

Critical Success Factors in Construction Projects

Maninder Singh, S.K. Sharma

Abstract: For the successful implementation of the construction projects, researchers have tried to analyze the success factors. In the available literature, there is no clear indication to the success factors that are related to the projects related to construction. Many major construction journals were included to review the project success factors and developed a framework including six groups of independent variables, namely PRF, PMTMRF, PMRF, CLRF, CORF & EF and one dependent variable, i.e., CPS. The main purpose of this research is to test the developed conceptual framework on the CSFs in construction projects. Further the scale is tested for validity and reliability and finally SEM is applied and it is found that CSFs have 70.8% impact on the CPS. And also it is found that PMRF has the maximum impact in the success of construction projects.

Keywords: - CSFs – Critical Success Factors
PRF – Project Related Factors

PMTMRF – Project Management/Team Member related factors

PMRF – Project Manager related factors

CLRF – Client Related Factors

CORF – Contractor Related Factors

EF – External Factors

CPS – Construction Project Success

SEM – Structural Equation Modeling

I. INTRODUCTION

Construction Industry is one of the most vibrant and evolving sector of Indian Economy providing livelihood to number of people. The construction industry constitutes those individuals and organisations who are engaged in the designing, manufacturing, and maintenance of the construction projects. In the past few years, this industry internationally has laid increasing dependence on accentuating the prominence of construction to the economy of the country. Engaging an extensive variety of practices and methodologies, the intention of the industry is to influence policy makers to inspire development of construction related activities or, at a least, to avoid implementing policy actions that would discourage the companies to get involved in construction projects.

Revised Manuscript Received on January 15, 2020

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Zawawia, et al (2011)^[15], CSFs are a management terminology for a section that is essential for an organization or plan to accomplish its mission. To realize their goals they must be responsive to each key success factors and the disparities between these elements and the diverse roles of key result area. CSFs have been utilised extensively to categorize a few key elements that business organizations should concentrate in order to be unbeatable.

Identifying CSFs is vital as it permits the organisations to emphasis their efforts on structuring their capabilities to meet the CSFs, or even let the organisations to decide if they have the competence to build the requirements essential to meet CSFs. Chen et al (2012)^[4], Construction project success is dependent on the organization effectiveness. Company's works on their skills, ability, knowledge, and experience, to complete the construction projects but still it may lag in the successful completion of the project. Zavadskas, et al (2012)^[14], Project success of the construction projects could be achieved by the better performance of the project managers in the construction project. As most of the researchers found human factors as an important role in the success of a project. CSFs are usually identified in such key areas such as construction methods, employees and business skills, functions, methods, and technologies. This Paper begins with providing key insights about what CSFs are all about. It is then followed by identifying some of the important key variables on the basis of available Literature that contributes to the success of an organisation. The next section talks about methodology that is used to identify, correlate and finding the impact of the prominent variables using statistical tools like smartPLS. The paper ends with deliberation of the research limitations and future implications for future practitioners.

II. LITERATURE REVIEW

There is vast literature available on the CSFs in Construction projects. Researchers have worked on finding the success factors for the enhancement of the construction companies. CSFs are in the introduction stage in India in construction projects. Review of Literature is conducted to develop the framework on CSFs in Construction Company in relation to the success of construction projects.

Ngacho and Das (2005)^[9] developed a framework for the evaluation of the performance of the construction projects that are based on the six major key indicators that were, cost, quality, time, minimum disputes, safety and environmental disputes. Researcher surveyed literature and identified characteristics of the construction projects named as CSFs of the projects. These CSFs were divided into six broad variable named as PRF, PMTMRF, PMRF, CLRF, CORF & EF. Conceptual framework was framed to calculate the overall success performance of the project with regard to the variables defined.

Pilot survey was conducted with few of the experts of the construction industry and a questionnaire was developed. They found that these variables defined were very much related to the construction projects especially in the developing countries. Finally researcher's concluded that the performance of the projects also effects the satisfaction of the community.

