Int. J. Res. Ind. Eng. Vol. 7, No. 3 (2018) 381–395

International Journal of Research in Industrial Engineering
www.riejournal.com

Integrated Model of Critical Success Factors of Construction Projects: A Case of Esfahan

N. Janatyan[1*], M. R. Hashemianfar[2], M. Kasaee[1]

[1]Department of Management, Shahid Beheshti University, Tehran, Iran.
[2]Department of Civil Engineering, Institute of Daneshpajoohan, Esfahan, Iran.

A B S T R A C T

Nowadays, the construction managers try to accomplish the projects on time and successful simultaneously. However, the concept of success is not clear in their mind. The purpose of this paper is to identify the factors that effect on project success in the construction field; so, an integrated model of critical success factor for construction projects has been suggested. The proposed model consists of three categories of variables, i.e. people related factors, project related factors, and environmental factors. This model clarifies the definition of success in the mind of construction professionals and develops the critical success factors for construction projects through prior research. The novelty of this research is the comprehensive view of critical success factors in an integrated model format. The model has been tested on construction project managers in Esfahan. Findings show that in Esfahan the success of construction projects depends on people, project, and environment related factors, respectively. This paper clarifies the ambiguous definition of success in the mind of construction professionals.

Keywords: Critical success factors (CSF), People related factors, Project related factors, Environment related factors, Construction projects.

Article history: *Received: 08 June 2018* *Revised: 02 September 2018* *Accepted: 10 October 2018*

1. Introduction

Since the 1950s the most of the studies in project management has focused on project scheduling problems, assuming that the development of better scheduling techniques would result in better management and thus the successful completion of projects. There are many factors outside the control of management which could determine the success or failure of a project [6]. The subject of project success is at the heart of project management. Many factors impact the degree of project success. Project success is therefore among the top priorities of project managers and project stakeholders. It has long been accepted [10, 11] that success in projects has two different

* Corresponding author
E-mail address: n.janatyan@yahoo.com
DOI: 10.22105/riej.2018.143702.1053

aspects. Project success is concerned with judgments about the outcomes of a project while Project Management (PM) success is about the successful delivery of a project. However, judgments about the success of an individual project are not necessarily same across both aspects. A regarded project as well-managed may fail to deliver the intended outcomes and a poorly-managed project can still be capable of delivering success, though almost always at a price [24].

Critical Success Factors (CSFs) are varied in each research, fundamental to the achievement of a particular strategic objective. Performance indicators are the quantifiable measures of CSFs. These factors are referred to as critical success/failure factors and only a few studies have been done to assess, clarify, or analyze these factors. Most of the early studies in the area focused on the reasons for project failure rather than project success. In these studies it was assumed that if a project's completion time exceeded its date or expenses over-ran budget or outcomes did not satisfy a company's predetermined performance criteria, the project was assumed to be a failure. There can be ambiguity in determining whether a project is a success or a failure. There are two main reasons for this ambiguity. First, as mentioned in a paper by Pinto and Slevin [30], it is still not clear how to measure project success because the parties who are involved in projects, perceive the project success or failure differently. A project, which is considered to be a success by the client, might be considered a failure by top management if the project outcome does not meet top management specifications, even though it might satisfy the client. In this case, both of these parties are evaluating project success differently and thus they value the outcome differently. Second reason is that the lists of success or failure factors vary in various studies in the literature. Although several lists of factors are generated, they seem to tabulate the individual factors rather than grouping them according to some criteria to help to analyze the interaction between them and the possible consequences.

Construction is a risky business and the possibility of failure always exists, so the construction companies have to consider the factors that can have a direct effect to their success in construction project performance [13, 14]. 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. A construction project is completed as a result of 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. However, the concept of project success has remained ambiguously defined in the mind of the construction professionals [34].

This paper tries to identify the integrated and novel model of Critical Success Factors (CSFs) through now, and concentrates on construction projects. For this purpose, at the first part of this paper, the literature of subject and previous research in this field will be presented and then the model and the methodology to recognize, analysis, and the regression between factors are calculated. In the last section the results will be discussed and will be concluded.

