



CRITICAL SUCCESS FACTORS FOR THE CONSTRUCTION INDUSTRY

Zakari Tsiga⁴⁸, Michael Emes, Alan Smith

University College London, Mullard Space Science Laboratory, UK.

Abstract

This study aims to identify the critical success factors for projects in the construction industry. A list of factors were identified from the existing literature and grouped into categories. The authors added project risk management and requirements management to the list of categories to test the hypothesis that these should also be considered as critical success factors in the construction industry. The study identified 58 success factors classified into 11 groups, which were tested using an elicitation technique. Forty-nine responses were collected from project managers, who had an average of 15 years of project management experience and had participated in more than 15 projects. Once the data was collected, the authors adopted the use of the relative importance index to rank the categories. From the results, the top five most important are (1) Project Organization, (2) Project Manager Competence, (3) Project Risk Management, (4) Project Team Competence and (5) Requirements Management. This led to the conclusion that both project risk management and requirements management should be considered as critical success factors. Further analysis of the data highlights the importance of scope management and soft skills in Requirements Management and Project Risk Management respectively.

Keywords: Construction Projects; Critical Success Factors; Project Risk Management; Project Success; Requirements Management.

JEL codes: D20, L10, M19

Introduction

The Construction industry is one of the main sectors of the economy; it consists of the entire process from project visualization to demolition of buildings and infrastructure. As a service industry it is interlinked with various industries. The importance of the construction industry can be seen throughout history and in the development of economies. According to the World Market Intelligence (2010) the construction industry employs more people than any other single industry in the world. The report by Global Construction Perspectives and Oxford Economics (2013) suggest that the sector is globally expected to rise by \$6.3 trillion or over 70 % to \$15 trillion by 2025 compared to \$8.7 trillion in 2012. The construction industry incorporates all civil engineering projects such as building projects as well as the maintenance and repair of existing constructed projects.

As the industry is constantly growing, newer and bigger projects are always undertaken (Chan & Chan, 2004). These new undertakings generally come with more complexities as boundaries are being pushed. An example of such large project currently being undertaken is the Saadiyat Island project in Abu Dhabi, UAE with an estimated budget cost of \$26 billion (Ponzini, 2011).

Project success is the end deliverable of every undertaken project. Project success has been a subject of debate (Alexandrova & Ivanova, 2012). In the construction sector various efforts have been taken in order to determine these project success criteria because different

⁴⁸ Corresponding author: Zakari Tsiga, E-mail address: zakari.tsiga.13@ucl.ac.uk.



stakeholders have different views and perception of a project this in itself can lead to various views on project success.

Background

Project Success

In the past, research on project success focused on the achievement of the iron triangle objectives (time, cost and quality) until recently researchers have identified the need to widen the criteria for measuring project success (Atkinson, 1999; Wateridge, 1998). Researchers such as de Wit (1988) emphasize that a project is considered successful if its stakeholders are generally successful and the projects technical performance specification has been achieved. Muller (2007) states that projects differ in a variety of ways such as size, uniqueness and complexity this has lead researchers such as Westerveld (2003) to state that the criteria for measuring project success should vary from project to project and hence it would be difficult to have a unique set of criteria for all projects in all industries.

Critical Success Factors

The identification and careful consideration of critical success factors can have a positive outcome on a project. New participants in the construction industry and also established companies can use these factors to easily help themselves in better project delivery for future projects (Bullen & Rockart, 1981).

Rockart (1982) define critical success factors as “those key areas of activity in which favorable results are absolutely necessary for a manager to reach his/her goals”. Researcher such as Futrell et al (2001) agree with the above stated definition as they believe critical success factors are those factors in a project that can lead to a positive achievement of stakeholder expectations and requirements. Boynton & Zmud (1984) goes to the extent of stating that the achievement of CSFs in projects ensures positive outcome.

Critical success factors have been used in a wide variety of projects in different sectors such as information technology (Almajed & Mayhew, 2014), Petroleum (Tsiga et al., 2016), Space (Tsiga et al., 2016) as well as for generic projects (Muller & Jugdev, 2012; Pinto & Prescott, 1988). A review of the literature by Tsiga et al. (2016) identified the critical success factors and their corresponding categories as shown in **Table 1**.

