

Providing a framework for the success of construction projects in Iran, focusing on large national projects

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Abstract

A construction project is a combination of various planned or unplanned events that happen during the life cycle of the project and continue to exist under changes in the environment. In the meantime, some factors have double importance in the success of a project or its failure; these factors are known as project success factors. The purpose of this research is to provide a framework for the success of construction projects in Iran, focusing on large national projects. In terms of the nature of the research, the present research is an exploratory study. In terms of research strategy, it is a single case study about large national projects. The data collection tool in the research is the interviewing method. In the present investigation, the snowball sampling method, which requires consultation with knowledgeable people, has been used to introduce suitable cases for the research by them. To analyze the data, the thematic analysis and thematic network analysis methods have been used. The findings showed that the competence of the project manager was repeated more than other items in all the interviews. Therefore, the most important factor in project management is the competence of the project manager and the competence of the team. Nowadays, the employment of skilled and qualified personnel is an essential requirement for construction projects. It has been considered an important factor in other industries of the country, and the results of gathering the opinions of experts in the construction industry in this research also confirm this is the issue. Among the critical factors affecting the success of construction projects in Iran, the lack of use of advanced and up-to-date technologies was the most important factor. In other words, technology is changing and improving every day so it has entered into new fields.

Keywords: construction project, project success, competence, technology, large national projects
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1 Introduction

According to the 2021 Development Perspective Document of Iran and the economic plan of the country, there is an urgent need to do the basic things to prevent the waste of national funds. In the last twenty years, valuable efforts have been made in the field of introduction and expansion of management concepts and to some extent project management and project planning and control systems. However, the concepts of management and project planning have not been developed appropriately due to several reasons, including the unfamiliarity of project managers with their responsibilities and duties, the lack of a system for evaluating the performance of plans and projects, the limited publication and distribution of books [11].

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The implementation of construction projects in each region will improve the economic situation and trade exchanges in that region. Generally, road construction projects as a country's infrastructure projects require heavy budgets and a long period. Therefore, delays in such projects cause irreparable damage to the country's economy. Hence, proper and efficient planning and management are very necessary for road construction projects so that they can be operated within the estimated time, predicted cost, and appropriate quality [23].

Delays in construction projects can also affect their quality goals. The project managers should speed up the project implementation process in a period to avoid fines caused by non-excusable delays and to complete the project on time. In some cases, achieving this goal has decreased the quality of the project implementation significantly [20]. The astonishing and unimaginable lack of progress and inactivity of plans and projects as the foundation of the country which attracts a huge amount of budget every year cannot be caused by one or more minor problems. On the other hand, the generality of this issue in the vast majority of plans and projects indicates the existence of obstacles and root problems in the implementation of the country's capital plans, which seriously threaten the economic reconstruction of the country. Iran is in a new phase whose characteristic feature is the economic reconstruction of the country to deal with the problems it has faced in the past. Unfortunately, many construction projects are currently being implemented in the country that not implementing plans and projects in the designated time and with the allocated credit has caused delays in delivery and operations despite a large amount of involved capital leading to increased public dissatisfaction; so that annually only 10% of the national projects that can be finished are completed [5]. The success of the project depends on establishing a proper balance between three important factors including work time, used resources, and work results to provide a suitable level of service to the customer. The project serves the satisfaction of the customer, so these three important factors should be considered and a proper balance should be made among them. The customer wants to implement the project on time, the results meet the requested specifications exactly based on what he wanted, and finally, the project has an appropriate full price upon which there was previously an agreement and a certain budget was allocated for it. The above three items represent the three basic factors of time, quality, and cost, among which there is a balance.

The purpose of this research is to provide a framework for the success of construction projects in Iran, focusing on large national projects. A construction project is a combination of various planned or unplanned events that happen during the life cycle of the project and continues to exist under changes in the environment. In the meantime, some factors have double importance in the success of a project or its failure; these factors are known as project success factors. Identifying the success factors of construction projects is one of the most important issues in the field of project management, and according to the reports of the Iranian Parliament Research Center, the main causes of delays in construction projects are lack of credit, weakness of executive entities in performing construction tasks, contracting problems and a lower percentage of the problems are related to the location of the construction of the project, study, procurement and required machines, design consultant and supervisor consultant of the project.

2 Theoretical foundations and literature review

A project is a temporary effort to produce a unique product, service, or result. The temporary nature of the project means that it has a beginning and an end. The end of the project is when its goals have been achieved, the project has not been canceled due to non-achievement or unprofitability of the goals, or the project is no longer needed. The temporary nature of the project does not mean that its time is short; it does not necessarily mean that the product, services, or results of the project are temporary; the output (product, service with results) of many projects remains for a long time. For example, the construction project of a national monument creates a product that will last for centuries. The project also has social, economic, and environmental consequences that are much longer than the output of the project. In other words, when a project moves towards the future, in addition to having a kind of compulsion in movement caused by the pressure of competitive conditions, there will be uncertainty about the final place due to the lack of prediction of future events (Wikipedia Internet Encyclopedia). The existence of such an interpretation on a project includes the existence of risk in the project [17].