Saqib, et al. (2010)^[4] observed that the construction projects were dynamic due to the uncertainties in the budgets, technologies and the development process. And they claimed that the CSFs could lead to the effectiveness of projects. Researchers surveyed 37 construction firms in Pakistan with the help of a questionnaire. Questionnaire was based on the performance selected indicators of the construction project and 77 factors were framed in 6 variables, namely PRF, PMTMRF, PMRF, CLRF, CORF & EF and the respondents ranked and scored these variables. On the basis of the critical score, researchers found that the CORF was the most important for the success of the construction projects and CLRF was the least important. Individually, decision making ability was scored as the most important factor for the success of construction project.

Alzaharani and Emsley (2012)^[1] tried to analyze the success and causes of the cost and the time overrun in the construction industry. Researcher surveyed the vast literature and framed a questionnaire. On the data collected factor analysis was applied and nine cluster were framed namely "(i) safety and quality; (ii) past performance; (iii) environment; (iv) management and technical aspects; (v) resource; (vi) organization; (vii) experience; (viii) size/type of pervious projects; and (ix) finance". Further logistic regression was applied and results indicated that "turnover history, quality policy, adequacy of labour and plant resources, waste disposal, size of past projects completed, and company image" were the most important factors affected the project's success.

Gudiene et al (2013)^[5] developed a conceptual framework model for the construction projects in Lihuania. They found seven major factors of success, that were institutional factors, PRF, PMTMRF, PMRF, CLRF, CORF & EF.

Muhammad, et al. (2016)^[7] suggested that the Public-private partnerships (PPP) as an alternative strategy could be utilized by the government to overcome the independent inability of public firms to meet the incremental infrastructure and services demand. While conducting literature review they found that there were mixed verdicts given on the application of PPP. For the improvement of the implementation of the PPP projects, CSFs were established. And researchers found that time were the most important factor for the successful implementation of the PPP projects. Also found that the social and political and economic environments of the county were complex and dynamic to understand which may lead to the barrier in the implementation of PPP.

Thote, et al (2017)^[13] claimed that the construction industry contributed to the economic growth of the nation. Researchers identified the success factors and the failure factors and included commercial and the residential projects in the city of Pune. They further identified 24 CSFs grouped in 5 variables and 11 failure factors. 80 respondents were interviewed and relative importance index was used to find the results. Researchers found that the "Leadership" was the

most important factor and the "Good Subcontractor" was the least important success factor. "Slow decision making" was the most important and the "Price Fluctuation" was the least important failure factor. **Nallathiga, et al (2017)**^[8] also worked on analyzing the success/failure factors in road construction project by PPP on the basis of different stages of project. They used questionnaire to draw responses from stakeholders of the project like Government firms, Road contractors, Consultants, Financial institutions and Users. Using relative importance index, researchers found that "Traffic assessment" was the most important success factor at "Project preparation stage", "Bid criteria (Financial Attraction of Project to Investors)" was most important success factor at "Procurement stage", at "Development stage" the most important success factor was "Infusion of Capital into Project" and finally "Availability of Contractor's Resources" was the most important success factor at "Construction, Operation and Management stage". Similarly researchers found that "Public Protest & Opposition" was the most important failure factor at "Project preparation stage", "Influence of Higher Authorities & Political Parties" was most important failure factor at "Procurement stage", at "Development stage" the most important failure factor was "Force Majeure" and finally "Maintenance Cost Overruns" was the most important failure factor at "Construction, Operation and Management stage"

Tamgadge and Shinde (2018)^[12] proposed that construction projects faces challenges due to unexpected changes therefore CSFs needed to be studied. They analyzed six major variables as PRF, PMTMRF, PMRF, CLRF, CORF & EF. Using questionnaire and Relative importance index method, researcher found that "Good leadership" in PMRF was the most critical factor related to the success of the project. And "Cost control", "Organizing of project" was the least important factor in PMTMRF and "Clients/contractors type & experience" in CLRF & CORF.