Table 1

Critical success factors and categories		
Category	Critical Success Factors	Sources
External Challenge	Economic environment, social environment, political environment, physical environment and regulatory/legal environment.	(Gudiene et al., 2014); (Omran et al., 2012); (Tan & Ghazali, 2011)
Client knowledge and experience	Nature of finance, experience, organization size, emphasis on cots quality and time, ability to brief, decision making, roles and contribution, expectations and commitment, involvement and influence.	(Gudiene et al., 2014); (The Standish Group, 2013); (Omran et al., 2012)
Top management support	Support given to project head, support to critical activities, understanding of project difficulty and stakeholder influence.	(Ram & Corkindale, 2014); (Varajao et al., 2014); (Almajed & Mayhew, 2014).
Institutional	Standards and permits.	(Gudiene et al., 2014);



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factors		
Project characteristics	Project type, size, nature, complexity, design, resources allocation time and level of technology.	(Yong & Mustafa, 2013); (Omran et al., 2012).
Project manager competence	Experience, coordinating and motivating skills, leading skills, communication and feedback, management skills, conflict resolution skills and organizing skills.	(Toor & Ogunlana, 2009); (Malach-Pines et al., 2009); (Barclay & Osei-Bryson, 2009).
Project organization	Planning and control effort, team structure and integration, safety and quality program, schedule and work definition, budgeting and control of subcontractors.	(Gudiene et al., 2014); (Varajao et al., 2014); (Berssaneti & Carvalho, 2015).
Contractual aspects	Contract type, tendering (procedures or steps for the selection of that service) and procurement (company selection to provide services) process.	(Yong & Mustafa, 2013); (Omran et al., 2012); (Tan & Ghazali, 2011); (Chan et al., 2004).
Project team competence	Team experience, technical skills, planning and organizing skills, commitment and involvement, teams adaptability to changing requirements, working relationships, educational level, training availability and decision making effectiveness.	(Gudiene et al., 2014); (Varajao et al., 2014); (Almajed & Mayhew, 2014); (Ram & Corkindale, 2014).
Project Risk Management	The factors under project risk management are sub divided into two which are firstly hard aspects with initiation, identification, assessment, response planning, response implementation and secondly, soft aspects of risk, which are risk communication and attitude, monitoring and review	(Almajed & Mayhew, 2014), (Rabechini Junior & Monteiro de Carvalho, 2013), (Didraga, 2013),
Requirements Management	Elicitation technique, identification, analysis and negotiation, modelling, validation and scope management	(Mirza et al., 2013) (Didraga, 2013)

Source: (Tsigas et al., 2016)

Methods

There has already been some research performed on projects in the construction industry. The first step taken in this research was to examine the already established CSFs from literature and previous work. Projects such as the London Olympic Park (Davies & Mackenzie, 2013) and the Sydney Opera House (Colbert, 2003) were carefully analysed before a standard set of factors was obtained. The factors gotten were then categorised into 11.

Another strategy implemented in this research was to develop the questionnaire using the key categories and factors identified and test them by asking professionals working in the industry to provide us with their views. The implementation of the technique allowed the authors to be able to analyse and quantify the data gotten from the respondents.

The data was analysed using the Statistical Package for Social Science (SPSS) software to perform test such as the hypothesis test would be discussed in section 4.



Questionnaire Design

The survey consisted of 37 questions, which were then grouped into 5 different sections. The first section contained background information of the respondents such as experience and qualification. The next section had 11 questions that the respondents ranked based on a 10-point scale. The third and fourth sections asked respondents to rank factors of project risk management and requirements management also using the 10 point scale and the final section consisted of only two questions aimed at asking respondent's details of they wanted to be contacted for further research and discussions.

After the questionnaire was designed before being distributed, a small pilot test was conducted with potential participants to get feedback on possible improvements. The recommendations gotten from the test was implemented to the design before final distribution.

Study Sample

The study was distributed online via email and business oriented social networking sites LinkedIn, as such the participants are geographically located in different parts of the world with diverse project experience in the construction industry. The total number of completed and valid responses are obtained from the survey was 49.

Most respondents are currently project managers with master's degrees, have an average of more than 15 years' project experience and also more than 15 years' project management experience.

They have participated in more than 15 projects with an average value of order of magnitude 100 million \$/€/£, delivering service projects and other categories of projects; they are mostly geographically located in the United Kingdom, United States of America, Nigeria, Australia and Canada.

Data Analysis and Findings

Relative Importance index

Relative importance index has been implemented in this study with the aim of it providing a better understanding of individual predictors and their individual role amongst a given set (Tonidandel & LeBreton, 2011). This method has been implemented in various project management literature such as (Gudiene et al., 2013; Iyer & Jha, 2006). The formula for the calculation is shown below:

(1)

M is the weight given to a factor by a respondent, in the range of 1 to 10. N is the highest score available (10 in this case) and P is the total number of respondents that have answered the question. The results of the relative importance index for the CSFs are shown in **Table 2**.

