

Determination of Critical Success Factors in Residential Construction Projects

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Abstract- *The purpose of this research is to identify the success which can help project parties to reach their anticipated goal with greater efficiency. This research use a widespread literature review to design and conduct a survey to investigate success factor and then obtain consent of experts opinion. With the help of literature and expert opinion the questioner where developed. In questioner there are forty four critical factors related to critical success factors (CSF) were identified and categorized into five groups: Administrative/organizational, Technical, Risk management, Communication and Behaviour, Customer's feedbacks in the model for project success. CSFs and their implementation/consideration where evaluated by questionnaire survey. The analysis of the identified factors followed by rating is done by "Spearman Rank Correlation Co-efficient Method". Study revealed that, as a whole there is a gap between the importance of success factors against their implementation/consideration as majority of CSFs are not properly implemented compared to the importance attached to them.*

Keywords- Critical Success Factors, Standard Deviation, Spearman Rank Correlation Co-efficient.

I. INTRODUCTION

Search for project success factors is not new in management studies. Since 1960, various studies have been conducted to explore the factors that are really important to be considered for achieving the success on projects Cooke-Davies, 2002)[14]. In their review, Belassi and Tukel (1996) note that the success and failure factors were first introduced by Rubin and Seeling (1967) in context of project management. The term "critical success factors," in the context of projects and the management of projects, was first used by Rockart (1982)[7]. Researchers have frequently emphasized on the need for identifying a set of common success factors that can be used by construction professionals and project managers to measure the success on their projects. Even among several research studies, there seems to be little or no agreement on the list of success factors due to unique internal features and different boundary conditions of every construction project (Nguyen et al., 2004)[15], every project has a specific set of success factors which may not be

transferable to another project. Although some characteristics are common in projects – for example, limited budget, schedule, quality standards and a series of complex and interrelated activities (Belout and Gauvreau, 2004)[16], most vary from project to project. Disagreement on project success factors is also partly due to different perceptions about project success – measured against the overall objectives of the project and project management success and project management success – measured against the widespread and traditional measures of performance against cost, time and quality as well as how and when the success is measured.

Unfortunately the promises of critical success factor research have not been fully realized. Despite nearly a decade's subsequent work, the construction industry is substantially unchanged, and we have only a marginally better understanding of the factors that make projects successful.

II. OBJECTIVES

The objectives of the study are to:

- Identify the relative importance of success and failure attributes
- Identify how frequently is each factor achieved and what special efforts are needed
- To know the importance level of each critical success factors
- Reduce the effort of preparing modified CSF lists as well as understanding specific features of particular types of projects in residential construction projects of different countries
- Identify problems on current projects and take corrective action.
- The ultimate objective of this project is to find most important critical success factors.

III. RESEARCH TASKS

The following research tasks were completed.

- Define the project success criteria
- Define the ideal facility life-cycle functions
- Develop structured questionnaire

- Select projects
- Collect data from sites
- Analyse data
- Develop guidelines for CSFs

IV. DATA COLLECTION

A questionnaire was developed to facilitate systematic data collection. Apart from some questions intended to capture background information of the respondents, the remaining questions in the questionnaire invite the participants to consider the relative importance of a pair of success-related factors at each time, based on the nine-point scale summarized in following Table1. Throughout the questionnaire, the concept of importance is interpreted in a generic way and is comparable to preference, dominance, and similar relationships. To ensure consistency throughout by the participants, the definition of the factors has been provided. The questionnaire was designed in a manner that will help in the safeguarding of integrity and consistency in the data. The questions relating to different project aspects are presented in different sections. This will help the participants to focus on one project aspect at a time. In each section, the participants begin by comparing factors at the bottom level of the sub hierarchy. This approach will assist the participants to detain the collective significance of lower level factors as they proceed upward in the construction project success hierarchy.

All participants are currently holding senior managerial positions in leading private construction companies or consultant firms in statutory boards (public organizations) responsible for development of public projects. They have an average of 15 years of experience in the industry. 30% of the participants have worked mainly as contractor, 20% as manager and 50% as engineers. To secure good quality data, a brief presentation with regard to the object and methodology of the study was made to every participant individually. The participants were specifically reminded of the importance of observing consistency in their answers. They were made to understand that their responses should not be biased toward any particular project whether it was highly successful or disastrous.

It is therefore not surprising that most of this research has been taken up in developed countries' context and their applicability in the developing countries such as India is yet to be explored. In the present study the success of a project is measured in terms of its performance on schedule, cost, quality, and no dispute.

Table 1 Rating Scale For CSF

RATING SCALE FOR CSF	
SCALE	PREFERENCES
1	WORST
2	POOR
3	VERY BAD
4	BAD
5	SATISFACTORY
6	FAIR
7	GOOD
8	VERY GOOD
9	EXCELLENT

Background of Participants:

Table 2 and table 3 provide background of research participants. Table 2 shows the participants were managers, deputy project managers, engineers & contractors. All the participants were professionally positioned at middle or top management level which implies that a certain level of accuracy and credibility in the data collected were achieved. It can be seen from Table 3 that majority of the participants had considerable experience both in the field of project management as well as project manager. Further, more than 80percent of the participants had educational background of civil engineering. All participants had experience of working in large-scale construction projects and most were working in joint ventures and consortiums in addition to their parent organizations.