In institutions that have several projects in progress, the need for models that manage the quality of the project is increasing. It has been a long time that the revolutions related to the success of the project are associated with a project management model, not because there is no need for these models, but because there are practical problems that are not related to time, cost, and quality [4]. The best way for comprehensive project management is to find a model (framework) that creates a relationship between the main criteria for the success of the project and the success area [15]. The success of the project can be defined as the planned and deliberate fulfillment of the maximum expectations of the project's stakeholders. Based on this, by determining the success of the project concerning the estimation of the expectations of the stakeholders, the health of the project can be evaluated. Most of the existing project measurement

tools focus on financial dimensions such as return on capital and profit per unit. Financial parameters are useful, but they also have shortcomings; For example, they do not have a strategic focus, and they do not provide information about quality, communication, and environment [14]. In Australia, a framework for Project Performance Appraisal (PPE) is implemented, which covers a wide range of performance parameters. The selected parameters include time, cost, quality, safety and health, contract, communication, environment, and conflict resolution elements [7]. The main goal of (PPE) is to expand the performance indicators of the project to cover parameters such as communication and conflict resolution. In England, a project performance measurement tool called Key Performance Indicator (KPI) has been given by the KPI working group. The three main steps in implementing KPIs are as follows: Deciding what to measure. This is the first critical step in determining performance measurement issues that are relevant to the construction industry. In KPI, seven main categories are used: time, cost, quality, client satisfaction, client changes, business performance, and safety and health. Data collection forms are used [19].

Brill et al [6] used a multidimensional perspective to evaluate the success of the project. They considered the effectiveness of the project, its impact on the client, and setting the stage for the future. Also, the perspectives of three groups of stakeholders were considered for each project evaluation including the project management team, contractors, and employers. Automatic Project Progress Measurement System (PPMS) method is suggested for construction projects. This method uses the Internet and database technologies to facilitate monitoring processes, which leads to quick and convenient data entry and display. The number of performance parameters used depends on the complexity of the project. The classification of key performance criteria in this method is as follows: People: This index is about how people feel about the performance of the project about time, cost, quality, safety, and health in a specific period. Performance cost: a project cost to show the degree of compliance of the project with the accepted budget. Quality: this criterion is to guarantee that the project will reach the quality standards mentioned in the contract. Safety and health: this covers four key areas: supervision and acceptance, education and training, inspection, and complaints. Environment: this indicator is related to the monitoring of abnormalities caused by construction activities, including air pollution, noise pollution, and water pollution etc. Client satisfaction: the degree of client satisfaction with the performance of the project. Communication: This criterion is used to evaluate the effectiveness of communication between project participants [3].

PPMS receive the above data online and provide the Project Performance Appraisal report based on the planned methods. Of course, it should be noted that PPMS has a series of performance indicators for each of the above eight classes and subjects and detailed information about these detailed indicators is entered into the program [1].

Senior managers use the term the total success of the project to describe subjectively and objectively evaluate the achievements of their projects; but, there are different opinions to evaluate the success. There are multiple stakeholders in projects (organization managers, project managers, project teams, and end users). Each of these views is influenced by nationality, culture, interests related to fear, hope, motivation, etc. In this article, a general project evaluation model is presented, that is, it is not dependent on the type of project. The model allows it to be implemented in any type of project. Now managers can use the most appropriate scale to measure the success of the project to address their focus. For example, managers can use Project Management Success (PMS) to evaluate the performance of the project manager, Project Ownership Success (POS) to evaluate the performance of the project owner, and Project Investment Success (PIS) to evaluate the value of the project. In addition, actions can determine the effectiveness of project selection and strategy implementation [3].

On the other hand, identifying factors of the success of construction projects and criteria is one of the most important issues in project management. The lack of sufficient and comprehensive understanding of the success factors of the project makes it difficult to control, monitor, and how projects work. But the distinction between the success criteria and the success factors is also very important. The critical success factors of a project include areas of activity that bring favorable results to a specific manager to achieve goals [16]. The success factors of the project are things that must go well to guarantee success for the managers and the organization [2]. Zou et al have identified 7 success factors and 6 success criteria. The success factors are planning of construction activities, design planning, the commitment of senior executives, defining the objectives, motivation of the project team, technical capabilities of the project manager, control systems, and definition of work and work scope. The six success criteria are budget performance, schedule performance, client satisfaction, task orientation, contractor satisfaction, and project team manager satisfaction [24].

In their research, Sadegh Amalnik et al. [21] presented a model for predicting the success rate of construction projects by combining the technique of designing gray Taguchi and taxonomy experiments. In the gray taxonomy method, the rate of progress of construction projects predicted that LSF structures play an important role in the rate of progress of projects due to the increase in the speed of projects. In a research titled the factors affecting the Selection of the Type of construction projects contracts and their success rate in Iran, Salehi and Lork [22] discussed

the criteria considered by the contractor and the employer in the selection of the type of contract and were distributed as a questionnaire in the form of a fuzzy technique among the experts of the statistical population. Based on their output, the desired criteria were ranked. In their research, Etezadi and Lork [10] showed the causes and effects of delays in construction projects (case study: mass housing projects). Based on the research results, better solutions can be considered by identifying the factors that have been the most repeated in creating delays in projects.

