Providing a Framework for the Success of Construction Projects in Iran Focusing on National Mega-Projects

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Abstract
This study was conducted to provide a framework for the success of construction projects in Iran focusing on national mega-projects. The statistical population included the contractors of national mega-projects.The statistical sample size was estimated to be 327 people using Cochran's formula.Data were collected using a 65-item researcher-made questionnaire, the face and content validity of which was confirmed by 10 experts, and its reliabilitywas higher than 0.7 for all variables in a preliminary test on 30 subjects, which is acceptable.Descriptive and inferential statistical methods and regression tests were used in SPSS software to analyze the data.65 indicators in the form of 6 general components were identified for contractors after reviewing studies on the factors affecting the success of construction projects.Questionnaires in which the extent of the impact of each of these components and indicators were assessed were distributed among the statistical population.Findings indicated that factors concerning human resources, factors concerning political and economic issues, factors concerning project management, factors concerning the organization and project partners, factors concerning project equipment supply, and technical and professional factors affected the success of construction projects in Iran.
Keywords: htsuccess of construction projects in Iran, factors concerning human resources, factors concerning political and economic issues, factors concerning project management, factors concerning the organization and project partners, factors concerning project equipment supply, technical and professional factors.

Tob Regul Sci.™ 2022; 8(1): 1069-1096
DOI: doi.org/10.18001/TRS.8.1.88

1. Introduction

Today, many advances have been made in all different fields of science(A Rahmaniet al., 2010), (O Rahmani Seryasatet al., 2016), (OR Seryasat, J Haddadnia, 2017). Defining a set of critical success factors (CFSs) and preparing a checklist to evaluate the contractor's performance in construction projects, especially the construction industry, is a requirement for employers in the construction industry in today's competitive world.Common outputs, such as the completion of a project on schedule, within a defined financial framework, and with the desired quality, are the basic needs of the employer and can no longer be considered as criteria for measuring the good

performance of the contractor.There are many factors referred to as CSFs that act as project input and can lead to the desired output for the project, which is compliance with the schedule, cost, and quality.So, those contractors who want to have a place in today's competitive market and cooperate and interact with employers for a long time must pay attention to these CSFs.CSFs and organizational competencies are the integral pillars of management systems and strategic planning.Identifying critical success factors and determining their place in the company's scorecard are among the pillars of popular strategic performance management systems. CSFs formulate the short-term strategies of the organization.On the other hand, identifying competencies is one of the sources of formulating the main organizational strategies and leads the organization to acquire a core competency.A project manager must identify and control the CSFs. Recognizing these factors contributes to the success of the project, and not providing them increases the likelihood of project failure.These factors exist and are not created, but must be identified and discovered at various organizational or environmental layers of the project.

Industry, organizations, as well as managers at various organizational levels, are the most important sources for extracting these factors.Useful and necessary information systems can be provided for decision-making in different phases of the project and the success of the project can be achieved in different phases by identifying the CSFs. Identifying and managing CSFs ensures the achievement of the strategic goals of the industry, organization, and project at the budget and time level and the success of the various parties to the project.The development plans of each country are one of the characteristics of the economic development of the country so that the cycle of affairs is completed optimally with the lowest cost and the highest profit.Therefore, the success of a country's development plans determines the progress, welfare, and excellence of the people of that country (Hosseini et al., 2015).A distinctive feature of construction projects and, in general, housing projects is the different conditions of each of them.Some factors such as the type of system implemented in the building, type of materials, method of implementation, use, the status of resource allocation, etc. have received much attention today.Researchers have begun extensive studies on identifying the success factors of each type of project according to their nature over the past decade (Sunindijo, 2015).

A construction project is a combination of various planned or unplanned events that occur during the project life cycle and continue to live under the influence of changes in the environment.Meanwhile, some factors are doubly important in the success or failure of a project.They are known as project success factors (Vazifeh Doost et al., 2015).

One of the most important issues in project management is identifying the success factors of construction projects.Lack of sufficient and comprehensive knowledge of project success factors makes it difficult to control and monitor project performance. So, identifying the factors affecting the failure or success of projects by managers, employers, and executives appropriate to the type of project can provide a good framework for evaluating and reviewing project outputs.Besides, understanding the success factors in housing projects can help manage the

proper allocation of resources over the life of the project (Yamin and Sin, 2016).Lim and Mohamed (1999) defined project success factors as a set of environmental, factual, or influential factors that can affect project outputs.These are the factors that can speed up or hinder a project. They can lead to project success or failure but cannot be the basis for project evaluation (Cserhati and Szabo, 2014).According to the American Academy of Project Management (AAPM) (2013), project success can be defined as completion by time, cost, quality, constraints, resources, and risks.Atkinson (1999) argues that metrics for measuring project success require an iron triangle of time, cost, and quality (Yamin andSin, 2016).However, Shenhar (2001) suggested that the scale for measuring success should go beyond the iron triangle and include items such as project efficiency, effect on the customer, business, direct success, and preparation for the future.Baccarini (1999) used the logical framework method as a basis for determining project success and differentiating project success into two components, project management success (time, quality, and stakeholder satisfaction) and product success (meeting with strategic organizations, goals, user satisfaction, profitability, and market share).

The concept of project success became more advanced when the two distinctions between project success versus project management success and success metrics against success factors were demonstrated by Cooke-Davies (2002).Ika (2009) defines project success as hexagonal, including the six components of time, cost, quality, achievement of strategic goals, end-user satisfaction, and other stakeholder satisfaction.In a study by Morris and Hough (1987), the early development of a comprehensive framework that is a prerequisite for project success was provided.According to them, the basic parts of this comprehensive framework include elements such as attitudes, project definition, external factors, organizational budget, contract strategy, program, communication, control, quality of human life, and resource management.Morris and Hough(1987) suggest that success should be measured in objective and subjective dimensions.Moreover, they argue that success may vary at different points in the project life cycle and that success depends on the perspective of stakeholders.These findings reflect new expressions of the widespread need to understand the effectiveness of project success (Drouinet et al., 2013).Expanding the concepts proposed by Morris and Hough(1987), de Wit (1988) argued that the factors affecting project success are prerequisites for the success or failure of similar projects with the hygienefactors of Herzberg's motivation-hygiene theory. He holds that the presence of successful factors may lead to project success, but the lack of success factors may lead to project failure (Ika, 2009).