III. RESEARCH OBJECTIVES AND HYPOTHESIS

Many researchers have worked earlier on CSFs and found many essential details that could benefit other researchers. However there are very few studies that have worked on the construction companies with regard to CSFs. The research question for this study comes out to be "To find out the impact of the CSFs in the success of the construction projects?"

And objective of the study is framed as: -

Objective 1: "Effect of Critical Success Factors in Success of Construction Projects"

3.1 Variables of the study

CSFs have been identified and classified differently by a number of authors. On the basis of review of literature, CSFs as independent variable is divided into six extensively used variables, i.e, "Project Related Factors (PRF), Project Management/Team Member related factors (PMTMRF),

Project Manager related factors (PMRF), Client Related Factors (CLRF), Contractor Related Factors (CORF) and External Factors (EF) to find the impact on the dependent variable, i.e., Construction Project Success (CPS).

PRF – includes project value, type, size, complexity, , risk, goals, etc.

PMTMRF – Selection of team members, Coordination between all the stakeholders. PMTMRF includes factors such as competence, effectiveness in decision making, experience, motivation, personnel issues, and technical capability.

PMRF – Project manager competence in project planning and implementation. Skills of project manger like leadership, authority, trust, etc

CLRF – includes client’s experience, public or private, size, timely decision making ability, influence, risk taker or averter, clear and precise goals, etc.

CORF – expertise and performance of contractor. Includes economic and financial condition, technical capability, professional capability, maintaining health and safety standards, providing good working conditions, etc

EF – Political, Economic, Social, Technological, Legal and Ecological analysis of the region/nation.

CPS – includes timely completion of project, quality project, etc

3.2 Hypothesis of the Study

For the purpose of this study hypothesis is framed on the basis of the review of literature. Hypothesis based on the explicit survey done on the earlier researches is given below: -

H1: Proper implementation of CSFs enhances the success rate of the Construction Projects.

IV. RESEARCH METHODOLOGY

This study deals with six major variables that is decided on the basis of the review of literature and on the basis of through discussion with knowledgeable people of construction companies, i.e, PRF, PMTMRF, PMRF, CLRF, CORF & EF. For the purpose of the study, structured questionnaire is designed having two section. First section includes the general description of the respondents and the second section includes the questions asked on PRF, PMTMRF, PMRF, CLRF, CORF, EF and CPS. Nine items (PRF1 to PRF9) are designed for PRF, six for PMTMRF (PMTMRF1 to PMTMRF6), seven for PMRF (PMRF1 to PMRF7), five for CLRF (CLRF1 to CLRF5), six for CORF (CORF1 to CORF6), four for EF (EF1 to EF4) and six items (CPS1 to CPS6) are designed for CPS on the basis of the items used in the earlier studies. Five-point Likert scale that is ranging from “strongly disagree” to “strongly agree” is used.