Table No. 2 Averagely experience of participants:

sr. no	constructi on firms	Manager	Engineer	Contra ctor	Total
1	Lodha group	9	6	5	20
2	Palava group	3	3	0	6
3	B.A.C	2	1	2	5
4	SKYi group	2	0	0	2
5	Contractor	0	0	0	19
6	sahajanand	1	5	0	6
	Total				57

Table No.3 Participants Experience In Project Management

Participants	Experience in project management
Manager	18
Contractor	15
Engineers	10

V. RESEARCH METHODOLOGY

To develop a comprehensive questionnaire, a thorough literature review was carried out that resulted in identification of 44 CSFs for large-scale construction projects. This provided the basis for the formulation of a preliminary questionnaire. Few items were combined for better understanding of the participants. Some items were reworded to adapt to the terminology used in the local construction industry. And some additional items were included as per recommendations received during the pilot phase. As a result of this exercise, a list of few success factors was finalized to be included in the final version of the questionnaire.

At a later stage during analysis, a total of 57 questionnaires were delivered to the participants in person, together with a covering letter explaining the purpose of the study and assuring them of anonymity.

Participants were asked to rate each success factor based on their frequency of occurrence according to their professional judgment on a given nine-point Liker-type rating scale from 1 to 9 (where 1 – not important at all and 9 – extremely important).In addition to the questionnaire surveys, 57 face-to-face semi-structured interviews were also conducted with the professionals who had responded to the questionnaires.

VI. ANALYSIS

- The data whichever collected with the help of questionnaires, will be in the form of rating
- To calculate Spearman Correlation Co-efficient method data should be in rating form.
- For that purpose 1st calculate the standard deviation. On the basis of Standard deviation those factors were ranked separately.

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (X - \bar{X})^2}{N}}$$

Where,
 σ - standard deviation
 X- each value in data set

\bar{X} - mean of all values in data set
 N- number of value in data set

To calculate the standard deviation mean also calculate

MEAN :-

$$\bar{X} = \frac{\sum_{i=1}^n X}{N}$$

Where,
 \bar{X} - mean
 Σ x –sum of all data values
 N- is number of data item in sample

Spearman Rank Correlation Method:

Spearman Correlation Co-efficient method is applied here to get ranking to the factors.

Spearman Rank Correlation Method: Spearman rank correlation co-efficient *p* is useful to determine the measure of association/correlation (including positive or negative direction of relationship) between ranks achieved by the different MCDM (multicriterion decision method).Different decision-makers and/or different scenarios for a given set of alternatives. If *U_a, V_a and W_a* denote the ranks achieved by above situation for the same alternative *a*, then *p* is defined as (spearman 1904)

$$\rho = \frac{6 \sum_{a=1}^{A'} D^2}{A'(A'^2 - 1)}$$

Where,

D= Difference between ranks *U_a, V_a and W_a* achieved by the same alternative *a*
A'= Number of alternatives
ρ values vary between -1 and 1.

Table 4- Results of Analysis

Sr.no.	DESCRIPTION OF SUCCESS FACTOR	RATING									
		Manager (U)	engineer (V)	contractor (w)	d1 ²	d2 ²	d3 ²	D ²	p	rank	
	ADMINISTRATIVE/ ORGANIZATIONAL				U-V	U-W	V-W	D ²			
1	Top management sponsorship	22	35	29	169	49	36	254	0.9821	27	
2	Positive organizational culture for effective project management	44	30	35	196	81	25	302	0.978717	30	
3	Clearly written lines of responsibility	35	40	37	25	4	9	38	0.997322	6	
4	Building a balanced and winning team	30	27	26	9	16	1	26	0.998168	5	
5	Standard software infrastructure and adequate use of IT	7	25	6	324	1	361	686	0.951656	39	
6	Creating accountabilities, expectations, roles, and responsibilities for the organization	21	11	8	100	169	9	278	0.980409	28	
7	Absence of bureaucracy from the work place	16	22	12	36	16	100	152	0.989288	19	
8	Competent team members	34	33	33	1	1	0	2	0.999859	1	
9	Fast trouble-shooting capabilities in the system	27	31	13	16	196	324	536	0.962227	38	
10	Awarding bids to the right designers/contractors	42	26	32	256	100	36	392	0.972375	35	
11	Clear prioritization of project goals by the client	41	36	38	25	9	4	38	0.997322	6	
12	Knowing what client really wants	16	13	8	9	64	25	98	0.993094	16	
13	Client acceptance of plans	36	34	28	4	64	36	104	0.992671	17	
14	Regular client consultation	28	39	36	121	64	9	194	0.986328	25	
15	Responsiveness of client	13	6	11	49	4	25	78	0.994503	12	
16	Competent project manager	37	32	38	25	1	36	62	0.995631	11	
	TECHNICAL										
1	Effective project planning and control	38	42	34	16	16	64	96	0.993235	15	
2	Effective change management	23	16	18	49	25	4	78	0.994503	12	
3	Sufficient resources	29	38	43	81	196	25	302	0.978717	30	
4	Strategic alignment of project goals with stakeholders' interests	6	17	19	121	169	4	294	0.979281	29	
5	Learning from previous experiences	40	43	42	9	4	1	14	0.999013	3	
6	Reliable estimates by quantity surveyors	25	10	24	225	1	196	422	0.970261	36	
7	Using up to date technology and automation for construction work	9	15	16	36	49	1	86	0.993939	14	
8	Budget and Monitoring / Value Engineering	3	8	5	25	4	9	38	0.997322	6	
9	Quality	33	29	41	16	64	144	224	0.984214	26	
10	Safety	14	2	1	144	169	1	314	0.977872	32	
	RISK MANAGEMENT										
1	Political Risk	15	18	21	9	36	9	54	0.996195	10	

