

Success Factors Evaluation in Construction Projects

Mohammad Hosein Ramin ^a, Parviz Ghoddosi ^b

^a Department of Construction Management, Faculty of Civil Engineering, University of Iran University of Science and Technology, Tehran, Iran.

^b Faculty Member of Civil Engineering, University of Iran University of Science and Technology, Tehran, Iran.

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Abstract: Nowadays, contractors, employers, and all stakeholders of a civil project looking to improve the quality level of construction in any type of project. This demands attention to some factors, which the project will be completed in the determined time and with an intended and predicted budget. Furthermore, the demands and expectations of stakeholders should be fulfilled. A project like this is called a successful project. Probably, the first issue in the implementation of civil projects is manpower resources, which are responsible for advancing the contractor and employer objectives. Therefore, paying attention to these resources and considering them more can improve the speed and quality of performance in the project. Considering their needs and motivation in a project can create energy and motivation in each of them individually, to improve performance. The aim of this study is success factors evaluation in the civil projects which is in terms of the purpose objectives and descriptive method. Statistical society of engineers that works in employer, consultant, and contractor teams of construction firms in Tehran, is in a site area in the residential project between 250 to 350 m². To collect data, a five-item questionnaire was used. Questionnaires were distributed electronically among 170 engineers who work in the contractor, consultant, and employer teams in construction firms, and 149 questionnaires are answered. The final questionnaire results were obtained through Cronbach's alpha of 0.858. Based on these results, the five project success were ranked highest point to lowest, respectively, which contain employer and team satisfaction, project accidents, and project financial budgeting and scheduling. As seen in the results, the projects received very few scores in terms of scheduling that needs more attention.

Keywords: project success, civil projects, construction firms in Tehran

1. Introduction

In the past and now, contractors and employers have been looking for the best implementation of their civil projects. Various variables have been defined by them to check their project's implementation. Generally, to measure the project's performance, you should consider to construction quality level. And also, the number of spent costs comparing by the prime cost of the considered at the beginning of the project is a notable variable that the costs issues are one of the success factors. Another of the success factors variables is the project implementation time. At the end of the project, how much of the employer and stakeholders' objective values are fulfilled is very important and determinant and affects the project's success.

Since manpower costs contain between 25 and 40 percent of the total project cost, reducing these costs will have great potential as an increased productivity source. Construction efficiency is affected by many factors other than manpower, like materials, equipment, tools, construction methods, and management skills. Although, these resources are breathless and would be meaningless if they were not turned into means of production by the human element.

Considering the success factors in projects increases the probability of project success and more satisfaction with the final result, which is one of the important project objectives. Due to the increments in the probability of project success, again we will obtain the main objective, which is to increase and improve the final project quality.

Success factors for different projects are not general. So, in terms of limitations, a described project that is very limited should be different from one that has few. Furthermore, the experimental findings of this study illustrated that self-confidence, respect, loyalty, and obligation are common values and the lack of these values can lead to power struggles, resistance, indifference, and finally, failure in the project.

Li (2019) in his study expressed that his objective was an overall investigation of publications from 2005 to 2018 on critical success variables for green building projects. So, paying attention to the success factors of researchers in obtaining the time, economic, and quality intentions of the project and help to improve their usefulness and will be very effective in the quality level of the project increment.

The research theoretical basis

The project success factors

Project success defines as on-time project completion, in the budget, and with desired quality or performance which project delivery obtains the expected by stakeholders (Meyer and Torres 2019). In the study conducted by Mavi and Standing (2018), they aimed to identify the important variables of project management success and classify them into five criteria: (1) project, (2) project management, (3) organization, (4) external environment,

and (5) stability. Afterward, he examined 41 variables. Data were gathered from 26 Australian construction industry project managers is illustrated in Table (1) by using a decision-making trial and evaluation laboratory.