2. Literature Review

The success and failure factors were first introduced by Rubin and Seelig [32]. They investigated the impact of a project manager's experience on the project's success or failure. Technical performance was used as a measure of success. It was concluded that a project manager's previous experience has minimal impact on the project's performance, whereas the size of the previously managed project does affect the manager's performance.

Avots [3] identified the reasons for project failure and concluded that the wrong choice of project manager, the unplanned project termination, and the unsupportive top management were the main reasons for failure. In 1983, Baker et al. [4] suggested that instead of using time, cost, and performance as measures for project success, the perceived performance should be the measure.

Hughes [15] conducted a survey to identify the factors that affect project performance. He concluded that projects fail because of improper basic managerial principles, such as the improper focus on the management system, rewarding the wrong actions, and the lack of communication of goals.

One of the first efforts to classify critical factors was carried out by Pinto and Prescott [29]. They classified the factors as strategic or tactical. These two groups of factors affect the project performance at different phases of implementation. The strategic group includes factors such as 'project mission', 'top management support', and 'project scheduling' whereas the tactical group consists of factors such as 'client consultation', 'personnel selection and training'. In their follow-up work, Pinto and Slevin [30] identified seven success factors and their relative importance for each stage of a research and development project life-cycle.

Finally, in a similar study by Pinto and Prescott [28], the relative importance of each group (tactical vs. strategic) over the project life cycle was analyzed. It was found that the relative importance of the success factors varies at different stages of the project's life cycle, depending on the used success measure. When the external success measures are employed, planning factors dominate tactical factors throughout the project life cycle.

Atkinson [2] separated the success factors in to delivery and post-delivery stages and provided a 'square route' to understanding success criteria: Iron triangle, information system, benefit (organizational), and benefit (stakeholder community). The 'iron triangle' has cost, time, and quality as its criteria (for the delivery stage). The post-delivery stages comprise the information system, with such criteria as maintainability, reliability, validity, and information quality use; benefit (organizational): Improved efficiency, improved effectiveness, increased profits, strategic goals, organizational learning, and reduced waste; benefit (stakeholder community): Satisfied users, social and environmental impact, personal development, professional learning, contractors profits, capital suppliers, content project team, and economic impact to surrounding community.

Chua et al. [9] proposed a hierarchal model for construction project success. In this model the objectives of budget, schedule, and quality are the key measures that contribute to the goal of 'construction project successes'. Lim and Mohamed [21] modeled the project success measurement into micro: Viewpoint, completion time, completion cost, completion quality, completion performance, and completion safety; macro-viewpoints: Completion time, completion satisfaction, completion utility, and completion operation.

In 1996, Belassi and Tukel [6] also divided the critical success factors into four main groups in a new format: Project dependent factors, team members and project manager dependent factors, organizational structure dependent factors, and External environment dependent factors. Sadeh et al. [33] divided the project success into four dimensions: Meeting design goals, which applies to contract that is signed by the customer, the benefit to the end user, which refers to the benefit to the customers from the end products, benefit to the developing organization, which refers to the benefit gained by the developing organization as a result of executing the project, and the benefit to the technological infrastructure of the country and of firms involved in the development process.

Sagib et al. [34] researched about construction projects in Pakistan and succeeded to identify 77 factors in 7 different groups and finally achieved to the prioritization of 10 critical success factors in construction projects of Pakistan. Patanakul and Milosevic [27] grouped their measurement criteria into three: (i) criteria from organizational perspective: Resource productivity, organizational learning, (ii) criteria from project perspective: Time-to-market, customer satisfaction, and (iii) criteria from personal perspective: Personal growth, personal satisfaction.

Khosravi and Afshari [19] developed a success measurement model for construction projects to fulfill two main objectives to provide a project success index for every finished project in order to compare them with each other and to establish a benchmark for future improvement in success of construction project execution. The model's output is a project success index which is calculated based on five project success criteria. The project success index will be calculated by using an equation: Project success index, project time performance, project cost performance, project quality performance, project HSE performance, and project client's satisfaction. Muller and Jugdev [24] saw diversity in how success is defined and measured. The CSFs vary by project types, life cycle phases, industries, nationalities, individuals, and organizations.