In a study by Hosseini et al [12], they identified and prioritized the key success factors of construction projects. To prioritize factors and groups using an analytic hierarchical process (AHP), first, a hierarchical model was created and then the matrix of pairwise comparisons was given as input to Expert Choice software with the opinion of experienced experts in this field. Finally, based on the results obtained from the analytic hierarchical process (AHP), the final prioritization of the main key success factors of the country's construction projects was determined.

In their study, Mukhtar et al. [18] examined critical success factors (CSFs) for public housing projects (PHPs) in Nigeria. This study identified 7 critical success factors for public housing in Nigeria. These factors are (1) institutional framework for public housing, (2) availability of competent personnel, (3) effective project management, (4) good maintenance management practice, (5) appropriate design and good location, (6) effective housing finance system and (7) adequate political support. The critical success factors developed in this study can serve as a guide for housing policymakers, public housing developers, and project managers to successfully achieve public housing in Nigeria.

In their research on critical success factors influencing the performance of construction projects, Das and Ngacho [9] did an empirical study on Constituency Development Fund projects in Kenya. Findings reveal that items constituting these six factors represent six CSFs including project-related, client-related, consultant-related and contractor-related, supply chain-related, and external environment-related factors. The findings of their study are also related to development projects in other developing countries.

Ika and Donnelly [13] studied the success conditions for international development capacity-building projects. A hypothesis was stated that high levels of multi-stakeholder commitment, collaboration, alignment, and adaptation are necessary for projects to succeed.

3 Methodology

In terms of the nature of the research, the present research is an exploratory study. As its name suggests, an exploratory study seeks to discover things that happen and the main research question is about them. This method is especially useful when there is not enough knowledge about a phenomenon. Therefore, the exploratory method can lead to a decision about whether the topic is worth to be investigated or not. The exploratory method can be done by reviewing the literature, talking to experts in the relevant field and conducting interviews with individuals or groups, reading various texts and writings, consulting with professors and experts, etc. Exploratory research is non-experimental and based on observation. In other words, the researcher only observes the variables without changing them. In such studies, the discovery of relationships is studied without the manipulation of variables. The main goal in exploratory research is to know a situation about which there is no necessary information. In other words, in this research, the researcher seeks to obtain information by which one can understand the subject of the research well. Accordingly, any research requires conducting a series of exploratory studies, that is, exploratory research is a field for conducting more important and extensive research. Therefore, the task of exploratory research is not to deal with the research hypotheses, nor to collect information about the research problem, but it creates a suitable context for a better understanding of various phenomena or a specific problem that the researcher lacks sufficient information about.

One of the qualitative research strategies is a case study. The case study method is one of the most common qualitative research strategies. This approach is not a method or procedure but it is a kind of research strategy. Within this strategy, several methods are used. These methods may be quantitative, qualitative, or a combination of all methods. Although case study is often based on qualitative methods, it cannot be defined only through qualitative research techniques but it must be defined in terms of its theoretical orientation. In this strategy, the emphasis is not on separating the context from the research subject, but rather on seeing the subject in the research context. Due to the opportunity of an open investigation, most case studies can extract inductive methods of research, which aim is to theorize and construct a hypothesis, not to test it. The use of case studies as one of the research strategies in social science studies, especially in small-scale research, is increasing rapidly. The purpose of the study is to establish a bridge between library studies on the one hand, and real-life information on the other hand, so that scientific principles and theories are used in life. A case or thesis is a written account of the research that has already existed and is not an artificially created situation. In addition, it is not similar to experimental research where variables are manipulated

to measure the effect of a specific element. A case study is an in-depth and multidimensional investigation that is done using qualitative research methods on a social phenomenon. The data collection tool of this research is the interviewing method. The snowball sampling method has been used where consulting with knowledgeable people leads to introducing suitable research cases by them. To analyze the data from the methods, thematic analysis, and thematic network analysis have been used. In terms of research strategy, the current research is a single-case study about large national projects, and the research intends to answer these questions: 1- Which factors are effective on the success of construction projects in Iran? 2- To what extent are factors related to human resources, political and economic issues, project management, project organization and partners, provision of project equipment, and technical and professional factors of the project affecting the success of construction projects in Iran? 3- What factors are there critical factors affecting the success of construction projects? 4- To what extent are critical factors affecting the success of construction projects in Iran? 5- What is the status of construction projects in Iran from the point of view of the above issues?

4 Findings

To analyze qualitative data from thematic analysis and among different methods, the thematic network analysis method is used. In the definition of theme, it can be said as follows: "Theme is a pattern that is found in the data which describes, organizes, observes and interprets aspects of the phenomenon. This method is a unified way for analyzing textual data and transforms diverse and scattered data into technical and detailed data." [8]. Thematic analysis is done in different ways, in this research; the thematic network (to show the relationship and dependence of themes) was used.