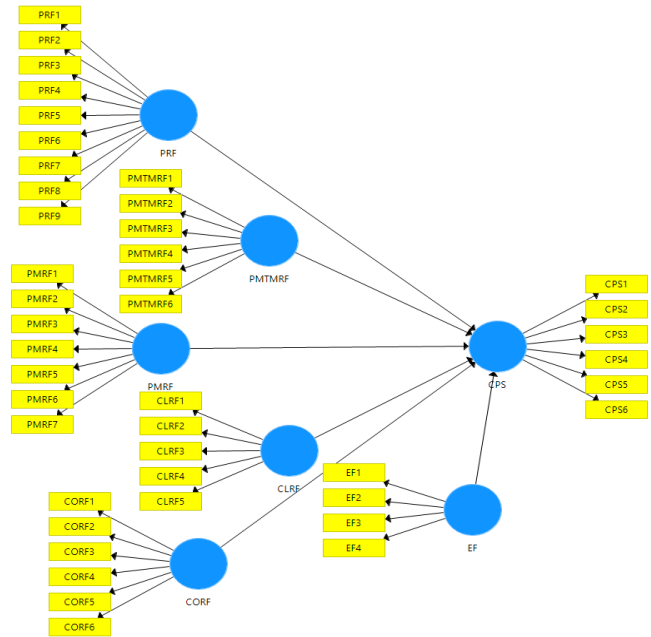


Figure 4.1: Framework for the Study

For the collection of data, respondents above the engineering position were taken into account. And data is collected from these engineers that are working on the construction projects in the state of Punjab. Projects are selected on the basis of the investment and importance of the project to the state. And simple random sampling is be used to select the respondents from the selected construction projects. A total of 99 employees are selected for the study. Finally a framework is designed and then finally SEM has been applied. Using smartPLS, discriminate validity is been checked and then statistical tools, i.e, correlation and regression is be applied to find out the association and dependence of PRF, PMTMRF, PMRF, CLRF, CORF & EF on CPS.

V. RESEARCH FINDINGS

By visiting the selected construction projects in Punjab, simple random sampling is used to collect data with the help of structure questionnaire. Data is being collected from 99 respondents that are working in construction projects above the position of engineers in the selected project in Punjab. Framework designed is first tested for reliability and validity by using smartPLS. Below is the analysis shown of the same: -

Table 5.1: Cronbach’s Alpha, Composite Reliability and Average Variance Extracted

	Cronbachs Alpha	Composite Reliability	AVE
CLRF	0.791	0.857	0.704
CORF	0.921	0.939	0.719
CPS	0.948	0.959	0.796
EF	0.872	0.912	0.723
PMRF	0.896	0.918	0.781
PMTMRF	0.859	0.896	0.755
PRF	0.929	0.941	0.724

Critical Success Factors in Construction Projects

As per table 5.1, it can be inferred as Cronbach's Alpha value for PRF, PMTMRF, PMRF, CLRF, CORF, EF and CPS is 0.929, 0.859, 0.896, 0.791, 0.921, 0.872 and 0.948 respectively, which is greater than 0.7. This means that the data collected using the questionnaire is reliable for the study. Even Composite Reliability is greater than 0.7, means that the questionnaire is reliable.

Average Variance Extracted is also depicted in the table and it reports as 0.724 for PRF, 0.755 for PMTMRF, 0.781 for PMRF, 0.704 for CLRF, 0.719 for CORF, 0.723 for EF and 0.796 for CPS, which is greater than 0.5. This means the questionnaire is convergent valid.

Further Discriminate Validity is calculated. For this calculation square root of the Average Variance Extracted is calculate and put in the diagonal and checked if all the remaining values are below this square root value. This method is used in Fornel and Larcker (1971). It is calculate and reported below in table 5.2.

Table 5.2: Discriminate Validity

	CLRF	CORF	CPS	EF	PMRF	PMTMRF	PRF
CLRF	0.839						
CORF	0.765	0.848					
CPS	0.597	0.796	0.892				
EF	0.798	0.680	0.647	0.850			
PMRF	0.797	0.815	0.789	0.796	0.884		
PMTMRF	0.814	0.722	0.632	0.845	0.859	0.869	
PRF	0.810	0.654	0.620	0.818	0.839	0.836	0.851

As per the above table it can be reported that the questionnaire is discriminate valid. Hence the data collected on the questionnaire is valid and reliable for the study. Further test of association (correlation) and dependence (regression) is applied and is reported one by one.

VI. DATA ANALYSIS AND INTERPRETATION

Finally the model for the study is tested using Smart-PLS and the below depicted image explain the effect of CSFs on competitive advantage of the company.

SEM is tested using smartPLS as shown in figure 6.1, and it is found that PMRF, CLRF and EF have a positive relation with the CPS. It also depicts that PMRF has the maximum positive ($r = 0.596$) relation with CPS. Finally using SEM, the hypothesis of the study is tested.

H1: Proper implementation of CSFs enhances the success rate of the Construction Projects.