2	Economical Risk	19	37	40	324	441	9	774	0.945455	41
3	Risk Identification and Allocation	32	28	27	16	25	1	42	0.99704	9
4	Risk Mitigation plan	4	5	7	1	9	4	14	0.999013	3
	COMMUNICATION & BEHAVIORAL									
1	Effective project control mechanics	10	7	17	9	49	100	158	0.988865	21
2	Clearly designed and coordinated technical tasks	18	19	4	1	196	225	422	0.970261	36
3	High-quality workmanship	24	20	15	16	81	25	122	0.991402	18
4	Proven methodology of project management and project procurement	8	12	30	16	484	324	824	0.941931	42
5	Proper dispute resolution clauses incorporated in the contract	26	3	22	529	16	361	906	0.936152	43
6	Developing positive friendly relationships with project stakeholders	20	14	10	36	100	16	152	0.989288	19
7	Adequate communication among related parties	39	41	31	4	64	100	168	0.988161	23
8	Mutual trust among project stakeholders	5	4	3	1	4	1	6	0.999577	2
9	Frequent meetings among various stakeholder to evaluate overall performance	43	24	23	361	400	1	762	0.9463	40
	CUSTOMERS FEEDBACK									
1	Requiring the use of facts and data to support actions at all levels of decision making	12	9	2	9	100	49	158	0.988865	21
2	Feedback capabilities in the system	1	1	14	0	169	169	338	0.97618	33
3	Benchmarking firm's performance against successful projects	11	21	20	100	81	1	182	0.987174	24
4	Conducting regular reviews to assure and verify progress on project	2	23	24	441	484	1	926	0.934743	44
5	Owner's Satisfaction with Delivered Project	31	44	44	169	169	0	338	0.97618	33

VII. RESULT AND DISCUSSION

Rating of success factors in Table reveals high-scoring factors are mostly related to the five major aspects that are: Administrative/ Organizational, Technical, Risk management, Communication & Behavioural ,Customers Feedback These themes were also revealed during the interview sessions in which interviewees mostly emphasized on the need of effective project planning and control, competent personnel, and continuous involvement of client. On the basis of analysis the most important success factor is 'competent team member' which is belong to the Administrative/ Organizational factor second most important factor is 'mutual trust among project stakeholders' this factor is belong to Communication & Behavioural also third important factor is 'risk mitigation plan' and "Learning from previous experiences" which belong to Risk management and

Technical on that basis it is concluded that each group are important.

Result also shows that some other factors are also important. This factors are grouped under managers perspective, engineers perspective, contractor's perspective.

Managers perspective:- first most important factor is 'Feedback capabilities in the system', second most important factor is 'Conducting regular reviews to assure and verify progress on project' and third most important factor is 'Budget and Monitoring / Value Engineering'.

Engineer perspective:- first most important factor is 'Owner's Feedback capabilities in the system' in the system second most important factor is 'Safety and Proper dispute resolution clauses incorporated in the contract' on project and third most

important factor is 'Proper dispute resolution clauses incorporated in the contract' clauses incorporated in the contract.

Contractor perspective:- first most important factor is 'Safety' in the system second most important factor is 'Requiring the use of facts and data to support actions at all levels of decision making' on project and third most important factor is Mutual trust among project stakeholders' clauses incorporated in the contract.

The result shows on the basis of Engineers and contractors rating the most important factor 'competent team member'.

VIII. CONCLUSION

Conclusion and future directions of success of construction projects depends on several aspects which may include human-related factors, project-related factors, project management-related factors, and factors related to external environment. Depending on their needs, different participants in construction may have divergent interests in the project but they must have an agreement, in principle, about project objectives and critical factors that can help to achieve those objectives. Results in this study reveal that most of the high-rated CSFs are related to project Administrative/Organizational Second Important Factor is Communication & Behavioural and third important factor is from Risk management. 'On the basis of this it will conclude that each group is important in construction project'. This was not only observed from the results of questionnaire survey but also interviews conducted as a part of this study also highlighted the same issues. In terms of practical application, project leaders can use these findings to establish CSFs for their own construction projects. Project leaders can also compare these success factors with real success factors in they have already accomplished in the past. Also, project managers can work out measures for improvement to raise the probability of success and reduce the chances of any setbacks in their own projects.

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