4.1 Presentation of the thematic network

The purpose of the thematic network is to create a relationship between the generated categories. This action is usually done based on the paradigm model and helps the theoretician to carry out the theorizing process easily. In Table 1, basic themes, organizing themes, and global themes are mentioned in the nine categories of the country's information and spatial data integration requirements. Unrelated themes were removed and some related themes were merged and a total of 41 organizing themes were produced.

Table 1: Presentation of themes

Organizing themes	Basic themes	Global themes
Correct and timely decision making	The factors affecting the success of construction projects in Iran	
Clear and realistic objectives for the project		
Project planning		
Competence of the project manager		
Previous experience with the project team		
The competence of the team/ project management		
Clear and precise goals of the customer		
Project value		
The complexity and uniqueness of the project		
Project manager experiences		
The employer's ability to make timely decisions		
Implementation of effective policies		
Allocation of completed residential units to the target		
Accurate and calculated schedule		
Coherence and coordination in project operations		
project schedule management		
project management		
Integration between project team staff in decision-making stages		
The presence of responsible, experienced, and specialized people		
Compliance with the safety of employees		
Staff training		
Project human resource management		
Acquaintance and expertise of experts in the process of producing documents and transferring information to departments		
Manpower distribution method and mechanism at different time points of projects		
Paying attention to the factors related to personnel errors and mistakes		

Human, political, and economic issues, project management, project organization, and partners, provision of project equipment, and technical and professional factors of the project

Good leadership of the project manager	
Qualification of project team members	
Good coordination between project participants	
Senior management support	
Obligations of the participants in the project goal meeting	
Project financing instructions	
Project cost management	
Attention to labor strikes	
Paying attention to the problems in the country's industry or economy	
Paying attention to changes in the banking system and related guarantees or laws	
Paying attention to problems related to the global economy	
Paying attention to appropriate loan sources	
Paying attention to sudden changes in material prices	
Employee salary and benefits determination system	
Paying attention to (national and international) social changes	
Appropriate estimate of the financial capacity of the entire group and sponsors of the project	
Taking into account interest rate	
Taking into account inflation changes	
Taking into account stock price changes	
Taking into account the change in the tax rate	
Taking into account the Payback period rate (or incorrect estimate)	
Existence of competitive invitation to tender system	
Comprehensive and flawless contract	
Management of project stakeholders	
Participation of stakeholders in the project	
Failure of the employer to pay attention to contractual obligations	
Apply personal style	
Lack of attention to value engineering	Critical factors affecting the Success of construction projects in Iran
disorganization executive agents	
Non-transparent division of tasks between teams	
Lack of transfer of personal experiences	
Recruiting inefficient forces	
An incorrect estimate of operational costs	
Doing things incorrectly and increasing rework	
Not using advanced and up-to-date technologies	
Forming a team appropriate to the project	
Team spirit and knowledge of teamwork ethics	
Team spirit and knowledge of teamwork ethics	
Empowering the management team	
Belief in customer satisfaction	
Attention to fortuitous events (such as floods and earthquakes)	
Detailed geology of the project	
Paying attention to environmental pollutants	Necessities of construction projects in Iran
Attention to man-hour proportionality	
Project procurement management	
Supplying labor, materials, and machinery	
Project risk management	
Predicting delays in projects	
Effective control system	
Adequate use of communication between project participants	
Clarity of project objective for the project team	

In the thematic network stage of the current research, the relationship between the main category and other categories was determined. At this stage, the main category and sub-categories were connected to collect theoretical concepts to identify the factors affecting the success of large national projects. These actions allowed the researcher to integrate the concepts obtained in the previous stages and use them to present the thematic network.

4.2 Searching themes

In this section, to check the importance of each of the organizing themes in each basic theme, experts were surveyed and the most important categories were selected and placed in the thematic network model.