Pakseresht and Asgari [31] identified and ranked the critical success factors in construction projects of Pars Garma Company. This study was planned and performed in two stages. At the first stage to identify the critical success factors, a questionnaire was made and distributed among 58 people of staff managers; at the second stage by omitting low-effect factors, a questionnaire was designed based on AHP method to collect the opinions of experts and distributed among 15 persons of the organizational experts.

Jugdev et al. [17] examined the relationships between project delivery success factors, project management tools, software, and methods. Belassi and Tukel [6] suggested a framework for

determining critical success factors in projects; they grouped CSFs in to four areas: Factors related to the project, factors related to the project manager and team members, factors related to the organization, and factors related to the external environment.

The factors in this framework are interrelated; a factor in one group may affect a factor in another group [1]. They pointed out that this framework presents the factors systematically; they also tested their model through the questionnaire.

These studies tried to identify and categorize the variables that affect success in projects. They do not study the relations of these variables. Some researchers proposed models for CSFs in the field of construction project; they identified both the success factors and their relations.

One of the recent models belongs to Gudiene et al. [13, 14], the purpose of this study is to identify and to rank the critical success factors of construction projects in Lithuania. A survey with 71 critical success factors was distributed among to 15 construction professionals and experts from 5 construction companies who have projects management knowledge and related experience; the data were processed by expert judgment. Based on the results, ten factors including experience of project management, project value, experience of project manager, technical capabilities of project manager, experience of contractor, project size, competence of project team members, clear and realistic goals, decision making effectiveness of projects management, and technical capability of project management were determined as the most important success factors for construction projects. These two models do not examine the relation of variables and their effects on success, and like the previous research concern with prioritizing the variables.

Table 1. Literature of Identifying CSFs in Projects.

Researcher	Grouping the CSFs in projects
Hughes [15]	Proper basic managerial principles and the communication of goals.
Pinco and Prescott [29]	Classified factors as strategic or tactical.
Atkinson [2]	Iron triangle (cost, quality and time), information system, benefit (organizational), and benefit (stakeholder community).
Chua et al. [9]	Budget, schedule, and quality.
Lim and Mohamed [21]	▪ Micro viewpoint: Completion time, completion cost, completion quality, completion performance, and completion safety. ▪ Macro-viewpoints: Completion time, completion satisfaction, completion utility, and completion operation.
Belassi and Tukel [6]	▪ Project dependent factors. ▪ Team members and project manager dependent factors. ▪ Organizational structure dependent factors. ▪ External environment dependent factors.

Researcher	Grouping the CSFs in projects
Sadeh et al. [33]	▪ Meeting design goals, which applies to contract that is signed by the customer. ▪ The benefit to the end user, which refers to the benefit to the customers from the end products. ▪ Benefit to the developing organization, which refers to the benefit gained by the developing organization as a result of executing the project. ▪ The benefit to the technological infrastructure of the country and of firms involved in the development process.
Sagib et al. [34]	77 factors in 7 different groups and finally achieved to the prioritization of 10 critical success factors in construction projects of Pakistan. Project management, trouble shooting, experience of sub-contractors, and the contractor's cash flow.
Patanakul and Milosevic [27]	▪ Criteria from organizational perspective: Resource productivity, organizational learning. ▪ Criteria from project perspective: Time-to-market, customer satisfaction. ▪ Criteria from personal perspective: Personal growth, personal satisfaction.
Muller and Jugdev [24]	The CSFs vary by project types, life cycle phases, industries, nationalities, individuals, and organizations.
Gudiene et al. [13, 14]	Factors related to people, factors related to project, and factors related to environment.
Ihunah et al. [16]	Competent project team top management support project manager/leader authority, realistic project cost and time estimates, project problem solving abilities…
Osei-Kyei and Chan [26]	Government commitment and support, strong community support and relationship, openness and constant communication, and project profitability and capable private partner.
Molwus et al. [23]	Stakeholder characteristics project characteristics (SCPC), stakeholder analysis (SA), stakeholder dynamics (SD), and stakeholder engagement/empowerment (SE).
Banihashemi et al. [5]	Project managers' experience and competence, commitment to high quality workmanship, and having stakeholders, innovative practices…