Although there are various definitions of project success, researchers believe that project success is achieved primarily through efficiency and effectiveness. However, project success is relatively subjective.Success and its criteria must be perceived in terms of a set of standards or principles.Perhaps this is why Baker et al. (1974) thought that project success can only be perceived and can never be absolute (Ika et al., 2012; Yamin et al., 2016).The developed countries of the world today use new methods and technologies of construction. This has led to the construction of housing projects with high speed and quality and reasonable cost.Adherence

to the correct principles of project management and the application of the necessary standards, such as the project management knowledge system or PMBOK in these countries has caused these projects to be at high levels of desirability in terms of time, cost, and quality.In developing countries such as Iran, construction in most small towns still relies on traditional methods. Unfortunately, this has not had the desired result, and a large number of Iranians suffer a lot of financial and human losses every year due to earthquakes and the destruction of residential structures (Radfar and Dastyar, 2016).Today, the tendency to use modern technologies and identify critical success factors in housing projects in Iran has increased due to population growth, increasing need for housing, the inefficiency of conventional construction systems in the country to produce fast and high-quality housing, non-earthquake resistant structures.One of the main goals of using modern methods is to accelerate and improve the quality of construction.In many executive plans, the speed of executive operations plays a decisive role in choosing the construction method (Yamin and Sim, 2016).Examining traditional building systems in Iran, it can be seen that most of these systems cannot build the building in a short time with high quality and strength.Cheap and economical implementation of construction projects is possible using modern construction technologies due to the high productivity of production factors and process repetition.However, the use of modern methods requires efficient project management and full knowledge of the success factors in the project to make the optimal use of both world-class technologies and domestic capabilities of Iran and produce cheap houses with desirable living standards in a shorter time.Understanding the success factors of construction projects can help significantly in managing the allocation of appropriate resources throughout the life of the project (Ahadzieet et al., 2008).In this regard, this present study was conducted to identify CSFs in construction projects in Iran.

2. Theoretical Foundations

2.1 Project success

The development plans of each country are one of the characteristics of the economic development of the country so that the cycle of affairs is completed optimally with the lowest cost and the highest profit.Therefore, the success of a country's development plans determines the progress, welfare, and excellence of the people of that country ((Shakeriand Ghorbani, 2005).One of the most important issues in project management is identifying the success factors of construction projects.Lack of sufficient and comprehensive knowledge of project success factors makes it difficult to control and monitor project performance. So, identifying the factors affecting the failure or success of projects by managers, employers, and executives appropriate to the type of project can provide a good framework for evaluating and reviewing project outputs(Ahadzieet et al., 2008).Project success is a complex and multidimensional concept that can be varied due to different project stakeholders' perceptions of failure or success.The following are some definitions of project success.There are various definitions of success in different dictionaries. The Idiomatic and Syntactic English Dictionary, for example, defines success as the

fact that you got what you wanted and tried to get.The hsilgnE nallimcaM Dictionary defines success as the achievement of something you have planned or tried to achieve.The intersection of the above definitions is usefulness and intentionality.The project success can be defined as the planned and intentional realization of the maximum expectations of the project stakeholders(Amin Hosseini et al., 2015).

Project success is the degree to which project goals and expectations are met, which may include technical, financial, cultural, social, and professional aspects. So, their realization depends on the involvement of certain processes in the project.Lehtiranta et al. (2012) suggest that the success of construction projects depends on the satisfaction of the organization and the company involved in the project.Success, therefore, must be viewed from a perspective beyond traditional criteria such as budget, schedule, and characteristics. The project CSFs arecharacteristics, conditions, or variables that can significantly affect project success if properly controlled and managed.

2.2 Introduction of CSFs

Success is a familiar term in everyday human conversation.However, not all humans can achieve it.Achieving success is very important in the age of industry and information where many affairs are done socially and appropriate and correct decisions cause great satisfaction.Accordingly, managers and those involved are always looking to identify the appropriate solutions to achieve it.CSFs encompass a limited number of areas that have satisfactory results and ensure successful competitive performance between individuals, groups, and organizations. CSFs cover limited key areas in which things must go right so that managers' goals are achieved (Radfer and Dastyar, 2016). CSFs have been defined by some researchers over the past 30 years, most notably by Rockart (1921).Rockat (1971) and Anthony (1928) defined CSFs as a limited number of actions that, if satisfactory, ensure the successful performance of the organization or project.According to Leadker and Bruno (1921), CSFS are characteristics, situations, or variables that, if properly controlled and managed or conform to predetermined standards, greatly affect the organization's success to compete in a particular industry or the successful implementation of a project by the organization.Selvinopinto (1922) argued that CSFs greatly increase the chances of a project being implemented if carefully considered. So, CSFs are fundamental factors in an organizational process or project that managers must focus on to be successful.For this reason, they are referred to as CSFs, that is, issues that are critical to a project's success.The word critical means that if the issues are not properly addressed, the whole process (project or organizational performance) will face a crisis. The key to managers' success is identifying the issues that replace failure with successand are used to assist in the organization's planning process and the development of the project management system (Khazaei, 2014).

For those involved in a project, project success usually means achieving some predetermined project goals, such as time, cost, performance, quality, and safety.However, it should be borne in mind that users and the public do not have such predetermined goals for the project and that

everyone's expectations about project output and perceptions of project success or failure will vary.