Table 2: presentation of themes

Basic themes	Organizing themes	Theme weight	Theme status	
The factors affecting the success of construction projects in Iran	Correct and timely decision making	3	Confirmed	
	Clear and realistic objectives for the project	3	Confirmed	
	Project planning	2	Rejected	
	Competence of the project manager	3	Confirmed	
	Previous experience with the project team	2	Rejected	
	The competence of the team/ project management	2	Rejected	
	Clear and precise goals of the customer	2	Rejected	
	Project value	1	Rejected	
	The complexity and uniqueness of the project	1	Rejected	
	Project manager experiences	2	Rejected	
	The employer's ability to make timely decisions	3	Confirmed	
	Implementation of effective policies	1	Rejected	
	Allocation of completed residential units to the target	1	Rejected	
	Accurate and calculated schedule	1	Rejected	
	Coherence and coordination in project operations	1	Rejected	
	project schedule management	3	Confirmed	
	project management	2	Rejected	
	Human, political, and economic issues, project management, project organization, and partners, provision of project equipment, and technical and professional factors of the project	Integration between project team staff in decision-making stages	1	Rejected
		The presence of responsible, experienced, and specialized people	2	Rejected
		Compliance with the safety of employees	2	Rejected
Staff training		3	Confirmed	
Project human resource management		2	Rejected	
Acquaintance and expertise of experts in the process of producing documents and transferring information to departments		1	Rejected	
Manpower distribution method and mechanism at different time points of projects		1	Rejected	
Paying attention to the factors related to personnel errors and mistakes		1	Rejected	
Good leadership of the project manager		1	Rejected	
Qualification of project team members		1	Rejected	
Good coordination between project participants		2	Rejected	
Senior management support		2	Rejected	
Obligations of the participants in the project goal meeting		2	Rejected	
Project financing instructions		2	Rejected	
Project cost management		3	Confirmed	
Attention to labor strikes		1	Rejected	
Paying attention to the problems in the country's industry or economy		1	Rejected	
Paying attention to changes in the banking system and related guarantees or laws		1	Rejected	
Paying attention to problems related to the global economy		1	Rejected	
Paying attention to appropriate loan sources		1	Rejected	
Paying attention to sudden changes in material prices	3	Confirmed		
Employee salary and benefits determination system	1	Rejected		
Paying attention to (national and international) social changes	1	Rejected		
Appropriate estimate of the financial capacity of the entire group and sponsors of the project	2	Rejected		
Taking into account interest rate	2	Rejected		
Taking into account inflation changes	3	Confirmed		
Taking into account stock price changes	1	Rejected		
Taking into account the change in the tax rate	1	Rejected		
Taking into account the payback period rate (or incorrect estimate)	1	Rejected		

Critical factors affecting the Success of construction projects in Iran	Existence of competitive invitation to tender system	2	Rejected
	Comprehensive and flawless contract	2	Rejected
	Management of project stakeholders	3	Confirmed
	Participation of stakeholders in the project	2	Rejected
	Failure of the employer to pay attention to contractual obligations	3	Confirmed
	Apply personal style	1	Rejected
	Lack of attention to value engineering	3	Confirmed
	disorganization executive agents	1	Rejected
	Non-transparent division of tasks between teams	1	Rejected
	Lack of transfer of personal experiences	2	Rejected
	Recruiting inefficient forces	1	Rejected
	An incorrect estimate of operational costs	2	Rejected
	Doing things incorrectly and increasing rework	1	Rejected
	Not using advanced and up-to-date technologies	3	Confirmed
	Necessities of construction projects in Iran	Forming a team appropriate to the project	2
Team spirit and knowledge of teamwork ethics		2	Rejected
Empowering the management team		3	Confirmed
Belief in customer satisfaction		1	Rejected
Attention to fortuitous events (such as floods and earthquakes)		2	Rejected
Detailed geology of the project		2	Rejected
Paying attention to environmental pollutants		3	Confirmed
Attention to man-hour proportionality		1	Rejected
Project procurement management		1	Rejected
Supplying labor, materials, and machinery		2	Rejected
Project risk management	3	Confirmed	
Predicting delays in projects	2	Rejected	
Effective control system	3	Confirmed	
Adequate use of communication between project participants	1	Rejected	
Clarity of project objective for the project team	2	Rejected	

4.3 Extracting the final model from basic themes, organizing themes, and global themes

This section deal with the way to analyze the data and extract basic themes, organizing themes, and global themes from the raw data from the interviews shown in the above table. After conducting the interviews, the quotes that were explicitly or implicitly related to the research questions were selected and then basic themes, organizing themes, and global themes were extracted from them. The form of the thematic network consists of 17 organizing themes arranged into 4 main global themes that have been identified from the beginning. The thematic network is shown in Fig. 1. As it can be seen, in drawing the thematic network, global themes and organizing themes are enough arranged under global themes.

5 Discussion and conclusion

One of the most common surveys in the operational phase of the mixed model is the implementation of semi-structured interviews with some experts. To conduct interviewing, the selection of qualified members for the interviewing panel is considered an important step. Contrary to what is common in quantitative surveys, experts are not selected based on probability sampling because the interviewing process requires qualified experts who have a deep understanding and knowledge of the research topic. One of the methods used to select experts is purposive sampling which is based on the assumption that the knowledge of the researcher is enough to select the panel members. This method was used according to the author's experience and scientific expertise on the subject. Therefore, in this study, 18 experts in industrial engineering and construction project management, who are experts in the field of research, were selected.

