants commitment
8. Updated technology and
9. Deliver directions with specification are the reduced number of factors from the 26 factors.

Ranking the factors is important to know which factors influence the project management success most. Below table 5 shows the ranking of factors using mean.
**Table 4. Factor Analysis**

| Factor | Item                                      | Rotated Factor Loadings | Eigen Value | % of Variation | Factor Name                           |
|--------|-------------------------------------------|-------------------------|-------------|----------------|---------------------------------------|
| I      | Monitor performance and feedback          | 0.805                   | 5.007       | 19.26          | Planning, estimation and monitoring   |
|        | Realistic cost and time estimate          | 0.737                   |             |                |                                       |
|        | Detailed plans in design and construction | 0.515                   |             |                |                                       |
| II     | Schedule Performance                      | 0.812                   | 2.148       | 8.263          | Time and cost management              |
|        | Adequate budget                           | 0.623                   |             |                |                                       |
| III    | Client involvement                        | 0.682                   | 1.895       | 7.288          | Client participation with definite objectives |
|        | Clarity of project goals                  | 0.76                    |             |                |                                       |
| IV     | Project understanding                     | 0.639                   | 1.566       | 6.024          | Capability of project manager towards particular project |
|        | Project manager technical capabilities     | 0.774                   |             |                |                                       |
| V      | Competent project team                    | 0.725                   | 1.431       | 5.504          | Competent team work with satisfaction |
|        | Overall Employee satisfaction             | 0.735                   |             |                |                                       |
| VI     | Communication                             | 0.633                   | 1.307       | 5.025          | Communication towards reaching objectives |
|        | Clear and realistic objectives            | 0.71                    |             |                |                                       |
| VII    | Top management support                    | 0.736                   | 1.257       | 4.836          | Management support and participants commitment |
|        | project participants commitment towards goals | 0.747               |             |                |                                       |
| VIII   | Use of superior and appropriate technology | 0.87                    | 1.162       | 4.471          | Updated Technology                    |
| IX     | Well laid out specifications              | 0.581                   | 1.019       | 3.919          | Deliver directions with specification  |
|        | Good Leadership                           | 0.804                   |             |                |                                       |
### Table 5. Ranking Factors using mean

| S.No | Description                                      | Mean   | Std. Deviation | Rank |
|------|--------------------------------------------------|--------|----------------|------|
| 1.   | Top management support                          | 3.4310 | 1.23868        | 17   |
| 2.   | Monitor performance and feedback                 | 3.0862 | 1.40539        | 25   |
| 3.   | Competent project team                           | 3.5948 | 1.09527        | 7    |
| 4.   | Problem solving abilities                        | 3.4914 | 0.89923        | 16   |
| 5.   | Realistic cost and time estimate                 | 3.2069 | 1.41124        | 24   |
| 6.   | Management of risk                               | 3.2845 | 1.03677        | 23   |
| 7.   | Communication                                    | 3.5000 | 1.18322        | 15   |
| 8.   | Detailed plans in design and construction        | 3.5862 | 1.18739        | 9    |
| 9.   | Systematic control over project execution        | 3.4310 | 1.12848        | 17   |
| 10.  | Client involvement                               | 3.6724 | 1.20705        | 2    |
| 11.  | Project understanding                            | 3.3276 | 1.23553        | 22   |
| 12.  | Project manager competence                       | 3.6466 | 1.10536        | 5    |
| 13.  | Clarity of project goals                         | 3.6724 | 0.88245        | 2    |
| 14.  | Effective communication between stakeholders      | 3.7328 | 1.09034        | 1    |
| 15.  | Schedule performance                             | 3.5345 | 1.09092        | 12   |
| 16.  | Adequate budget                                  | 3.5862 | 1.15019        | 9    |
| 17.  | Project manager technical capabilities           | 3.5172 | 1.21213        | 14   |
| 18.  | Project manager commitment towards goals         | 3.5690 | 1.12075        | 11   |
| 19.  | Project participants commitment towards goals    | 3.6121 | 1.10155        | 6    |
| 20.  | Well-laid out specifications                     | 3.3966 | 1.20057        | 21   |
| 21.  | Good Leadership                                  | 3.6724 | 0.98489        | 2    |
| 22.  | Clear and realistic objectives                   | 3.5259 | 1.11481        | 13   |
| 23.  | Project management methods and tools             | 3.5948 | 1.13428        | 7    |
| 24.  | Complete the project according to requirements   | 3.3707 | 1.18344        | 21   |
| 25.  | Use of superior and appropriate technology       | 3.4224 | 1.37145        | 19   |

In the above table 5 shows highest mean having highest ranking. Here the top 5 success factors of project management success in construction project success are effective communication between
stakeholders, good leadership, and clarity of project goals, client involvement and competency of project manager. [26] research found that communication among stakeholders, competency and commitment are more important in construction project management. The success factors having schedule performance and budgeted performance have 7th and 8th factor in project management for project success[27]. In this survey, schedule performance and adequate budget have 12th and 9th factor because of increasing of other important factors in this study. Monitoring of the project, effective coordination, effective decision making, feedback capabilities, plan and schedule, team work and control mechanisms are the critical success factors of project management[28]. The study about critical success factors of project management in sustainable housing development. Project manager authority, communication/information, effective planning, monitoring and performance and feedback are the success factors for sustainable housing development[29]. [16] Explained about the factors of project management and project success. According to project management, cost, time, quality and client satisfaction are the success factors. [14] Adequate fund for execution have highest ranking in the success factors followed by professional and technical skills, relationship with stakeholders, companies financial strength, client decision making process. In this survey, adequate budget have 9th factor for project success. The success factors of sustainable housing in Nigeria. In his research [30] competent project team, support from the top management, adequate fund and resources, realistic cost and time estimates have 1, 5, 6, and 10. In this survey these factors have ranking of 7, 17, 9, and 24. [31] The user involvement, good planning and estimation, good leadership and team members technical skills have top 4 success factors for project success. Top 4 critical factors in project management are project mission, top management support, project plan and schedule, client consultation. Classified critical factors into strategic and tactical[32]. Project mission, top management support and project scheduling have highest ranking in strategic factors. Client consultation, personnel selection and training have highest ranking in tactical factors.

6. Conclusion
The significant factors found by using regression analysis are support from top management support, competent project team, abilities to solve problems, realistic cost and time estimates, information/communication, competency of the project manager, schedule performance, technical capability of the project manager, commitment of all project managers, good leadership, past experience of project management tools and technology and use of superior and appropriate technology. Using factor analysis, 25 factors were reduced to 9 factors. These are
1. Planning, estimation and monitoring,
2. Time and cost management
3. Client participation with definite objectives
4. Capability of project manager towards project
5. Team work
6. Communication towards reaching objectives
7. Management support and participants commitment
8. Updated Technology
9. Deliver directions with specification.

From ranking of the factors using mean, effective communication between stakeholders got highest ranking. Clarity of project goals, good leadership and client involvement has second priority. Project manager competence, project participants’ commitments towards goals have third and fourth priority.

7. Recommendations
- Bringing talented pool of employees within organization give better results. They have the ability to solve complex situations within less time. Good HRM should be developed. This play a major role in the construction industry.
- In small scale industries also project management training should be required. Most of the small industries face cost and time overrun because of inexperience in the initial stage.
• Proper training in the conception stage in the project management gives fruitful results in the upcoming future.
• Planning, scheduling and estimation are the main area to be focused by the project manager.
• The communication between stakeholders is most important in project management success. To improve this communication between stakeholders, maintain the long term relationship with stakeholders.

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