Project success factors were first introduced by Rockart (1982) as factors that could predict project success.These factors are divided into different groups by different researchers according to the type and level of the project.Most of these studies have focused on various industries, and a few have focused on the construction industry and construction projects.Studies in this field are mostly at the level of the construction industry and should be expanded to lower levels, i.e., the type of project.According to the literature review, there is no study on the factors affecting the success of space structure projects.Researchers such as Ahadzie(2007) conducted studies on the success factors of mass-production projects.In a study by Chan (2014), the factors affecting the success of construction projects were examined.He categorized these factors into 5 groups: factors concerning project management, equipment supply, factors concerning the project (its nature), project partners, and factors concerning the environment and economic conditions around the project.The project implementation phases should be given special attention to gninimaxe the success factors of construction projects.Some researchers have studied these factors according to the pre-construction, construction, and post-construction phases (Vahidi Arbabi and Malek, 2011).In a study by Dvir Dov (2002) to examine the relationship between project planning and project success, it was found that there is a positive relationship between efforts to set project goals and job requirements and product technical characteristics on the one hand and project success on the other.The researcher stated that no effort should be spared in the initial phase of the project (idea generation) to define the project goals and that this will not be achieved without involving the final stakeholders in the processes.

2.3 The Hierarchy of CSFs

In the implementation of any project, some CSFs must be identified.In a study by Ika et al. (2012) five project success factors were identified including CSF monitoring, CSF coordination, CSF design, CSF training, and CSF organizational environment.

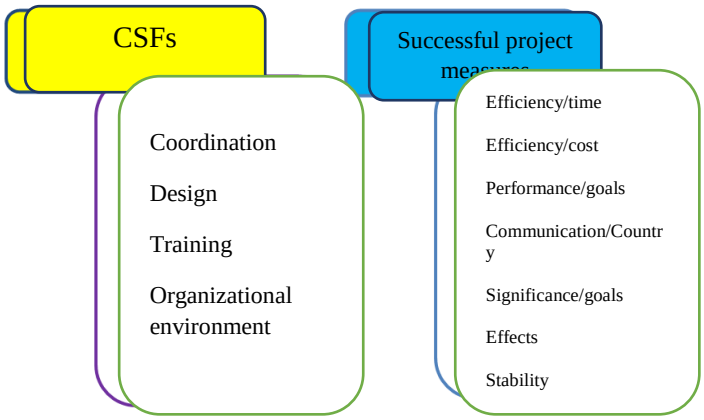

Figure 1. The hierarchy and sources of CSFs (Yamin and Sim, 2016)

2.4 Project CSFs

An organization's project is temporary, and the project manager is traditionally responsible for implementing the project according to three predetermined indicators of time, cost, and project specifications.The more complex the project, the more efficient the management tools used by the project manager.One of these management tools is project risk management, which generally includes 4 steps as follows (Ahmadpour, 2006): 1. risk identification: Identifying project risks and classifying them., 2. risk quantification: Separation of different risks according to their effect on the project, 3. risk response: The use of appropriate contingency planning that is controlled in the event of a risk, 4. risk control: responding to future risks based on the experiences and lessons learned from past risk response programs (Amberg et al., 2005). CSFs and risk management overlap, especially in the identification phase, but there are also differences between them.Both have different emphases on the role of the manager. Risk management sees people as equals, at least in the identification phase.Risk elements emphasize more on technical risks. They usually consider technical or control personnel and pay less attention to political and managerial risks (Ashraf, 2016).

Risk management does not pay much attention to programs and strategies, which are general concerns of management.Everything will go well if risk activities are done.Risk management usually focuses on negative uncertainties and does not address project CSFs.The factors that determine the success of a project sometimes concern the organization and issues such as creativity and teamwork and do not concern technical issues and, therefore, are ignored in project control.So, CSFs appear to be a better management tool than risk management because they provide a standardized process for identifying project success factors.The CSF method is a complete process that consists of focusing, communicating, measuring, and identifying information and its feedback (Etezadi and Lork, 2016).

CSFs have the following benefits:

1. They can reduce organizational ambiguities, i.e., identifying a set of CSFs can reduce the concern of not achieving the organizational goals and serve as a comprehensive and complete guide for managers;
2. They are more reliable than goals. An organization can theoretically have a set of goals that meet the organization's views, but if these goals are poorly defined, there is no guarantee that they will be achieved.Regardless of the quality of the goals set, CSFs reflect what top managers do to achieve the goals;
3. They are very suitable for reflecting the current environment and operational situation of the organization, i.e., they can act as a radar screen for managers and monitor the organization;
4. They can be valuable for path correction. By identifying these factors, managers may realize that what is important to the organization is different from what they thought, and use critical success factors to improve their operations (Odeyinka et al., 2012).

Identifying CSFs helps focus on key issues and tasks.Identifying CSFs as a separate issue may not reflect strategic critical thinking, but when used in conjunction with a planning process, it is

important because it helps the manager determine the factors to focus on(Ika and Donnelly, 2017).

Rockart states that the three main functions of CSFs are as follows: a) assisting managers ot determine the information needed, b) assisting the organization in the overall planning process for annual, long-term, and strategic goals, and c) assisting the organization in the planning process of project management information systems (Babaei and Hosseini, 2014).Dobbins and Donlley describe the uses of CSFs as follows: identifying key managers' concerns, helping develop strategic plans, identifying key factors in each phase of project life and the main reasons for project failure, evaluating the validity of an information system, identifying job opportunities and threats, and measuring the efficiency and power of individuals (Bazan et al., 2011).

2.5 The situation of construction projects in Iran

In a report published to review the budget bill for 2012, the Parliamentary Research Center stated that the process of completing development projects during the years 2002 to 2011suggests that on average, only 28%, equivalent to 134 projects, have been completed out of 473 construction projects that must be completed annually in the country during these years, 72% have not been completed, and a cost equivalent to 95-75 thousand billion tomans has been imposed on the Iranian economy more than the forecast of budget laws.This is about 60 thousand billion tomans or 95-75 thousand billion tomans more than the annual average required to complete projects.On average, 245% of the excess budget is allocated to each project to be completed.In other words, each construction project costs 2.5 times its real price.Some reports indicate that there are 9,080 national development projects and 45,000 semi-finished and ongoing provincial projects in the country.Lack of credit has sometimes contributed to a 36% delay in national and development projects.Another major reason for project delays is the weakness of executive agencies in performing their duties, with a share of 5.8%, due to problems caused by financial and credit failures.Besides, contracting problems are the cause of 4.8% of project delays.This figure is 3.14% in some ministries, including the Ministry of Roads and Urban Development, 2.13% in the Ministry of Industry, Mine, and Trade, and 10% in the Ministry of Energy, which is higher than the national average of 4.8%.In addition to the above causes, there are problems concerning the project site, study, procurement, required machinery, design consultant, and supervisor consultant, each of which accounts for 8, 4, 4, 7, 3, 3, 5, and 1% of the causes of delays in construction projects, respectively (Shakeri et al., 2012).