Atkinson [2] in his study claimed that the iron triangle (cost, time, and quality) is so important to say if the project is successful or not; on the other hand Khosravi and Afshari [19] provided the project success index which will be calculated by using cost, time, and quality. In this study, researcher assumed that three elements of cost, time, and quality are indices of success in construction projects. These factors were stressed in the research of Bitici [7] and Kometa [18] previously. Ihunah et al. [16] highlighted 22 Critical Project Management Success Factors

(CPMSF) essential for the achievement of sustainable social (public) housing estates' delivery or provision in Nigeria. De Carvalho et al. [8] considered parameters of scheduling, cost, and margins as CSFs in their study. Osei-Kyei and Chan [26] implemented Public or Private Partnership (PPP) policy for public construction projects in Ghana. Molwus et al. [23] concentrated on stakeholders and project success interrelationship. They analyzed Stakeholder Dynamics (SD) and Stakeholder Engagement/Empowerment (SE). They found out the stakeholder's role significant in projects success. Banihashemi et al. [5] studied the CSFs and integrated these factors with sustainability three bottom line (environmental, social, and economic). Some factors like project managers' experience and competence.

3. Methodology (Proposed Integrated Model of CSFs of Construction Projects)

Through the study of pervious research in the field of critical success factors in construction projects, it has been found that there is not a model that shows all the aspect of CSFs and their relations. The question is which factors of construction projects must consider more to achieve the success. For this purpose, in this paper, it is tried to achieve an integrated model that covers all important factors that pervious research emphasized before. For this purpose, the critical success factors in construction projects were collected and categorized in three groups, i.e. people related factors, project related factors, and environment related factors. Each group contains some sub groups. This categories and details of CSFs in construction projects is depicted in Figure 1 as a framework of CSFs model. In this model the CSFs that are listed through the previous research are grouped in these three bottom lines.

3.1 Factors Related to People

Through the studies could be found that the important factors related to people, are involved in construction projects. These people are:

- Project managers: The project manager related factors that are common in studies are ability to delegate authority, competence, commitment [5, 6, 12, 25], communication skills [6, 12], troubleshooting [6, 34], and prior experiences of project manager [34].
- Client: Client satisfaction is the key factor, which effects on success in construction projects [6].
- Employee: The factors of prior experiences of team, technical ability of team, clear and precise definition of project objectives (goal and task), and commitment of employees are important to success of construction projects [20, 35].
- Stakeholders: Stakeholders in this study include suppliers and sub-contractors that have special role in success of construction projects, so cooperation from suppliers, collaboration of sub-contractors [22], experience of sub-contractors, and the contractors cash flow [34] are prominent factors in this category. Molwus et al. [23] studied the reciprocal relations between the CSFs for stakeholder management and project success in construction projects.

3.2 Factors Related to Project

According to prior research in this field the factors that are related to the project can be summarized to project management, process, and the results.

- Project management: The project management is the key factor of success that approximately all the researchers in this area consider and link several factors to project management. The factors that are common in most of studies are size and value of project, uniqueness of project activities, support of top management [6, 13], realistic schedule planning, innovation, clear and realistic goals, utilization of up to date technology, control system (tools and reports), and access to the resources [31].
- Process: The two important aspects of business process factors are if they are time consuming and need special expertise [22], most of studies did not pay attention.
- Result factors: The result factors are related to what the company achieves in relation to its planned business performance profit [22], productivity [26], predictability of time, and cost and risk that must be considered precisely.

3.3 Factors Related to Environment

Belassi and Tukel [6] pointed out the importance of the environmental factors in the model of success; Gudiene et al. [13, 14] in different pattern emphasized on environmental factors (political, physical, legal, and cultural). The common factors are technical, legal and political factors, standards, competitors, and culture [6, 34].

For checking the validation of this integrated model of CSFs in construction projects, the model has been tested for construction projects in Esfahan. So, the statistical population in this study is construction projects in Esfahan that were finished recently. Sampling method is intended in this study. In Figure 1, the integrated model of success in construction projects and the relationships among the factors is considered.