Table 1: Critical Success Factors examined by Mavi and Standing (2018)

No.	Success factor	No.	Success factor
1	Real objective specificity	22	Project technical understanding and ability
2	Project size and complexity	23	Experience content from previous projects and assigned them to the next projects
3	Agile development process	24	organizational maturity level
4	Minimum domain change	25	Time-controlling system and accurate feedback
5	Project alliances with corporate strategy	26	Limitations that the final operator has applied
6	Urgency	27	Political stability
7	Labor cost-effectiveness	28	Environmental problems
8	Fulfilling the planned quality standard	29	Getting a national profile
9	Project executive ability	30	Shareholders expectations
10	Project risk and debt management	31	Quantity and financial conditions in subcontracts
11	Good planning and scheduling methods	32	Market availability
12	A united and motivated team	33	Energy consumption
13	The project team global obligation	34	Water protection
14	Effective talk with stakeholders	35	Waste recycling and management
15	Project life cycle management processes	36	Recycling . The substance reusing
16	The project organizational structure	37	Construction cost
17	The sufficient resources availability	38	General convenience and health and safety
18	High-ranking management and sponsor	39	Users security
19	Continuous performance measurement	40	Public services
20	Skill maintaining in overtime	41	Noise pollution during construction
21	A good relationship with stakeholders		

In another study, Hussein (2019) expressed that this study aims to create a framework that categorizes project success factors by the project characteristics and using insights from real-life project items. This study was done based on a 21-project analysis case from a wide range of applications and industries in Norway. Unlike previous studies, which were based on statistical methods to determine important success factors, this study entirely was based on qualitative methods by using real project data and project management specialists in project management courses. In this study, 18 factors were presented and classified depending on the project field.

Table 2: Success factors examined by Hussein (2019)

Context	Key-factors success
Organization complexity	Going to different stakeholders targeted and on time Roles and responsibility clarity Sovereignly decision-making of the project manager. suitable organizational structure of the project. Stability . the project organization continuity. Aim and target clarity
Deformation	Final users involvement . customer . stakeholders Balanced project group which illustrates all units' interests. affected by the project. The manager . has a long business vision Organization level for the project target. informing the project important to the whole organization Support the project owner . the project management Supervision. following up by the owner . the project management
Business impact	

	Sufficient initial planning.Routines for deviation. changing control
	Cooperation in the project organization
	Cooperation between project . the contractors
	Priority clarity and requirements process
	Flexibility
Limitations	The management process of structural risk
	Using of experience content from previous projects
	Experience. skill . knowledge . ability
Uncertainty	Focusing on prejudice too much . being optimistic too much . doubt and guess

In the next study, Meyer et al. (2019) defined the term "supply chain management project" that was more comprehensive than other definitions in the literature. Furthermore, they tested the importance of ten factors for the success of supply chain management projects. They aimed to identify the most important project success factors for supply chain management projects. They prepared a list of ten potential success factors for supply chain management projects based on the literature that related to general project managers with the study of (Brinkhoff, 2015) and their own experience in managing supply chain management projects.

Table 3: Success factors examined by Meyer et al. (2019)

No.	Success variable
1	Proper relationship and stakeholders management
2	The sufficient resources availability
3	The project target clarity
4	Project management experience with the overall management of the project
5	Project management experience with supply chain management projects
6	The project team members experience with labor project
7	Organizing project team: external project team
8	Organizing project team: internal project team
9	Supporting the project sponsor and high-ranked management
10	Using one project management method

Table 4: Illustrate all the factors examined in previous studies, along with the repetition number of each.

No.	Factor name	repeatability	No.	Factor name	repeatability
1	Real objective specificity	4	29	Time-controlling system and accurate feedback	1
2	A united and motivated team	4	30	Political stability	1
3	Effective talk with stakeholders	4	31	Environmental problems	1
4	Project life cycle management processes	4	32	Getting a national profile	1
5	High-ranking management and sponsor	4	33	Shareholders expectations	1
6	Project risk and debt management	3	34	Quantity and financial conditions in subcontracts	1
7	Good planning and scheduling methods	3	35	Market availability	1
8	The project team global obligation	3	36	Energy consumption	1
9	The sufficient resources availability	3	37	Water protection	1