The conditions of the construction industry in the private sector are not as clear as in the case of construction projects because most construction projects are supervised by non-professional employers and construction companies, and the supervision of urban constructions is limited to the issuance of licenses by the municipality and the supervision of the supervising engineer, which in most cases is formal.Although the situation is slightly different in some cities due to the proper function of the Construction Engineering Organization, in general, it is difficult to judge the private sector (Fathi and Faqih Mirzaei, 2015).

According to what has been discussed, it can be argued that the problems such as not paying attention to the quality of construction, trying to reduce costs by eliminating the necessary costs, and the lack of any work plan in implementation threaten this sector.Construction management in the private sector is mostly traditional, less attention is paid to the principles of project management in this sector, and construction workshops are managed based on the personal experiences of their operators.The above reveals that the construction industry, like any other industry, faces problems and challenges, the main ones of which are as follows (Fathi and Faqih Mirzaei, 2015).

3. Literature Review

In this section, some studies in the field of the subject under review are discussed.For example, in a study by Zanjeerchi et al. (2015), a model was proposed to predict the success rate of construction projects by combining the design technique of Taguchi experiments and gray taxonomy.For this purpose, appropriate criteria were first determined. The weights for each criterion were determined after collecting data using the gray Taguchi method.Among the 17 criteria affecting the development of construction projects, factory production, payments made by the employer, and types of overtime were of greater importance.The rate of progress of construction projects was then predicted using gray taxonomy.LSF structures (referred to as factory production in this study) play an important role in the progress of projects due to the increase in the speed of project implementation.Finally, solutions to increase project progress were presented to company managers.In a study by Salehi and Lork (2019), the factors affecting the choice of type of construction project contracts and their success rate in Iran were investigated.In this study, the generalities of contracts and their advantages and disadvantages were first examined.The criteria considered by the contractor and the employer to select the type of contract were then identified.The criteria were distributed as a questionnaire in the form of a fuzzy technique among the experts of the statistical community.The criteria considered by the contractor and the employer to select the type of contract were ranked.Etezadi and Lork (2016) investigated the causes and effects of delays in construction projects (case study: housing mass construction projects).This is an applied study in which case studies and field methods are used.After reviewing the relevant books, an in-depth content analysis of the documents, records, and reports of the selected projects is performed.By re-examining the identified factors, the most important ones in terms of the number of occurrences from the perspective of the employer, consultant, and contractor are then introduced.The results showed that better solutions can be suggested by recognizing the factors that have the most occurrencein delays in projects. In a study by Hosseini et al. (2015), the CSFs of construction projectserewidentified and prioritized.For this purpose, 58 factors were extracted and classified into 7 groups after reviewing the literature and interviewing experts.Questionnaireswere then designed to collect the opinions of experts in Shiraz construction companies about the importance of each factor.A hierarchical model was created using the AHP technique to prioritize factors and groups.The pairwise

comparison matrix was then given as input to Expert Choice software.Finally, the final prioritization of the main CSFs of construction projects was determined based on the results obtained from AHP.

Mukhtar et al. (2020) examined CSFs for public housing projects (PHPs) in Nigeria.They noted that many developing countries, such as Nigeria, face serious challenges in providing public housing for their citizens.Data were collected using interviews, pilot studies, and questionnaires.Interviews were conducted with housing experts to determine the adequacy and appropriateness of the success characteristics collected from the literature review given the situation in Nigeria. A draft questionnaire was prepared and pre-tested after analyzing the interview results.The final version of the questionnaire was designed after partial editing.The data collection tool was a questionnaire. For this purpose, 550 questionnaires were distributed using stratified sampling techniques.Respondents were construction experts with experience in constructing public housing in Nigeria, working for development companies, consulting firms, contractors, or public housing organizations.Structural equation modeling was used to analyze the data.This study developed seven CSFs for public housing in Nigeria.These factors include 1. the institutional framework for public housing, 2. access to competent personnel, 3. effective project management, 4. good maintenance management, 5. proper design and location, 6. the financial system, and 7. adequate political support.The CSFs identified in this study can serve as a guide for housing policymakers, public housing developers, and project managers to successfully achieve public housing in Nigeria.Ngcho and Das (2019) conducted a study titled Definitive Success Factors inConstruction Project Performance: An Experimental Study of Constituency Development Fund (CDF) projects in Kenya.The case was about the CDF projects in Kenya between 2003 and 2011 and secured feedback from 175 clients, consultants, and contractors on the implementation of CDF projects in 30 success variables.The findings indicated that the items that make up these six factors include six CSFs: project-related factors, client-related factors, consultant-related factors, contractor-related factors, supply chain-related factors, and external environment-related factors. The findings also discuss development projects in other developing countries.Ika and Donnelly (2018) examined the conditions for success in capacity building in international construction projects.The case study was performed by qualitative analysis on 20 experts in capacity building projects in Ghana, Indonesia, Sri Lanka, and Vietnam and extracting the conditions for structural, institutional, and managerial success.A hypothesis was also developed that high levels of commitment, participation, coordination, and adaptation of several participants are essential to the success of projects.