Table 2

Results of Relative Importance Index Calculation

Category	RII	Rank
Project Organization	0.892	1
Project Manager Competence	0.890	2
Project Risk Management	0.850	3
Project Team Competence	0.843	4
Requirements Management	0.827	5
Top Management Support	0.824	6



Contractual Aspects	0.806	7
Institutional factors	0.790	8
External Challenge	0.749	9
Client Knowledge and Experience	0.730	10
Project Characteristics	0.716	11

Source: Authors' construction

Table 3

Results of Relative Importance Index Calculation on aspects of Project Risk Management

Project Risk Management	RII	Rank
Communication and culture	0.864	1
Initiation	0.853	2
Planning of Responses	0.834	3
Identification	0.823	4
Monitoring and Review	0.823	4
Implementation of responses	0.809	6
Assessment	0.760	7

Source: Authors' construction

Table 4

Results of Relative Importance Index Calculation on aspects of Requirements Management

Requirements Management	RII	Rank
Scope Management	0.883	1
Identification	0.867	2
Analysis and Negotiation	0.826	3
Validation	0.817	4
Modelling	0.770	5

Source: Authors' construction

Reliability of Scale

Reliability of scale is used to “calculate the stability of a scale from the internal consistency of an item by measuring the construct” (Santos, 1999). Nunnally & Bernstein (1994) suggest that in order to ensure high reliability and internal consistency the value of the Cronbach's alpha for the construct should be greater than 0.7. Table 5 depicts the results of the test on our study 47.

Table 5

Reliability of Scale Test Results

Constructs	No of Items	Cronbach's Alpha
Critical Success Factors	11	0.864
Project Risk Management	7	0.812
Requirements Management	5	0.745

Source: Authors' construction

Factor Analysis

Bartlett's Sphericity is one of the methods used for factor analysis, here the constructs in the study are considered viable and acceptable only if their individual factor loading is above 0.5



(Tabachnick & Fidell, 2007). In the case of this study all the questions had a factor loading of above 0.5. This is considered to be good.

Hypothesis Test

In order to accept a hypothesis and reject the null hypothesis, certain conditions have to be considered. The t-value should be > 2.0 and the p-value should be < 0.05 . **Table 6** depicts the results of the test, which means both hypotheses have been accepted as they meet the both criteria's.

Table 6

Hypothesis Test Result			
Hypotheses	t-value	p-value (Sig)	Outcome
H1: Project Risk Management	4.569	0.002	Accepted
H2: Requirements Management	2.051	0.008	Accepted

Source: Authors' construction

Discussion

The first aim of this research is to determine if project risk management and requirements management have an influence on project success in the construction industry. Once the data was collected, a hypothesis test was carried out on the data, the results of the test as depicted in **Table 6** supports the relationship of project risk management to project success and requirements management to project success which has led to the rejection of the null hypothesis.

As both hypotheses have been accepted, it is important to also rank the factors against the already established categories. To achieve this, the use of the relative importance index was implemented for the ranking. From the results in **Table 2**, one can denote that the most important factor is Project Organization. As Project Risk management and Requirement management have not been previously included in the past literature it is a bit surprising to see that Project Risk Management is regarded as the 3rd most important factor and Requirements Management came in as 5th in the ranking. More research should be carried out as to ascertain why so? Are they important for all projects in all sectors or only for the construction sector? And why they haven't been included as CSFs in previous research?

In the category of Project risk management, from the results shown in **Table 3**, communication and culture is deemed to be the most important aspect of the category, which showcases the importance of the soft side of risk management. Scope management is also deemed to be the most important factor in requirements management as show cased in the results in **Table 4**, this is known to have a cob web effect on the other factors in requirements management.

The result of this study highlights areas to utilize scarce resources with the aim of improving the chances of delivering better projects in the construction industry.

Conclusion

CSFs that can influence the outcome of projects have been an area of great discussion and debate in project management; some studies have determined that CSFs are sector specific and some factors play greater roles in some sectors. This study has identified 11 categories that have been with 58 factors that have an impact on projects in the construction industry.



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The 11 categories have been ranked based on their relative importance index calculated from the data gotten. This research highlights the importance of requirements management and project risk management in construction projects as both had a positive relationship with project success and ranked higher than some already established categories.

The results of this research highlights the importance of more research should be carried out in this area for better delivery of projects.

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