10	Limitations that the final operator has applied	3	38	Waste recycling and management	1
11	Experience. skill. knowledge. ability	3	39	Recycling. The substance reusing	1
12	Urgency	2	40	Construction cost	1
13	Labor cost-effectiveness	2	41	General convenience and health and safety	1
14	Fulfilling the planned quality standard	2	42	Users security	1
15	Project executive ability	2	43	Public services	1
16	The project organizational structure	2	44	Noise pollution during construction	1
17	Skill maintaining in overtime	2	45	Roles and responsibility clarity	1
18	A good relationship with stakeholders	2	46	Stability - the project organization continuity	1
19	Experience content from previous projects and assigned them to the next projects	2	47	Flexibility	1
20	Supervision. following up by the owner . the project management	2	48	Focusing on prejudice too much - being optimistic too much - doubt and guess	1
21	Skilled management team	2	49	Innovation technology	1
22	Project size and complexity	1	50	wide community support	1
23	Agile development process	1	51	Education	1
24	Minimum domain change	1	52	Project delivery system	1
25	Project alliances with corporate strategy	1	53	External environment of the project	1
26	Continuous performance measurement	1	54	Designers performance	1
27	Project technical understanding and ability	1	55	Longer startup and setup courses	1
28	organizational maturity level	1	56	private section for stability	1

2. Research Method

The current study is applied in terms of the purpose objectives and descriptive method. According to the research aim, which is to investigate the relationship between motivational factors and project success in civil projects, a valid questionnaire was used to design a questionnaire to assess project success factors. This questionnaire has been prepared and designed based on the 5-point Likert scale and the questionnaires of articles and studies reviewed in the relevant fields. Contains 5 success factors in 5 questions.

Table 5: Questions of success questionnaire.

Question No.	Question	Examined factors
1	Employer.customer satisfaction with the final project	Employer satisfaction.
2	I was able to satisfy my team members from the management and overall performance of the project.	Team satisfaction.
3	Totally, in comparison with the prime budget, the real cost in this project is than the prime budget.	The prime budget in comparison with the real cost.
4	Totally, in comparison with the scheduling plan, the real plan in this project is	The prime scheduling plan in comparison with real-time.

5	Totally, in comparison with a similar project, in this project accidents are caused by work quality and safety at work.	The current project’s accidents in comparison with the previous project.
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In this project, the Statistical Society of engineers that works in employer, consultant, and contractor teams of construction firms in Tehran, is in a site area in the residential project between 250 to 350 m².

To estimate the minimum sample volume to examine the motivation factors and success, the following relationship with 95% certainty was used:

$$n = \frac{n'}{1 + (\frac{n'}{N})} \tag{1}$$

$$n' = \frac{S^2}{V^2}$$

Where n is the minimum sample volume, N is the population volume, S is the standard deviation of 0.5 and V is the standard error of 0.05. According to the above relations, in this study, the minimum sample volume is 85.7, in which questionnaires were distributed electronically among 170 engineers who work in the contractor, consultant, and employer teams in construction firms, and 149 questionnaires are answered. The final questionnaire results were obtained through Cronbach's alpha of 0.858.

Table 6: The Kolmogorov-Smirnov examination results

Variable	P-value
Employer satisfaction.	0.000
Team satisfaction.	0.000
The prime budget in comparison with the real cost.	0.000
The prime scheduling plan in comparison with real-time.	0.000
The current project’s accidents in comparison with the previous project.	0.000

The findings of this study (P <0.05) illustrated that the distribution of data in all groups was unnormal so, statistical examinations should be used non-parametric tests. In all statistical tests used, a remarkable level of 5% was considered.

3. Findings

In this part, the examined project success factors are analyzed, and the obtained tables are illustrated. Note, in this part, the scores related to the questions are provided. Otherwise, the “I strongly disagree with” option was given a score of 1, and a score of 5 was given to the option” that I completely agree with” and in this section, the obtained scores are presented. Note, according to the type of options in the three scoring factors, when explaining those factors, the explanations related to scoring will be repeated.