After reviewing various studies, the framework for the success of construction projects in Iran focusing on national mega-projects is provided as follows:

Table 1. A framework for the success of construction projects in Iran focusing on national mega-projects

Component	Indicator	Reference
Factors concerning human resources	Integration between project team members in decision-making Presence of responsible, experienced, and specialized people Observing employee safety Staff training Human resources management Familiarity of experts with the process of document production and transfer of information to departments Mechanism of manpower distribution in different periods of projects Paying attention to the factors associated with personnel errors and mistakes Good leadership by the project manager Qualifications of project team members Good coordination between project participants Senior management support Obligations of the participants in the project objective meeting Enforcing effective housing policy Allocation of completed housing units to the goal	(Shrivastava et al., 2014) (Khazaei, 2014) (Ika et al., 2012) (Guerrero et al., 2012) (Vazifeh Doost et al., 2015) (Kaliba et al., 2009) (Bahadori Kosaji Zare et al., 2015) (Mokhtar et al., 2017)
Factors concerning political and economic issues	Project financing instructions Project cost management Paying attention to political issues Paying attention to labor strikes Paying attention to problems in industry or the country's economy Paying attention to changes in the banking system and related guarantees or laws Paying attention to the problems of the global economy Paying attention to appropriate loan sources Paying attention to sudden changes	(Guerrero et al., 2012) (Hesami and Molaei, 2015) (Jaslin and Müller, 2016) (Mukhtar et al., 2017) (Vahidi Arbabi and Malek, 2011) (Vazifeh Doost et al., 2015) (Villalba-Romero and Liyanage, 2016) (Kaliba et al., 2009) (Babaei and Hosseini, 2014) (Mukhtar et al., 2017)

Component	Indicator	Reference
	in the prices of materials Employee salary and benefit determination system Paying attention to social changes (domestic-international) Appropriate estimate of the financial strength of the whole complex and the project sponsors Considering interest rates Considering changes in exchange rates Considering changes in inflation Considering changes in stock prices Considering changes in tax rates Considering the rate of return on investment (or incorrect estimation)	
Factors concerning project management	Precise scheduling Cohesion and coordination in project operations Project time management Project quality management Project communication management Project risk management Pay attention to the traffic of people and vehicles through the project site Prediction of project delays Effective control system Adequate use of communication between project participants Clarity of the project goal for the project team Effective project monitoring Project team motivation Developing a good project schedule	(Khazaei, 2014) (Ika et al., 2012) (Jaslin and Müller, 2016) (Kaliba et al., 2009) (Vahidi Arbabi and Malek, 2011) (Vazifeh Doost et al., 2015) (Khezri and Galenoei, 2014) (Radfar and Dastyar, 2016) (Fathi and Faqih Mirzaei, 2015) (Kaliba et al., 2009) (Mukhtar et al., 2017)
Factors concerning the organization and project srentrap	The presence of the consultant and the supervisory organization Type of designer (consultant) and contractor (project builder) contracts Organizational environment Paying attention to the changing needs of the employer due to changes Considering employer delays in resource allocation	(Khazaei, 2014) (Amin Hosseini et al., 2015) (Chan, 2014) (Ika et al., 2012) (Vazifeh Doost et al., 2015) (Villalba-Romero Liyanage, 2016) (Ika and Donnelly, 2017) (Babaei and Hosseini, 2014) (Bazan et al., 2011) (Kaliba et al., 2009)

Component	Indicator	Reference
	Considering the employer's negligence in issuing approvals and fulfilling contractual obligations Considering the change of workshop conditions by the employer	(Etezadi and Lork, 2016) (Bahadori Kosaji Zare et al., 2015) (Mukhtar et al., 2017) (Ngcho and Das, 2015)
Factors concerning project equipment supply	Project procurement management Providing labor, materials, and machinery Using the latest technology in the world How to select suppliers	(Jaslin and Müller, 2016) (Vazifeh Doost et al., 2015) (Kaliba et al., 2009) (Mukhtar et al., 2017) (Yamin and Sim, 2016)
Technical and professional factors	Paying attention to unexpected events (such as floods and earthquakes) Paying attention to the weather conditions of the project environment Accurate geology of the project Considering the impassability of access to the project site Paying attention to environmental pollutants Paying attention to the fit of person/hour	(Vahidi Arbabi and Malek, 2011) (Vazifeh Doost et al., 2015) (Kaliba et al., 2009) (Babaei and Hosseini, 2014) (Mukhtar et al., 2017)

4. Hypotheses

To guide the analysis, six hypotheses were developed based on the findings of previous studies. These hypotheses are as follows:

Hypothesis 1: Factors concerning human resources affect the success of construction projects in Iran.

Hypothesis 2: Factors concerning political and economic issues affect the success of construction projects in Iran.

Hypothesis 3: Factors concerning project management affect the success of construction projects in Iran.

Hypothesis 4: Factors concerning the organization and project partners affect the success of construction projects in Iran.

Hypothesis 5: Factors concerning project equipment supply affect the success of construction projects in Iran.

Hypothesis 6: Technical and professional factors affect the success of construction projects in Iran.

By reviewing the studies on the subject of the study as well as the hypotheses presented, the following conceptual model is proposed.

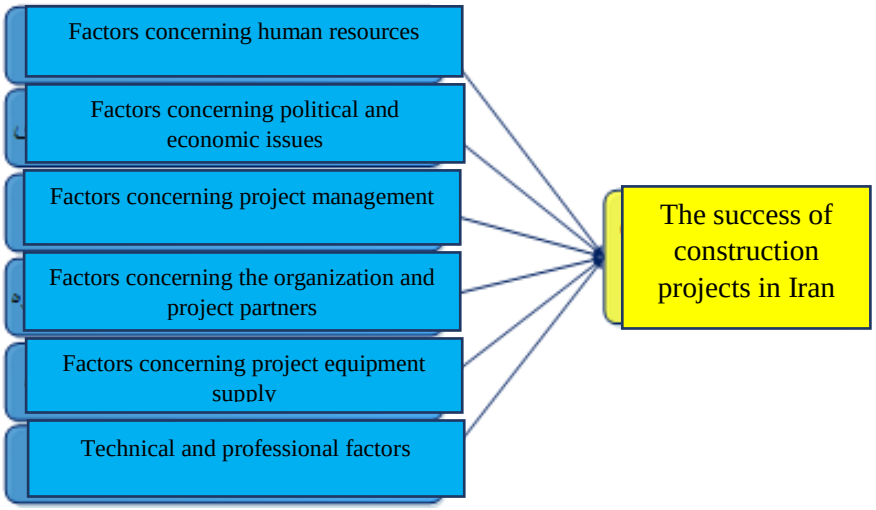

Figure 2. The researcher-made conceptual model

5. Methodology

Since this study was conducted to provide a framework for the success of construction projects in Iran focusing on national mega-projects, it uses a field survey method.Data were collected from statistical samples using questionnaires. Finally, the hypotheses were tested using appropriate statistical software (such as SPSS).The last step was to generalize the results to the whole statistical population.This was a field study that can provide data on attitudes, feelings, beliefs, past behaviors, recorded behaviors, as well as identifying personal characteristics.A field study is the systematic collection of data from respondents to understand or predict certain behavioral aspects of the population that should be accompanied by sampling, questionnaire design, and data analysis.