The method of verifying the CSFs in construction projects in Esfahan is testing through two questionnaires. Questionnaire 1 was designed to clarify if the gathered CSFs are critical for success of construction project or not. The 30 project managers were asked to fill the questionnaire 1. Questionnaire 2 was designed to fill by customers (Appendix I, II) to catch the mount of satisfactory of these 30 projects in Esfahan. The data where be exploited from two questionnaires provides the information that is needed to test this model. Although the other studies tested their models though the expert’s opinion on CSFs, in this study, the model was tested through data gathered from construction projects in Esfahan.

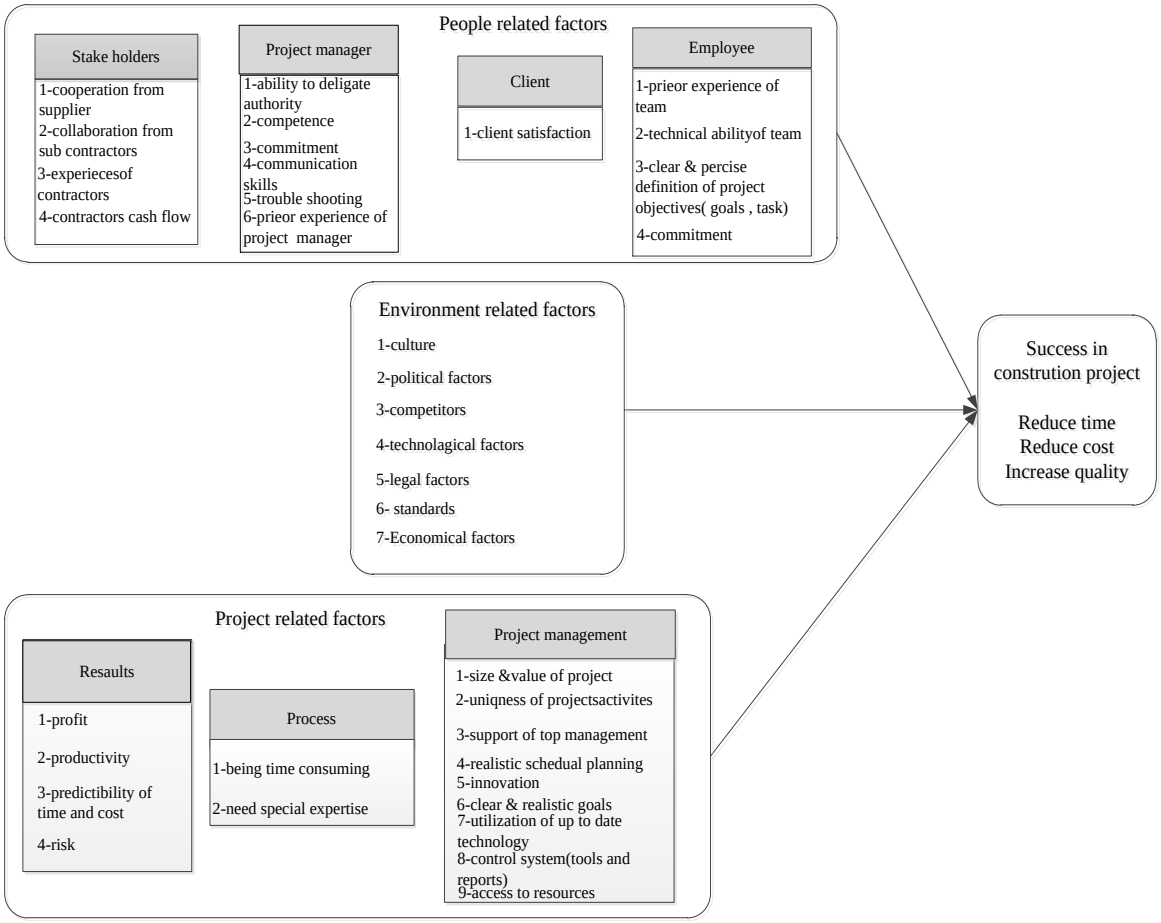

Figure 1. The Proposed Frame Work of CSFs Model in Construction Projects.