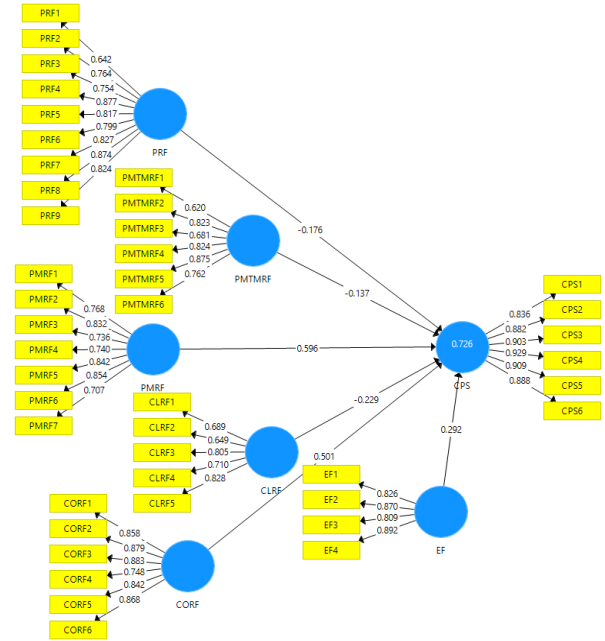


Figure 6.1: Final evaluated model

For the evaluation of the above hypothesis, regression is applied in smartPLS and regression value is reported in table below.

Table 6.1: Multiple Regression of PRF, PMTMRF, PMRF, CLRF, CORF, EF with CPS

	R Square	R Square Adjusted
CPS	0.726	0.708

As per the above table, Adjusted R Square value is 0.708. This means that 70.8% of the variance in the CPS (dependent variable) is explained by CSFs (independent variable including PRF, PMTMRF, PMRF, CLRF, CORF, EF) (C. Ringle, et al, 2015) [10].

Hence it can be inferred that the H1 is fully supported. And also the Objective 1 is fully supported.

VII. RESULTS

In this section the results are depicted and interpreted. Below is the table representing the results of the correlation and regression evaluated by using smartPLS software.

Table 7.1: Results of the Statistical Tools

Independent Variable	Dependent Variable	Test	Inference
PMRF	CPS	Correlation	$r = 0.596$
CORF	CPS	Correlation	$r = 0.501$
EF	CPS	Correlation	$r = 0.292$
PRF, PMTMRF, PMRF, CLRF, CORF & EF	CPS	Regression	Adjusted $R^2 = 0.708$

From the table above it can be interpreted that PMRF and CORF has a moderate positive relation with CPS. And EF has a weak positive relation with CPS. It can be inferred from the results that for the success of the construction projects, project related and contractor related factors needed to be addressed efficiently. Finally it can be inferred that the effect of the independent variable (PRF, PMTMRF, PMRF, CLRF, CORF & EF) on CPS is 70.8%. Therefore it can be inferred that for the success of the construction project, these independent variable plays a vital role. So these variables needed to be monitor properly and efficiently.

VIII. CONCLUSION

In the conducted research, following conclusion can be inferred: -

- There is a need of proper training programs for the proper implementation of the CSFs, as it is in the early stages of implementation in construction companies.
- If construction companies implement CSFs properly, they can achieve better edge over the competitors in the industry.
- Hypothesis testing done on independent and dependent variable shows the PMRF has the maximum positive (correlation coefficient value, $r = 0.596$) relation with CPS. And CORF is having positive (correlation coefficient value, $r = 0.501$) relation with CPS. This means that the PMRF and CORF is having a moderate ($0.5 > r > 0.7$) positive association with CPS.
- Hypothesis testing done on independent and dependent variable shows the EF has the positive (correlation coefficient value, $r = 0.292$) relation with CPS. This means that the EF is having a weak ($0 > r > 0.3$) positive association with CPS. Therefore it can be said that even after having a control over all the internal activities of the construction project, still external factor plays a role in the success of the project.
- For the final hypothesis, to evaluate the combined effect of PRF, PMTMRF, PMRF, CLRF, CORF & EF on CPS, regression was applied. Adjusted R Square value calculated using SEM is 0.708. This means that the overall effect of PRF, PMTMRF, PMRF, CLRF, CORF & EF on CPS is 70.8%. This shows that if the CSFs are managed properly construction project has a major chance of successful completion.