At first, the concepts and key points obtained from the main concepts from reviewing theoretical literature and the background of the research conducted inside and outside the country were examined and listed through semi-structured interviews in several provinces. Then, the categorization of phrases, concepts, and items extracted by detailed analysis and homogenization (choosing more correct words, removing common concepts) was done and 75 codes were obtained. The obtained codes were prepared in the form of a checklist and some of the items were removed and modified in consultation with experts. In the next step, after continuous comparison of the answers obtained from interviewing, similar answers were arranged and similar concepts were extracted from them. At the same time, items close to each other were integrated and placed in 4 categories. In the last stage, the categories of the fourth level (axial categories)

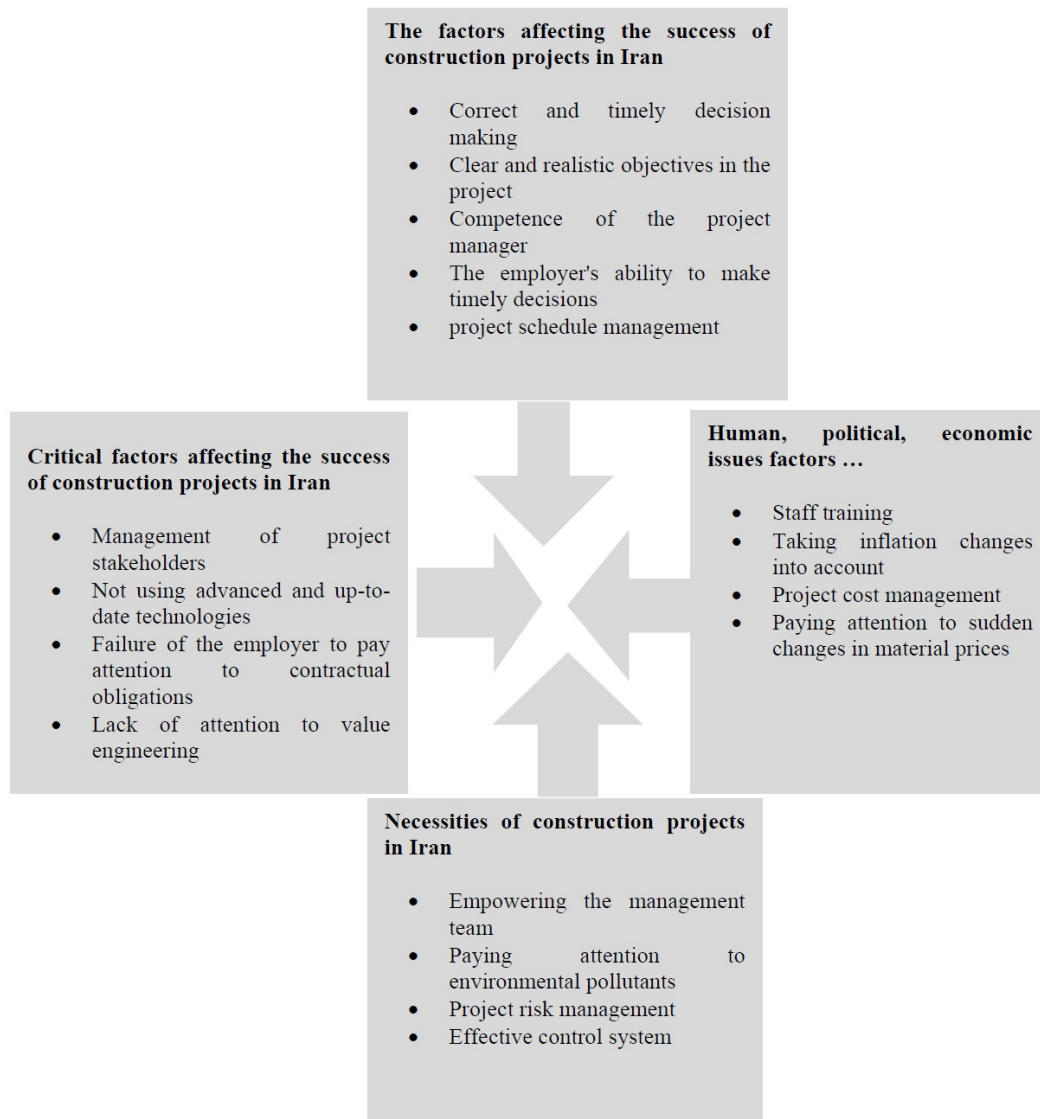


Figure 1: Thematic network of the research

and the third level were refined and selected until the thematic network was extracted. Finally, these categories were classified into four classes according to the final research model.

Without proper project management and planning, projects will be confused and routine. Proper project management and planning give purpose, motivation, and direction to projects. It increases the predictability of activities and the organization and people involved in the project know that the purpose of these successive steps is to achieve a predetermined goal. Today, project management is very well developed and widely used by organizations to achieve their business goals. Since most organizations define their activities as projects, the demand for project managers increases, and this increasing trend of demand has caused motivated organizations to attract competent and efficient managers. A senior manager says: The key to the success of projects is to use a committed and experienced manager. The results of this section are in line with the results of studies done by Sadegh Amalnik et al. [21] and Salehi and Lork [22].

