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A STUDY ON DIFFERENT METHODS TO ANALYSE CRITICAL SUCCESS FACTORS OF BUILDING PROJECTS.

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Abstract*: *The construction industry is dynamic in nature due to the increasing uncertainties in technology, budgets, and development processes. Nowadays, building projects are becoming much more complex and difficult. The study of project success and the critical success factors (CSFs) are considered to be a means to improve the effectiveness of project From literature review and past studies, it was obtained that there were different directions and methodologies used in order to achieve the required target, goals and objectives. The introduction about the success related factor which are necessary for success of building projects is discussed. The aim of this paper is to show Different methods use for analysis of CSFs, importance & need of those factors.

Keywords: Critical Success Factors, Construction Industry, Projects Success, Success Related Factors.

1. INTRODUCTION

Construction activity is an integral part of a country's infrastructure and industrial development and must be taken care of for a healthy growth of the economy. It is imperative to put an all-out effort into ensuring that projects are completed as per the stipulated objectives. An experimentation of the recent literature indicates that construction projects are frequently completed with large cost overruns, extended schedules and quality concerns.

During the last four decades a number of studies investigated factors which aid successful completion of projects. Project success can be defined as meeting the required expectation of the stakeholders and achieving its intended purpose. This can be attained by understanding what the end result would be, and then stating the deliverables of the project. Success criteria or a person's definition of success as it relates to a building often changes from project to project depending on participants, scope of services, project size, sophistication of the owner related to the design of facilities, technological implications, and a variety of other factors. A building project is completed through a combination of many events and interactions, planned or unplanned, over the life of a facility, with changing participants and processes in a constantly changing environment.

The term Critical Success Factor in context of management of projects was first used by Rockart in1982. Critical success factor (CSF) is a management term for an element that is necessary for a project to achieve its mission. It is a critical factor or activity required

for ensuring the success of a construction project. A key area where satisfactory performance is required for the construction projects to achieve its goals.

2. METHODS TO ANALYSE CRITICAL SUCCESS FACTORS

There are several methods use for analysis of critical success factors. Some of the methods are listed below:

1. Significance index method
2. Relative importance index
3. Analytical hierarchy process
4. Factor analysis Technique

2.1 significance index method:

It is useful to analyze the relative significance of the CSFs. The following simple formula is developed to convert linearly the 0–5 scale used in the questionnaire survey to a 0–100 scale with 0 representing the lowest and 100 the highest significance. This means that "5,""4," "3," "2," "1," and "0" have significance indexes of 100, 80,60, 40, 20, and 0, respectively.

$$\text{significance index } S_i = \frac{R_{i0} \times 0 + R_{i1} \times 20 + R_{i2} \times 40 + R_{i3} \times 60 + R_{i4} \times 80 + R_{i5} \times 100}{R_{i0} + R_{i1} + R_{i2} + R_{i3} + R_{i4} + R_{i5}} = \frac{20R_{i1} + 40R_{i2} + 60R_{i3} + 80R_{i4} + 100R_{i5}}{R_{i0} + R_{i1} + R_{i2} + R_{i3} + R_{i4} + R_{i5}}$$

Where,

S_i=significance index for the i_{th} factor,

R_{i0}=number of responses as "0" for the i_{th} factor,

R_{i1}=number of responses as "1" for the i_{th} factor,

R_{i2}=number of responses as "2" for the i_{th} factor,

R_{i3}=number of responses as "3" for the i_{th} factor,

R_{i4}=number of responses as "4" for the i_{th} factor,

R_{i5}=number of responses as "5" for the i_{th} factor.

2.2 Relative importance index (RII):

The Relative Importance Index (RII) has been used to rank (R) the different factors that affect contractor performance. These rankings make it possible to cross-compare the relative importance of the factors as perceived by the three groups of respondents (i.e. architect/engineer, contractors, and developer/owner). Each individual factor RII perceived by all respondents will be used to assess the general and overall rankings in order to give an overall picture of the factor of contractor performance in Indian construction industry. This RII technique is used by many researchers like, Desai Megha et al., Hany Abd Elshakour et al. (March 2012) to rank the various performance factors in construction projects. The formula to calculate RII given below:

$RII = \sum W/A*N$

Where,

W = Weighting given to each factor by the respondents (ranging from 1 to 4),

A = Highest weight (i.e. 4 in this case),

N = Total Number of respondents.

2.3Analytical hierarchy process (AHP):

The **analytic hierarchy process** (**AHP**) is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. It was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then.

It has particular application in group decision making, and is used around the world in a wide variety of decision situations, in fields such as government, business, industry, healthcare, shipbuilding and education.

Rather than prescribing a "correct" decision, the AHP helps decision makers find one that best suits their goal and their understanding of the problem. It provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions.

Users of the AHP first decompose their decision problem into a hierarchy of more easily comprehended sub-problems, each of which can be analyzed independently. The elements of the hierarchy can relate to any aspect of the decision problem—tangible or intangible, carefully measured or roughly estimated, well or poorly understood—anything at all that applies to the decision at hand.

Once the hierarchy is built, the decision makers systematically evaluate its various elements by comparing them to each other two at a time, with respect to their impact on an element above them in the hierarchy. In making the comparisons, the decision makers can use concrete data about the elements, but they typically use their judgments about the elements' relative meaning and importance. It is the essence of the AHP that human judgments, and not just the underlying information, can be used in performing the evaluations.

The AHP converts these evaluations to numerical values that can be processed and compared over the entire range of the problem. A numerical weight or priority is derived for each element of the hierarchy, allowing diverse and often incommensurable elements to be compared to one another in a rational and consistent way. This capability distinguishes the AHP from other decision making techniques.