LIMITATIONS

For conducting this study there are some limitations as every study conducted have some or the other limitation. Below are the limitation reported of this study: -

- The area of the study is limited to Punjab only, so for further studies the area of the study can be enlarged.
- Respondent that are selected in the study are only above the level of engineers, so for further studies supervisors and foremen's could be taken into account as these people have the knowledge of the ground level realities.

- The industry picked for the study is on construction, so the results are limited to construction industry only.
- Only six major variables of CSFs is taken into consideration, which were related to the success of the construction project, so for further studies with more items/variables could be taken into account.

REFERENCES

1. Alzahrani, J. I., & Emsley, M. W. (2013). The impact of contractors' attributes on construction project success: A post construction evaluation. *International Journal of Project Management*, 31(2), 313-322.
2. Chan, A. P., Chan, D. W., Chiang, Y. H., Tang, B. S., Chan, E. H., & Ho, K. S. (2004). Exploring critical success factors for partnering in construction projects. *Journal of construction engineering and management*, 130(2), 188-198.
3. Chan, A. P., Scott, D., & Chan, A. P. (2004). Factors affecting the success of a construction project. *Journal of construction engineering and management*, 130(1), 153-155.
4. Chen, W. T., Chen, T.-T., Lu, Ch. Sh., Liu, Sh.-Sh. 2012. Analyzing relationships among success variables of construction partnering using structural equation modeling: a case study of Taiwan's construction industry. *Journal of Civil Engineering and Management*, 18 (6): 783-794.
5. Gudienė, N., Banaitis, A., Banaitienė, N., & Lopes, J. (2013). Development of a conceptual critical success factors model for construction projects: a case of Lithuania. *Procedia Engineering*, 57, 392-397.
6. Hanafi, A. G., & Nawi, M. N. M. (2016). Nine factors for competitiveness of construction companies in Asian region. *Revista tecnica de la facultad de ingenieria universidad del zulia*, 39(8), 33-44.
7. Muhammad, Z., Sik, K. K., Johar, F., & Sabri, S. (2016). An overview of critical success factors of public private partnership in the delivery of urban infrastructure and services. *Planning Malaysia Journal*, 14(4).
8. Nallathiga, R., Shaikh, H. D., Shaikh, T. F., & Sheik, F. A. (2017). Factors Affecting the Success/Failure of Road Infrastructure Projects Under PPP in India.
9. Ngacho, C., & Das, D. (2015). A performance evaluation framework of construction projects: insights from literature.
10. Ringle, C. M., Wende, S., and Becker, J.-M. 2015. "SmartPLS 3." Boenningstedt: SmartPLS GmbH, <http://www.smartpls.com>.
11. Saqib, M., Farooqui, R. U., & Lodi, S. H. (2008, August). Assessment of critical success factors for construction projects in Pakistan. In *First international conference on construction in developing countries*, Karachi, Pakistan (pp. 392-404).
12. Tamgadge, V., & Shinde, D. K. (2018). Analysis of Critical Success Factors for Construction Projects.
13. Thote, G., Shinde, R. D., & Kanase, A. K. (2017). Exploratory Study on Critical Success Factors in Construction Projects.
14. Zavadskas, E. K., Vainiūnas, P., Turskis, Z., Tamošaitienė J. 2012. Multiple criteria decision support system for assessment of projects managers in construction, *International Journal of Information Technology & Decision Making*, 11 (2): 501-520.
15. Zawawia, E.M.A, Kamaruzzamanb, S.N., Ithnina, Z., Zulkarnaina, S.H. A. 2011. Conceptual framework for describing CSF of building maintenance management, *The 2nd International Building Control Conference*, *Procedia Engineering* 20 (1): 110-117.

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