5.1 Data and measurement scale

After conducting a library study, a six-item questionnaire with standard components on a five-point Likert scale (from 1 for strongly disagree to 5 for strongly agree), which is one of the most common measurement scales, was presented toprovide a framework for the success of construction projects in Iran focusing on national mega-projects.

5.2 Validity

Extraction of the components of the measured variables and then their localization using the opinions of experts as well as preliminary samples were used to validate the scale.Accordingly, the evaluation of content validity and the measurement scale is a qualitative judgment. That is, the questionnaire had 3 content validities because the components of the variables were extracted from the relevant studies and the constructs of the questionnaire were properly understood by

the statistical sample.For this purpose, the questionnaire was given to 10 experts as a pre-test.After correction and adjustment, it was again provided to 30 experts. The relevance of the questions to the statistical population was ensured according to the corrective opinions of the experts.Finally, the questionnaires were designed and used for data collection.

5.3 Reliability

One of the most common methods of measuring the reliability of the questionnaire is Cronbach's alpha coefficient, which was developed by Cronbach.Reliability means that if the measured properties are re-measured with the same tool, under the same conditions, and at different times, the results will be almost the same.Cronbach's alpha coefficient is used to measure the one-dimensionality of attitudes, beliefs, and so on.Cronbach's alpha coefficient is used to determine to what extent the respondents' perceptions of the questions are the same.This coefficient is based on scales. Scales are a set of numbers assigned to people, objects, or behaviors on a continuum to quantify qualities.The most common scale used in social studies is the Likert scale, which is based on the assumption that items are of the same weight.Thus, scores are assigned to each item (for example, from 1 to 5 for a 5-point Likert scale). The sum of the scores that each person receives from the items will indicate his/her inclination.Cronbach's alpha is generally calculated using one of the following equations.

$$\alpha = \frac{k}{k-1}(1-(\sum_{i=1}^{k} S_i^2 / \sigma^2)) \quad (3)$$

$$\alpha = (k\overline{C})/(\overline{V} + (k-1)\overline{C}) \quad (4)$$

Where K is the number of questions, S_i^2 is the variance of question i, σ^2 is the total variance of the total questions, $\overline{C}$ is the mean covariance between the questions, and $\overline{V}$ is the mean-variance of the questions.Using the definition of Cronbach's alpha, it can be concluded that the closer the Cronbach's alpha value is to 1, the greater the internal correlation between the questions and, consequently, the more homogeneous the questions.Cronbach suggested a reliability coefficient of 45% as low, 75% as moderate and acceptable, and 95% as high.If the alpha value is low, it should be checked which questions should be removed to increase its value.In this study, Cronbach's alpha for variables was measured using SPSS software, the results of which can be seen in Table 2.According to the results, Cronbach's alpha value for all variables is higher than 0.7. Therefore, it has acceptable reliability.

Table 2. Cronbach's alpha value for variables

Component	Cronbach's alpha
Factors concerning human resources	0.712
Factors concerning political and economic issues	0.851
Factors concerning project management	0.871
Factors concerning the organization and project partners	0.824

Component	Cronbach's alpha
Factors concerning project equipment supply	0.749
Technical and professional factors	0.817
The success of construction projects in Iran	0.885

5.4 The Population

The statistical population includes all the people, events, or things that the researcher wants to research so that they share at least one attribute.The statistical population of this study included project contractors of national mega-projects, so, it was considered unknown. Sampling is one of the most important topics in humanities statistics.The researcher has to take samples according to the size of the population or the subjects studied.In this study, the statistical population was considered as unknown and the formula of the unknown population was used because there was no accurate information about the number of customers during the past year.The sample size was estimated using Cochran's formula, which is used for unknown populations.

$$n=\left(\frac{Z_{\alpha/2}\times\delta}{\varepsilon}\right)^2=\left(\frac{1.96\times 0.667}{0.0723}\right)^2\approx 327 \qquad (1)$$

Where $Z_{\alpha/2}$ is the statistical value of Z at a significance level of 95% (equal to 1.96), δ is the standard deviation of the population, the value of which is estimatedaccording to the range of changes in the answers (Likert five-point scale) using valid statistical references, and ε is the error level (acceptable error value).In the behavioral sciences, a value of less than 8% is acceptable.In this study, an accuracy of 7.23% was considered for greater reliability.The sample size was 327. Table 1 shows the demographic characteristics of the sample.

Table 3. Distribution and frequency of subjects' demographic variables

Variable		Frequency	Frequency percent
Gender	Male	261	79.82
	Female	66	20.18
Age	25-30	156	47.71
	31-35	102	31.19
	36-40	69	21.10
Education level	Associate Degree	21	6.42
	Bachelor	228	69.72
	Masters	78	23.85
The number of participants in national mega-projects	1-5	162	49.54
	10-20	96	29.36
	20-30	48	14.68
	Over 30	21	6.42

According to Table 1, males with a frequency of 79.82% had the highest frequency, and females with a frequency of 20.18% had the lowest frequency.The age group of 25-30 years with a frequency of 47.71% had the highest frequency, and the age group of 36-40 years with a frequency of 21.10% had the lowest frequency.The bachelor group with a frequency of 69.72%

had the highest frequency, and the associate-degree group witha frequency of 6.42% had the lowest frequency.Regarding the number of participants in national mega-projects, the group 1 to 5 times with a frequency of 49.54% had the highest frequency, and the group over 30 times with a frequency of 6.42% had the lowest frequency.