In the final step of the process, numerical priorities are calculated for each of the decision alternatives. These numbers represent the alternatives' relative ability to achieve the decision goal, so they allow a straightforward consideration of the various courses of action.

2.4 Factor Analysis Technique:

Factor analysis FA is a statistical technique used to identify a relatively small number of individual factors that can be used to represent relationships among sets of many interrelated variables Norusis 2008. This technique is powerful to reduce and regroup the individual factors identified from a larger number to a smaller and more critical one by scores of the responses Lam et al. 2008. Due to the large number of CSFs considered in this study it was important to define a set of commonalities. The number of individual factors would be required to represent that set of data was determined by examining the total percentage of variance explained by each individual factor. In this investigation, principal components analysis PCA was used to identify the underlying grouped factors because of its simplicity and distinctive characteristic of data-reduction capacity for extraction. In order to obtain a clearer image, extraction with Promax rotation and Kaiser normalization was conducted through the Statistical Package for Social Sciences SPSS FACTOR program. In fact, various methods of rotation including Varimax, Oblimin, Quartimax, and Equamax were also tried out. However Promax gave the highest individual factor loadings for the same set of individual factors and more interpretable results overall, therefore promax rotation method was finally selected for further discussion

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2.4.1 Kaiser-Meyer-Olkin Measure:

The appropriateness of the model was evaluated before using FA in this research. The sampling adequacy using Kaiser-Meyer- Olkin KMO and Barlett's test of sphericity can be used to test out the appropriateness Fox and Skitmore 2007.

The KMO statistic varies between 0 and 1. A value of 0 indicates that the sum of partial correlations is large relative to the sum of correlations, indicating diffusion in the pattern of correlations and, hence, FA would be inappropriate Norusis 2008.

In contrast, a value close to 1 indicates that patterns of correlations are relatively compact and FA would yield distinct and reliable individual factors. The KMO value should be higher than the acceptable threshold of 0.5 for a satisfactory FA to proceed Norusis 2008. The acceptance level of KMO value is indicated in Table Field 2005.

KMO value	Degree of common variance
0.90–1.00	Excellent
0.80–0.89	Good
0.70–0.79	Middling
0.60–0.69	Mediocre
0.50–0.59	Poor
0.00–0.49	"Forget it"

2.4.2Barlett's Test for Sphericity:

To reinforce the appropriateness of FA, the Barlett's test for sphericity is also carried out to highlight the presence of correlations among the variables. It is used to test the hypothesis that the correlation matrix is an identity matrix, which indicates that there is no relationship among the items Pett et al. 2003 . When the value of the test statistic for sphericity is large and the associated significance level is small, the population correlation matrix is not an identity matrix Statistical Package for Social Sciences SPSS 1997.

3. IMPORTANCE OF CSFs

Importance of critical success factors are shown as following:

- The problem of failure of construction project is worldwide. This problem can be solved by identifying critical success factor for construction project.
- These factors(CSFs) are success key for taking decision & preparing strategies in the choice of suitable project
- CSFs are useful for success of construction projects.
- Project success is not only determined exclusively by the PM, monitoring, and control efforts. It is also determined by CSFs.
- CSFs should pave the way for enhanced decision making in the choice of suitable projects.
- CSFs should enable a better understanding of the important individual factors affecting the success of project

4. CASE STUDY: CRITICAL SUCCESS FACTORS FOR DIFFERENT COMPONENTS OF CONSTRUCTION PROJECTS

ABSTRACT: The present study attempts to distinguish the different critical success factors (CSFs) for different components of construction projects as perceived by different professions, i.e., civil and structural engineers, mechanical and electrical engineers,

architects, and quantity surveyors. An analytical hierarchy process (AHP) is adopted to solicit the consistent subjective judgment of 27 experts in construction to identify the top 10 CSFs from 67 factors describing aspects of project characteristics, contractual arrangements, project participants, and interactive processes. The views of the different professionals are shaped by the experience they gained from their involvement in the respective components of the construction projects under their charge. It follows that the CSFs identified by the professionals are naturally relevant to the components of construction projects that they are familiar with. The present study reveals that the respective top 10 CSFs for the schedule, budget, and quality performance of architectural works, civil and structural works, and mechanical and electrical engineering works are markedly different.It follows that studies reported in the existing literature that have included views of respondents with less than 15 years' experience in construction or based on the views of professionals predominantly from a particular discipline are likely to be biased and misleading

CONCLUSION: The results of the present study reveal that adequacy of plans and specifications and project manager competency are two of the success-related factors included among the top 10 CSFs with respect to schedule, quality, budget, and overall performance for architectural, C&S engineering, and M&E engineering works of Construction projects. There is also consensus that project manager commitment and involvement is crucial to quality and overall performance for architectural, C&S engineering, and M&E engineering works of construction projects, economic risks is crucial to budget performance for architectural, C&S engineering, and M&E engineering works of construction projects, and constructability along with realistic obligations are crucial to overall performance for architectural, C&S engineering, and M&E engineering works of construction projects. The present study reveals that for architectural works, the human factors, particularly the quality of the consultant and contractor, are crucial to achieving project success. This observation is not valid for C&S and M&E engineering works. For C&S and M&E engineering works, it is more important to have some well defined control and monitoring mechanisms.

CONCLUSION

- CSFs can be used as a base for further detailed investigation on general construction projects, as well as a specific project, such as hospital or hotel. A more systematic way of determining project success is established.
- CSFs can help in selecting project team members, identifying the development needs of the project team members, and most important for forecasting the performance level of a construction project before it commences.

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