4. Findings and Discussion

Data were collected through two questionnaires for 30 construction projects. Analysis showed that there is significant correlation between people related factors and success in construction projects of Esfahan, significant correlation between variable of project related factors and success in construction projects, and significant correlation between variable of environment related factors and success in construction projects in this study (Table 2). It means that the impacts of three groups of CSFs on project success are verified at the 0.05 level.

Table 2. Correlations between Variables.

		People	Project	Environment	Success
People	Pearson Correlation	1	.186	.137	.655**
	Sig. (2-tailed)		.325	.471	.000
	N	30	30	30	30
Project	Pearson Correlation	.186	1	.038	.402*
	Sig. (2-tailed)	.325		.840	.028
	N	30	30	30	30
Environment	Pearson Correlation	.137	.038	1	.467**
	Sig. (2-tailed)	.471	.840		.009
	N	30	30	30	30
Success	Pearson Correlation	.655**	.402*	.467**	1
	Sig. (2-tailed)	.000	.028	.009	
	N	30	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

As the Table 3 shows, the correlation is significant at the 0.05 levels between success in construction projects and people and project and environment related factors. The results show that there is no relation among variables of people, project, and environment related factors, so the model must modifies the relationship between people related factors, project related factors, and environmental factors in construction projects in Esfahan. The quantity of each variable is the average of related factors in the model, for example the quantity of success in construction projects is the average of three variables (cost, time, and quality).

In continue, the regression between dependent factor (success in construction projects) and independent factors (people related factor, project related factor, and environment related factors) is calculated by SPSS 22. The results have been shown in Table 2 and it is significant at 0.05 level.

Table 3. Calculating Linear Regression.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.246	.744		.330	.744
	People	.439	.095	.550	4.634	.000
	Project	.266	.110	.285	2.420	.023
	Environment	.286	.088	.381	3.266	.003

a. Dependent Variable: Success

The regression between success and people, project, and environment is clarified in formula below:

Success= 0.550 people related factors+ 0.285 project related factors + 0.381 environment related factors.

Eq. (1) clears that people related factors have more impacts on success in construction factors than environment related factors, and environment related factors have more impacts on success in construction factors than project related factors. It shows that in Esfahan the success of construction projects is depend on people, project, and environment related factors, respectively.

5. Conclusion

The subject of project success is at the heart of project management. Many factors impact the degree of project success. Project success is therefore among the top priorities of project managers and project stakeholders. The concept of project success remains ambiguously defined in the mind of construction professionals. There is no an industry-accepted or standardized definition of project success because the fact is that the individual project teams find themselves in unique situations, implying that their definition of success will differ from that of another project team. Project success is a topic that is frequently discussed and yet rarely agreed upon. Construction is a risky business and the possibility of failure always exists, so the construction companies have to consider the factors that can have a direct effect to their success in construction project performance. Pervious research tried to identify and categorize the variables that affect success in projects. They did not study the relations of these variables and models did not examine the relation of variables and their effects on success and like the previous research concern with prioritizing the variables. This paper tried to identify the integrated, novel model of Critical Success Factors (CSFs) through research till now, and concentrated in construction projects. The integrated model clarified ambiguously the definition in the mind of construction professionals. The model indicated that CSFs of construction projects belong to three main categories. These three categories were factors related to people, factors related to project, and factors related to environment; the study cleared that there is no relation among variables of people, project, and environment related factors, so the model modified the relationship between people related factors, project related factors, and environmental factors in construction projects in Esfahan in Figure 3. The regression between success and people, project, and environment was calculated. Success= 0.550 people related factors+ 0.285 project related factors + 0.381 environment related factors. It showed that in Esfahan the success of construction projects was depend on people, project, and environment related factors, respectively. This research used the equal weight for each factor and used the average of factors in each three categories (people, project, and environment related factors) that these factors could be studied to identify the weight of each factor, this subject can be more considered in the further studies. The proposed model was tested on Esfahan construction projects but it is better to test in the other areas with different cultures and environment.