6. Findings

6.1 Normality test

Before testing the hypotheses, the appropriate type of test must be determined.The type of test is determined by the normal or abnormal distribution of the data.The Kolmogorov-Smirnov test is used to evaluate normality. This is a distribution conformance test for quantitative data.The researcher uses this test if ehs/eh has a sample of a quantitative size and wants to determine if this sample is obtained from a normally distributed population.The normality test of distribution is one of the most common tests for small samples that the researcher doubts its normal distribution. The Kolmogorov-Smirnov test is suitable for this purpose.In SPSS software, this test is used to match four different distributions of normal, Poisson, exponential, and uniform.This method is based on the difference between the relative cumulative frequency of observations and the expected value under the null hypothesis.The null hypothesis states that the selected sample has a normal, Poisson, exponential, or uniform distribution.The Kolmogorov-Smirnov test for distribution matching compares the cumulative probabilities of values in a data set with the cumulative probabilities of the same values in a particular theoretical distribution.If the difference between them is large enough, the test shows that the data do not match one of the theoretical distributions.In this test, if the significance level is less than 5%, the null hypothesis is rejected, meaning that the data cannot follow a specific distribution such as normal, Poisson, exponential, or uniform.In this study, the Kolmogorov-Smirnov test was used to evaluate the normal distribution of the data. Therefore, the null and alternative hypotheses are presented as follows:

Null Hypothesis: Data are not distributed normally.

Alternative Hypothesis: Data are normally distributed.

Table 4 shows the results of the Kolmogorov-Smirnov test on the variables.

Table 4. Kolmogorov-Smirnov test results

Component	Test factor	Significance level
Factors concerning human resources	1.29	0.67
Factors concerning political and economic issues	1.88	0.96
Factors concerning project management	0.91	0.90
Factors concerning the organization and project partners	1.44	0.97
Factors concerning project equipment supply	1.8	0.84
Technical and professional factors	3.57	0.95
The success of construction projects in Iran	2.67	0.87

Output from statistical software regarding the normal distribution of factors concerning human resources, factors concerning political and economic issues, factors concerning project management, factors concerning the organization and project partners, factors concerning project equipment supply, technical and professional factors, and the success of construction projects in Iran suggests that the null hypothesis is rejected at a significance level of 5% and that the data are normally distributed.

6.2 Testing hypotheses

In this section, hypotheses are tested using regression tests.

Hypothesis 1: Factors concerning human resources affect the success of construction projects in Iran.

This hypothesis was tested using aregression test, the results of which are analyzed below.

Table 5. The regression model fit coefficients

Independent variable	Dependent variable	r	t		Error	R^2	The adjusted coefficient of determination	F	
			The statistics value	Significance level				The statistics value	Significance level
Factors concerning human resources	The success of construction projects in Iran	0.710	0.710	8.501	0.000	0.504	0.497	72.261	0.000

The significance level of F) $Sig = 0/000 < 0/05$ (is less than 5%, indicating that the hypothesis is confirmed with 95% confidence and that there is a significant relationship between factors concerning human resources and the success of construction projects in Iran.According to the coefficient of determination (0.504), it can be argued that the proposed model is fitted with high accuracy. The value of the adjusted coefficient of determination (0.497) indicates that the independent variable (factors concerning human resources) explains about 50% of the changes in the dependent variable (the success of construction projects in Iran).Significance levels of the independent variable coefficient show that this variable affects the dependent variable in the proposed regression model.On the other hand, the coefficient r of the independent variable is reported with a positive sign, suggesting that there is a direct relationship between this variable and the dependent variable. So, it can be argued that the alternative hypothesis is confirmed and that there is a significant relationship between factors concerning human resources and the success of construction projects in Iran.

Hypothesis 2: Factors concerning political and economic issues affect the success of construction projects in Iran.

This hypothesis was tested using aregression test, the results of which are analyzed below.

Table 6. The regression model fit coefficients

Independent variable	Dependent variable	r	t		Error	R^2	The adjusted coefficient of determination	F	
			The statistics value	Significance level				The statistics value	Significance level
Factors concerning political and economic issues	The success of construction projects in Iran	0.739	0.739	9.230	0.000	0.545	0.535	85.185	0.000

The significance level of F) $Sig = 0/000 < 0/05$ (is less than 5%, indicating that the hypothesis is confirmed with 95% confidence and that there is a significant relationship between factors concerningpolitical and economic issuesand the success of construction projects in Iran.According to the coefficient of determination (0.545), it can be argued that the proposed model is fitted with high accuracy. The value of the adjusted coefficient of determination (0.535) indicates that the independent variable (factors concerningpolitical and economic issues) explains about 54% of the changes in the dependent variable (the success of construction projects in Iran).Significance levels of the independent variable coefficient show that this variable affects the dependent variable in the proposed regression model.On the other hand, the coefficient r of the independent variable is reported with a positive sign, suggesting that there is a direct relationship between this variable and the dependent variable. So, it can be argued that the alternative hypothesis is confirmed and that there is a significant relationship between factors concerningpolitical and economicissues and the success of construction projects in Iran.

Hypothesis 3: Factors concerningproject management affect the success of construction projects in Iran.

This hypothesis was tested using aregression test, the results of which are analyzed below.

Table 7. The regression model fit coefficients

Independent variable	Dependent variable	r	t		Error	R^2	The adjusted coefficient of determination	F	
			The statistics value	Significance level				The statistics value	Significance level
Factors concerning project management	The success of construction projects in Iran	0.747	0.747	9.467	0.000	0.558	0.552	89.631	0.000

The significance level of F) $Sig = 0/000 < 0/05$ (is less than 5%, indicating that the hypothesis is confirmed with 95% confidence and that there is a significant relationship between factors concerningproject managementand the success of construction projects in Iran.According to the coefficient of determination (0.558), it can be argued that the proposed model is fitted with high accuracy. The value of the adjusted coefficient of determination (0.552) indicates that the independent variable (factors concerningproject management) explains about 55% of the changes in the dependent variable (the success of construction projects in Iran).Significance levels of the independent variable coefficient show that this variable affects the dependent variable in the proposed regression model.On the other hand, the coefficient r of the independent variable is reported with a positive sign, suggesting that there is a direct relationship between this variable and the dependent variable. So, it can be argued that the alternative hypothesis is confirmed and that there is a significant relationship between factors concerningproject management and the success of construction projects in Iran.