Table 7: Project success factors and statistical components.

statistical components	Employer satisfaction	Team satisfaction	The prime budget in comparison with the real cost	The prime scheduling plan in comparison with real-time	The current project’s accidents in comparison with the previous project
Valid	149	149	149	149	149
Invalid	0	0	0	0	0
Average	4.01	3.99	2.67	2.47	3.8255
Center	4.00	4.00	3.00	2.00	4.0000
Mode	4	4	1	1	4.00
Standard deviation	0.818	0.793	1.454	1.393	1.00493
Variance	0.669	0.628	2.114	1.940	1.010
Domain	4	4	4	4	4.00

Minimum	1	1	1	1	1.00
Maximum	5	5	5	5	5.00
Total	597	595	398	368	570.00

According to the results and scores of each factor collected by the respondents. The five project success factors were ranked in the order of the highest score to the lowest, which are as follows:

1. Employer satisfaction
2. Team satisfaction
3. The project accidents
4. The project financial budgeting
5. The project timing

As seen, the projects got very few scores in terms of scheduling, and this is why this factor needs more attention. According to the observed studies, the results were expected to be close to the same results. Of course, in-person projects and according to previous experiences, it were expected to illustrate weakness in terms of time and cost. On another note, according to the factors that the satisfaction of employers in projects is more focused on the quality of work delivered. In comparison with the previous studies, the scheduled time and cost control are important factors for success, in which, it was found that these factors are not observed in this projects. Another important factor that was noted in this study was the project shareholders' and stakeholders' satisfaction and, which this factor is well observed.

To compare the opinions of different groups participating in this project, considering that the data distribution was unnormal, the Kruskal-Wallis non-parametric test was used. The average ranks of each group for each question are shown in table (8), respectively.

Table 8: The average ranks of each group for each question.

The success factor	Post	N	Mean rank
Employer satisfaction	Employer	17	88.24
	Consultant	45	73.09
	Contractors	87	73.40
	Total	149	
Team satisfaction	Employer	17	79.91
	Consultant	45	71.33
	Contractors	87	75.94
	Total	149	
The prime budget and the real cost	Employer	17	82.53
	Consultant	45	78.64
	Contractors	87	71.64
	Total	149	
The prime scheduling plan and real-time	Employer	17	74.26
	Consultant	45	76.93
	Contractors	87	74.14
	Total	149	
The current project's accidents compared to the previous project	Employer	17	80.35
	Consultant	45	82.24
	Contractors	87	70.21
	Total	149	

To find out the different sources between the groups due to the unnormal data distribution, the UMann-Whitney test was used. Otherwise, the report of the Kruskal-Wallis test illustrates that there is a significant difference between the scores of the three groups in these questions, but it does not indicate where and between which two groups this difference exists. To find out the different sources, it is necessary to perform three UMann-Whitney tests for each pair of groups to find the location of the differences. The aim of this, a remarkable level should be adjusted for multiple comparisons, in which case the remarkable level is divided by the number of tests, which equals 0.05 divided by 3, which will be approximately equal to 0.016, otherwise, the test result will be remarkable when it is $P < 0.016$. The test results are illustrated in Table (9).

Table 9: Kruskal-Wallis test results related to comparison of different groups

The success factor	Kruskal-Wallis	df	P-value
Employer satisfaction	2.322	2	0.313
Team satisfaction	0.716	2	0.699
The prime budget and the real cost	1.438	2	0.487
The prime scheduling plan and real-time	0.139	2	0.933
The current project's accidents compared to the previous project	2.840	2	0.242

There is no remarkable relationship between the mentioned success factors, according to the results of Table 9.

4. Conclusion

This study aims to investigate the success factors in civil projects. The five project success factors were ranked highest points to lowest, respectively, which include employer satisfaction, team satisfaction, project accidents, the project financial budgeting, and project scheduling. The results illustrated that the projects got very few scores in terms of scheduling, and this is why this factor needs more attention. According to the observed studies, the findings were expected to be close to the same results. Of course, in-person projects and according to previous experiences, it were expected to illustrate weakness in terms of time and cost. On another note, according to the factors that the satisfaction of employers in projects is more focused on the quality of work delivered. In comparison with the previous studies, the scheduled time and cost control are important factors for success, in which, it was found that these factors are not observed in this projects. Another important factor that was noted in this study was the project shareholders' and stakeholders' satisfaction and, which this factor is well observed. Also, in this study, the good team relationship factor has a high score, which was one of the important factors that were mentioned in this study.

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