References

[1] Abdollahzadeh, G. R., & Faghihmaleki, H. (2017). A method to evaluate the risk-based robustness index in blast-influenced structures. *Earthquakes and structures*, *12*(1), 47-54.

[2] Atkinson, R., Crawford, L., & Ward, S. (2006). Fundamental uncertainties in projects and the scope of project management. *International journal of project management*, *24*(8), 687-698.

[3] Avots, I. (1969). Why does project management fail? *California management review*, *12*(1), 77-82.

[4] Baker, B. N., Murphy, D. C., & Fisher, D. (1997). Factors affecting project success. *Project management handbook*, 902-919.

[5] Banihashemi, S., Hosseini, M. R., Golizadeh, H., & Sankaran, S. (2017). Critical success factors (CSFs) for integration of sustainability into construction project management practices in developing countries. *International journal of project management*, *35*(6), 1103-1119.

[6] Belassi, W., & Tukel, O. I. (1996). A new framework for determining critical success/failure factors in projects. *International journal of project management*, *14*(3), 141-151.

[7] Bititci, U. S. (1994). Measuring your way to profit. *Management decision*, *32*(6), 16-24.

[8] de Carvalho, M. M., Patah, L. A., & de Souza Bido, D. (2015). Project management and its effects on project success: Cross-country and cross-industry comparisons. *International journal of project management*, *33*(7), 1509-1522.

[9] Chua, D. K. H., Kog, Y. C., & Loh, P. K. (1999). Critical success factors for different project objectives. *Journal of construction engineering and management*, *125*(3), 142-150.

[10] Cooke-Davies, T. (1990). Return of the project managers. *Management today*, *119*.

[11] De Wit, A. (1988). Measurement of project success. *International journal of project management*, *6*(3), 164-170.

[12] Garbharran, H., Govender, J., & Msani, T. (2012). Critical success factors influencing project success in the construction industry. *Acta structilia*, *19*(2), 90-108.

[13] 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.

[14] Gudienė, N., Banaitis, A., & Banaitienė, N. (2013). Evaluation of critical success factors for construction projects–an empirical study in Lithuania. *International journal of strategic property management*, *17*(1), 21-31.

[15] Hughes, M. W. (1986). Why projects fail-the effects of ignoring the obvious. *Industrial engineering*, *18*(4), 14.

[16] Ihuah, P. W., Kakulu, I. I., & Eaton, D. (2014). A review of critical project management success factors (CPMSF) for sustainable social housing in Nigeria. *International journal of sustainable built environment*, *3*(1), 62-71.

[17] Jugdev, K., Perkins, D., Fortune, J., White, D., & Walker, D. (2013). An exploratory study of project success with tools, software and methods. *International journal of managing projects in business*, *6*(3), 534-551.

[18] Kometa, S. T., Olomolaiye, P. O., & Harris, F. C. (1995). An evaluation of clients' needs and responsibilities in the construction process. *Engineering, construction and architectural management*, *2*(1), 57-76.

[19] Khosravi, S., & Afshari, H. (2011, July). A success measurement model for construction projects. *Proceedings of the international conference on financial management and economics* (pp. 186-190). Singapore.

[20] Kumaraswamy, M. M., & Chan, W. M. (1999). Factors facilitating faster construction. *Journal of construction procurement*.

[21] Lim, C. S., & Mohamed, M. Z. (1999). Criteria of project success: an exploratory re-examination. *International journal of project management*, *17*(4), 243-248.