The next important factors include paying attention to sudden changes in material prices, paying attention to the problems in the country's industry or economy, paying attention to problems related to the global economy, and taking into account inflation changes. The increase in the cost of project implementation is one of the issues that always harm the success of the project and directs the economic enterprise toward a crisis. Trying to implement projects by optimizing three main indicators, namely time, cost, and quality, is one of the main goals of project managers and investors. Cost management includes three main stages, namely estimation and planning, providing financial resources,

and control over project cost performance. In the first stage, correct forecasting and estimation of the project costs and in the second stage, controlling the actual performance of the cost is one of the important goals to control the full price of the project. This issue has a great impact on the success or failure of the project. Therefore, according to the knowledge gained from the completed projects as well as the experience of experts, it is possible to identify the factors affecting the increase in the full price of the project and give solutions for it. The important reasons for the increase in the cost of project implementation include delays in project implementation, delays in estimating project volumes, many changes in the project and high inflation during the project implementation, weakness of design, contractor, or supervision in the project, and overhead factors of the projects.

One of the most important reasons for the increase in construction project costs is the delay and lack of proper progress in the project. According to the statistics published by the Organization of Management and Planning in 2015, the average completion time of national projects in the country was nearly 22.2 times the planned time. An increase in the duration of the project implementation means an increase in executory costs, an increase in losses due to the cost of lost opportunities, and a decrease in the value of the completed project, and of course, considering the problem of modification factors on excusable and non-excusable delays, which can also cause losses to the contractor. The project can be planned using project management software and existing standards such as PMBOK. The presence of project planning and control experts is very important in this matter; because it is possible to define corrective measures in the project using the available tools and techniques with timely analysis.

Estimating project volumes is one of the project management tools and this tool is the basis for estimating the full price of the project. If the required resources are limited, estimating the volumes at the beginning of the project provides this opportunity for the project managers to change and modify the plan limits and prevent losses due to the lack of resources during the implementation of the project and or the progress of executive operations is done according to the schedule after specifying the number of required resources. Unfortunately, due to many changes and delays in the finalization of the plans, project implementation policies are affected in terms of the full-price perspective. Change is an inevitable part of any project, lack of proper management of changes is one of the most important factors of project failure which raises project executory costs. Factors such as mistakes in initial estimates, technology changes, and product market conditions are effective in creating changes in a project. In project management, project change can cause a significant change in the duration of the contract and the total direct and indirect costs or both. The changes must be managed according to a correct process to see their positive effects on the project. The prolongation of the decision-making time on the project changes affects both the project implementation schedule and other project activities. It increases contracting costs and erodes the process of doing the work.

If inflation is considered as an unusual increase in prices in a certain period, it must be said that this event in the construction industry, especially in projects whose implementation is unusually longer than the predicted time in the contract, has significant effects in increasing project executory costs and it can also be a reason for a claim. The most important factor in reducing this risk is to complete the contract within the agreed period. The prolongation and delay in the implementation of the contractual content of the executive contractors on the project causes an increase in the expected costs and has a direct effect on the increase in the full price of the project. One of the ways to reduce the effect of inflation on the full price is to change the concept and specifications of the project items. Of course, it should be considered that this may lead to a change in the quality of the project product. The results of this section are in line with the results of Sadegh Amalnik et al. [21] and Das and Ngacho [9] investigations.

Among the critical factors affecting the success of construction projects in Iran, the lack of using advanced and up-to-date technologies was the most important factor. In other words, technology is changing and improving every day so it has entered into a new field. Like other fields, the construction industry is experiencing such technology and all kinds of innovations and new ideas are being implemented in it so that they have helped to improve the quality of construction. It can be said that construction technology is a set of methods and applications of technology in construction that helps to optimize the performance of projects in this field. It can be said that these technologies entered the construction process when the high waste of energy was felt in traditional structures, and today the way of using materials is in such a way that the available energies are optimized. However, modern technologies have seriously entered the construction industry for 10 years. Recent studies have shown that with the introduction of construction technology, the productivity of the construction industry can be increased by 30 to 45 percent. These days, even international institutions have entered this area and every day more conferences are held in this field and interesting ideas are proposed in this regard. This innovation and new ideas will increase the useful life of buildings soon while fewer costs will be paid for their maintenance and repair. The results of this section are in agreement with those of Etezadi and Lork [10] and Mukhtar et al. [18] studies.

To express the importance of assessment in risk management in construction projects, one should pay attention to project conditions. Few industries face the same risks as construction. The risk of any event is likely to dismiss the plans

from the schedule. Calculating any possible risk in the construction project is very challenging. If the construction is compared with other industries, it quickly becomes clear why risk management is much more complicated for the constructor. Other sectors also face relatively stable or predictable risks. For example, the biggest threat to manufacturing projects is supply shortages or labor problems. Meanwhile, the biggest agricultural concerns are related to weather and pests, but construction is much more unpredictable in nature. The results of this section are parallel with those of Hosseini et al. [12] and Ika and Donnelly's [13] studies.