Hypothesis 4: Factors concerningthe organization and project partners affect the success of construction projects in Iran.
This hypothesis was tested using aregression test, the results of which are analyzed below.

Table 8. The regression model fit coefficients

Independent variable	Dependent variable	r	t		Error	R^2	The adjusted coefficient of determination	F	
			The statistics value	Significance level				The statistics value	Significance level
Factors concerning the organization and project partners	The success of construction projects in Iran	0.710	0.710	8.501	0.000	0.504	0.497	72.261	0.000

The significance level of F) $Sig = 0/000 < 0/05$ (is less than 5%, indicating that the hypothesis is confirmed with 95% confidence and that there is a significant relationship between factors concerningthe organization and project partnersand the success of construction projects in Iran.According to the coefficient of determination (0.504), it can be argued that the proposed model is fitted with high accuracy. The value of the adjusted coefficient of determination (0.497) indicates that the independent variable (factors concerningthe organization and project partners) explains about 50% of the changes in the dependent variable (the success of construction projects in Iran).Significance levels of the independent variable coefficient show that this variable affects the dependent variable in the proposed regression model.On the other hand, the coefficient r of the independent variable is reported with a positive sign, suggesting that there is a direct

relationship between this variable and the dependent variable. So, it can be argued that the alternative hypothesis is confirmed and that there is a significant relationship between factors concerningthe organization and project partners and the success of construction projects in Iran.

Hypothesis 5: Factors concerningproject equipment supply affect the success of construction projects in Iran.
This hypothesis was tested using aregression test, the results of which are analyzed below.

Table 9. The regression model fit coefficients

Independent variable	Dependent variable	r	t		Error	R^2	The adjusted coefficient of determination	F	
			The statistics value	Significance level				The statistics value	Significance level
Factors concerning project equipment supply	The success of construction projects in Iran	0.899	0.899	17.274	0.000	0.808	0.805	298.375	0.000

The significance level of F) $Sig = 0/000 < 0/05$ (is less than 5%, indicating that the hypothesis is confirmed with 95% confidence and that there is a significant relationship between factors concerningproject equipment supplyand the success of construction projects in Iran.According to the coefficient of determination (0.808), it can be argued that the proposed model is fitted with high accuracy. The value of the adjusted coefficient of determination (0.805) indicates that the independent variable (factors concerningproject equipment supply) explains about 81% of the changes in the dependent variable (the success of construction projects in Iran).Significance levels of the independent variable coefficient show that this variable affects the dependent variable in the proposed regression model.On the other hand, the coefficient r of the independent variable is reported with a positive sign, suggesting that there is a direct relationship between this variable and the dependent variable. So, it can be argued that the alternative hypothesis is confirmed and that there is a significant relationship between factors concerningproject equipment supply and the success of construction projects in Iran.

Hypothesis 6: Technical and professional factors affect the success of construction projects in Iran.
This hypothesis was tested using aregression test, the results of which are analyzed below.

Table 10. The regression model fit coefficients

Independent variable	Dependent variable	r	t		Error	R^2	The adjusted coefficient of determination	F	
			The statistics value	Significance level				The statistics value	Significance level
Technical and professional factors	The success of construction projects in Iran	0.739	0.739	9.230	0.000	0.545	0.535	85.185	0.000

The significance level of F) $Sig = 0/000 < 0/05$ (is less than 5%, indicating that the hypothesis is confirmed with 95% confidence and that there is a significant relationship between technical and professional factors and the success of construction projects in Iran.According to the coefficient of determination (0.545), it can be argued that the proposed model is fitted with high accuracy. The value of the adjusted coefficient of determination (0.535) indicates that the independent variable (technical and professional factors) explains about 54% of the changes in the dependent variable (the success of construction projects in Iran).Significance levels of the independent variable coefficient show that this variable affects the dependent variable in the proposed regression model.On the other hand, the coefficient r of the independent variable is reported with a positive sign, suggesting that there is a direct relationship between this variable and the dependent variable. So, it can be argued that the alternative hypothesis is confirmed and that there is a significant relationship between technical and professional factors and the success of construction projects in Iran.

7. Conclusion

Project success is a complex and multidimensional concept that can be varied due to different project stakeholders' perceptions of failure or success.An overview of previous studies on the success factors of construction projects indicates that there is no universally accepted definition.However, it is important to determine from what point of view success factors are examined because of the different and sometimes conflicting interests of different people in a project.

65 indicators in the form of 6 general components were identified for contractors after reviewing studies on the factors affecting the success of construction projects.Questionnaires in which the extent of the impact of each of these components and indicators were assessed were distributed among the statistical population.The results show that there are many success factors in construction projects that are important for achieving a successful project.However, it is difficult to highlight just a few success factors that are applicable throughout the industry because each project has special conditions.It is worth noting that all factors are, to some extent, success factors, although some are mentioned more than others.In this study, success factors were evaluated from the perspective of contractors, the results of which are as follows.The output of

the statistical analysis indicates that from the perspective of contractors, economic factors and human and organizational procurement along with characteristics such as project financing instructions, labor supply, materials and machinery, senior management support, project team qualifications, the presence of responsible, experienced and specialized people, and considering the employer's negligence in issuing approvals and fulfilling contractual obligations are more important. Furthermore, there is the greatest correlation between project cost management, project procurement management, the presence of responsible, experienced and specialized people, the mechanism of distribution of manpower at different periods of projects, and the consideration of changes in workshop conditions by the employer.The main factors can be improved to get closer to the success of the project by considering these factors.

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