[22] Mbugua, L. M., Harris, P., Holt, G. D., & Olomolaiye, P. O. (1999, September). A framework for determining critical success factors influencing construction business performance. *Proceedings of the 15th annual conference of association of researchers in construction management* (pp. 255-64).
[23] Molwus, J. J., Erdogan, B., & Ogunlana, S. (2017). Using structural equation modelling (SEM) to understand the relationships among critical success factors (CSFs) for stakeholder management in construction. *Engineering, construction and architectural management*, *24*(3), 426-450.
[24] Müller, R., & Jugdev, K. (2012). Critical success factors in projects: Pinto, Slevin, and Prescott–the elucidation of project success. *International journal of managing projects in business*, *5*(4), 757-775.
[25] Duy Nguyen, L., Ogunlana, S. O., & Thi Xuan Lan, D. (2004). A study on project success factors in large construction projects in Vietnam. *Engineering, construction and architectural management*, *11*(6), 404-413.
[26] Osei-Kyei, R., & Chan, A. P. (2017). Implementing public–private partnership (PPP) policy for public construction projects in Ghana: critical success factors and policy implications. *International journal of construction management*, *17*(2), 113-123.
[27] Patanakul, P., & Milosevic, D. (2009). The effectiveness in managing a group of multiple projects: Factors of influence and measurement criteria. *International journal of project management*, *27*(3), 216-233.
[28] Pinto, J. K., & Prescott, J. E. (1988). Variations in critical success factors over the stages in the project life cycle. *Journal of management*, *14*(1), 5-18.
[29] Pinto, J. K., & Prescott, J. E. (1990). Planning and tactical factors in the project implementation process. *Journal of management studies*, *27*(3), 305-327.
[30] Pinto, J.K., & Slevin, D. P. (1988). Project success: Definitions and measurement techniques. *Project management*, *1*, 67-72.
[31] Pakseresht, A., & Asgari, G. (2012). Determining the critical success factors in construction projects: AHP approach. *Interdisciplinary journal of contemporary research in business*, *4*(8), 383-393.
[32] Rubin, I. M., & Seelig, W. (1967). Experience as a factor in the selection and performance of project managers. *IEEE transactions on engineering management*, (3), 131-135.
[33] Sadeh, A., Dvir, D., & Shenhar, A. (2000). The role of contract type in the success of R&D defense projects under increasing uncertainty. *Project management journal*, *31*(3), 14-22.
[34] Saqib, M., Farooqui, R. U., & Lodi, S. H. (2008, August). Assessment of critical success factors for construction projects in Pakistan. *First international conference on construction in developing countries (ICCIDC-1)*, Karachi, Pakistan, August.
[35] Shah, J. B., & Murphy, J. (1995). Performance appraisals for improved productivity. *Journal of management in engineering*, *11*(2), 26-29.

Appendix I Questionaire-1 (Project Manager)

Project name: …….

This questionnaire is designed to identify CSFs in construction projects in Esfahan.

- People related factors
  - Project manager

ID	Question	Very low	Low	Medium	High	Very high
1	Ability to delegate authority					
2	Competence					
3	Commitment					

ID	Question	Very low	Low	Medium	High	Very high
4	Communication skill					
5	Trouble shouting					
6	Prior experiences of project manager					

- Employee (team project)

ID	Question	Very low	Low	Medium	High	Very high
1	Prior experiences of team					
2	Technical ability of team					
3	Clear and precise definition of project objectives (goal and task)					
4	Commitment of employees					

- Stake holders

ID	Question	Very low	Low	Medium	High	Very high
1	Cooperation from suppliers					
2	Collaboration of sub-contractors					
3	Experience of sub-contractors and the contractor					
4	Contractors cash flow					

- Factors related to project
  - Project management

ID	Question	Very low	Low	Medium	High	Very high
1	Size					
2	Value of project					
3	Uniqness of project activities					
4	Support of top management					
5	Time consuming					
6	Need special expertise					
7	Realistic schedule planning					
8	Innovation					
9	Clear and realistic goals					
10	Utilization of up to date technology					
11	Control system (tools and reports)					
12	Access to the resources					

- Process and results

ID	Question	Very low	Low	Medium	High	Very high
1	Time consuming					
2	Need special expertise					

ID	Question	Very low	Low	Medium	High	Very high
3	Profit					
4	Productivity					
5	Predictability of time and cost					
6	Risk					

- Environment related factor

ID	Question	Very low	Low	Medium	High	Very high
1	Technical factors					
2	Legal factors					
3	Political factors					
4	Standards					
5	Competitors					
6	Culture					
7	Economical factors					

Appendix II Questionaire-2 (Customer)

Project name: ……started date: ……finished date……

This questionnaire is designed to identify CSFs in construction projects in Esfahan.

ID	Question	Very low	Low	Medium	High	Very high
1	Quality of project					
2	Total Satisfaction					