References

- [1] Z. Alias, E.M.A. Zawawi, K. Yusof, and N.M. Aris, *Determining critical success factors of project management practice: A conceptual framework*, Proc.-Soc. Behav. Sci. **153** (2014), 61–69.
- [2] H. Alinaitwe, R. Apolot, and D. Tindiwensi, *Investigation into the causes of delays and cost overruns in Uganda's public sector construction projects*, J. Const. Dev. Count. **18** (2013), no. 2, 33.
- [3] J.I. Alzahrani and M.W. Emsley, *The impact of contractors' attributes on construction project success: A post construction evaluation*, Int. J. Project Manag. **31** (2013), no. 2, 313–322.
- [4] M. Amberg, F. Fischl, and M. Wiener, *Background of critical success factor research*, Friedrich-Alexander-Universitat Erlangen-Nurnberg Work. **2** (2005).
- [5] M. Bahadori Koosji Zare, A.R. Mirjalili, and M. Mirabi, *Ranking and evaluation of factors affecting the success of the management team of construction projects*, Int. Conf. Archit. Urban Plan. Civil Engin. Art Envir. Future Horizons, looking at the past, Tehran, Conference Permanent Secretariat, 2015.
- [6] J.M. Brill, M.J. Bishop, and A.E. Walker, *The competencies and characteristics required of an effective project manager: A web-based Delphi study*, Educ. Technol. Res. Dev. **54** (2006), 115–140.
- [7] S.O. Cheung, H.C. Suen, and K.K. Cheung, *PPMS: A web-based construction project performance monitoring system*, Autom. Const. **13** (2004), no. 3, 361–376.
- [8] V. Clarke and V. Braun, *Using thematic analysis in counselling and psychotherapy research: A critical reflection*, Counsell. Psycho. Res. **18** (2018), no. 2, 107–110.
- [9] D. Das and C. Ngacho, *Critical success factors influencing the performance of development projects: An empirical study of constituency development fund projects in Kenya*, IIMB Manage. Rev. **29** (2017), no. 4, 276–293.
- [10] S. Etezadi and A.R. Lork, *Causes and effects of delays in construction projects (Case study: Mass housing projects)*, 4th Int. Cong. Civil Engin. Archit. Urbanism, Tehran, Conf. Permanent Secretariat, University Shahid Beheshti, 2016.
- [11] M. Fathi and M. Najafian, *Studying the causes of delays in construction projects in Kermanshah Province*, First Nnat. Conf. Const. Engin. Manag., 2009.
- [12] S.M.A. Hosseini, H.A. Mosalman Yazdi and M.R. Mosalman Yazdi, *Identifying and prioritizing the key success factors of construction projects*, Third Nat. Conf. Const. Materials and new Technol. Construction Industry, Islamic Azad University of Meybod, 2015.
- [13] L.A. Ika and J. Donnelly, *Success conditions for international development capacity building projects*, Int. J. Project Manage. **35** (2017), no. 1, 44–63.
- [14] K. Khorshidi, *Evaluation of project success factors in companies active in the field of energy: A case study of Mapna group*, Master Thesis, Sharif University of Technology, Tehran, 2008.
- [15] C.S. Lim and M.Z. Mohamed, *Criteria of project success: An exploratory re-examination*, Int. J. Project Manage. **17** (1999), no. 4, 243–248.
- [16] W. Lu, L. Shen and M.C. Yam, *Critical success factors for competitiveness of contractors: China study*, J. Const. Eng. Manage. **134** (2008), no. 12, 972–982.
- [17] S. Moradi, H. Arbabi, and Y. Gholdust Jouibari, *Factors affecting the success of the project*, Int. Conf. Res. Sci. Engin., 2016.
- [18] M.M. Mukhtar, R.B. Amirudin, T. Sofield, and I.B. Mohamad, *Critical success factors for public housing projects*

- in developing countries: A case study of Nigeria*, *Envir. Dev. Sustain.* **19** (2017), 2039-2067.
- [19] T. Rafiei and H. Shirouyehzad, *Identifying and prioritizing the main factors of the success of construction projects*, Second Nat. Ind. Engin. Sustain. Manag. Conf., 2012.
- [20] S. Rahimi Monshi, *Project Management (Especially for Construction Management) Including: "Project Management"/"Construction Project Management"*, Sarfaraz press, 2016.
- [21] M. Sadegh Amalnik, A. Ansarinejad, S. Ansarinejad, and S. Miri Nargesi, *Finding cause and effect relationships and ranking critical factors affecting the success or failure of information systems implementation projects is using the combination of ANP and group fuzzy DEMATEL methods*, *J. Indust. Eng.* **44** (2010), no. 2, 195–212.
- [22] R. Salehi and A.R. Lork, *Factors affecting the selection of the type of construction projects contracts and their success rate in Iran*, 4th Int. Cong. Civil Architect. Urban, Tehran, Permanent Secretariat of the Conference, Shahid Beheshti University, 2016.
- [23] A. Sanayei, F. Amiri, and O. Ganji Bidmeshk, *The relationship between organization marketing competencies and project management success in construction companies*, *Bus. Manage. Persp. (Manage. Persp. (Management Message))* **11** (2012), no. 11.
- [24] W. Zou, M. Kumaraswamy, J. Chung, and J. Wong, *Identifying the critical success factors for relationship management in PPP projects*, *Int. J. Project Manage.* **32** (2014), no. 2, 265–274.