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Evaluating The Efficiency of Contractor's Guidelines in Improving the Success of Construction Projects

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ABSTRACT

In the construction industry, the guidelines of contractors play a crucial role in improving the success of construction projects. Contractors have significant responsibilities in a construction project, including measurement, recording, and supervision of dimensions and work quality. In general terms, a contractor is responsible for planning, leading, executing, supervising and inspecting a building construction project. The responsibility extends from the beginning to the end of the project, regardless of its scope. Overall contractors are responsible for fulfilling the contract Which makes them liable. These specialties enable contractors to gather necessary information accurately and with high precision, contributing to sound decision-making in the project. Suitable guidelines for contractors involve standard methods and processes for measurements, data recording, reporting, and communication with other project team members. These guidelines enhance efficiency, quality, and project execution speed, facilitating coordination among team members. By adhering to appropriate guidelines, contractors will be able to collect and analyze required information accurately and make logical and effective decisions to improve project performance. Ultimately, these improvements will lead to cost reduction, time saving, and enhancement of the final project quality. Factors such as sales history, quality policies or guidelines, adequacy of human resources and factory resources, completion of past project waste disposal, and company image are the most influential factos in project success.

Introduction

The construction industry is considered an important and vital sector for the development of any country, and the physical development of construction projects such as buildings, roads, and bridges serves as a measure of their economic growth. The construction industry is one of the most important industrial participants for the European economy in terms of gross production and employment (Sepehrdoust, 2010). The success of construction projects is a fundamental issue for most governments, users, and societies. Housing and related infrastructure activities are crucial for the economic growth and development of society due to creating useful employment, earning income, reducing unemployment rates, providing basic life needs, and establishing other urban and rural household businesses (Ahmadi, 2023). So much so that the increasing urban population rates and the need for more investment in the housing sector and providing suitable living shelters have turned this sector of the economy into a growth stimulus for many developed and developing countries. It presents significant economic challenges to planners, so much so that the direct relationship between housing investment and economic growth is among the general discussions and topics in the literature of development economics, and most planners believe that encouraging investment should not only be considered as part of the economic development strategy but also as a logical consequence of economic growth (Sadri et al., 2022). In modern construction projects, due to the increasing complexity of design and involvement of multiple stakeholders, there are significant challenges for employers and contractors in delivering successful projects. In addition to the aforementioned complexity of construction projects, defining project success is in itself a complex issue.

1. Research Background

Chan and Chan (2004) developed the concept of project success to establish criteria and standards to help project participants in completing projects with the most desirable results. However, this concept remains somewhat of an enigma, as despite various studies, there is no consensus on critical success factors for construction projects.

The iron triangle (on time, within budget, as per specifications) has been the most practical criteria accepted for project success over the past two decades. However, Toor and Ogunlana (2010) reported that due to changes in user demands, evolution of environmental regulations, and shifting functions of buildings, the old performance criteria alone cannot determine project success.

There are many factors that contribute to project success. Construction projects and their success largely depend on contractors. Appointing the right contractor not only ensures the overall quality of the project but also offers cost-saving opportunities.

When the primary contractors commence their main duties, and when the project moves into the construction or implementation phase, this issue impacts the project's success. Real project work is carried out during this life cycle. Therefore, the aim of this study is to examine the impact of contractor criteria on the success of construction projects from the perspective of construction stakeholders, utilizing the viewpoints of employers, consultants, and contractors. In this regard, efforts have been made to determine the perception of construction project stakeholders regarding the critical success factors (CSFs) of contractors, which significantly influence project success because they play a crucial role in project success. To achieve this goal, this research consists of two main components: a comprehensive literature review and a questionnaire survey.

The main sections of this article are as follows. Firstly, we review project success and its definition in the construction industry. Then, we introduce the concept of CSFs in construction projects. Furthermore, we review the success criteria of contractors in construction projects, which includes the set of success criteria and identified CSFs from the literature review for this study. Then, we introduce the approach and methodology adopted for this article. Subsequent sections present data analysis, model development, and a discussion of the findings. The concluding section of the article is reached, summarizing the study's objectives and key findings.

2. Issues after the contract

The almost realistic and important assumption is that the employer does not have complete knowledge about the characteristics and capabilities of the contractor, as well as the contractor's actions and activities regarding the subject of the contract. However, the contractor has access to this information that the employer is seeking (Sadri et al., 2022). The issues that arise in these circumstances are that due to personal interests, the contractor may not be willing to share this information with the employer, or may even provide the employer with incorrect information. Based on basic models, the contractor always seeks to maximize their desirability by choosing the best available option. Since meeting the employer's expectations requires significant cost,

time, and effort on the part of the contractor, and given the presumption of relative conflict between the parties' objectives, the likelihood of the contractor underperforming will be high. In such circumstances, the employer will have two solutions to reduce the likelihood of the contractor's underperformance:

Table 1: Contractor's Underperformance Solutions

First Solution	Utilizing behavior-based contract and investment in information systems and contractor behavior control and auditing methods to obtain the maximum possible information about the contractor's behavior. In this method, the employer can even use the services of a third-party entity. For example, the employer can seek the help of a marketing consultant to control the behavior of the advertising agency.
Second Solution	Signing a result-based contract, in this case, the contractor's goals and preferences will be aligned with the employer.

3. Project Success

The concept of project success has been widely discussed in project management literature. Most studies emphasize dimensions such as how to measure it and other specific factors that influence project success. Project success means different things to different people (Forouzandeh et al., 2021). Common criteria, such as the time, cost, and quality triangle, have been indicators of superior performance in construction projects. However, there is more to project success than meeting time, cost, and quality goals, and the project management community needs to be well educated in this regard. The goal of developing the concept of project success is to establish suitable criteria and standards to help project participants complete projects with the most desirable results. At a basic level, success is said to be achieving project goals and expectations. Project success is referred to as results that exceed expectations or are usually observed in terms of cost, scheduling, quality, safety, and participant satisfaction (Keshavarzfar et al., 2023). It is considered an overall success when the project meets specified technical performance requirements or missions and achieves a high level of satisfaction among key organization members, key project team members, and key users or stakeholders. Despite the ongoing debate, this research follows a broad definition of project success (Kardoust et al., 2020).

One of the issues related to project success is the point of success or failure of the project. Another important issue is that performance measurement criteria vary in different projects. Distinguishing between success criteria and critical success factors (CSF) is of great importance. Researchers distinguish between project management success and project success when measuring success as two related but very different issues. Achieving successful cost, time, and quality goals is recognized as project management success factors. In contrast, project success is concerned with the project's ultimate goals. Additionally, good project management can contribute to project success but cannot prevent project failure. Contractors are often only involved in a process that produces a product, and the current study aims to explore the impact of contractors' tangible and mental success criteria on the success of construction projects in critical conditions, as they play a crucial role in project management success that can contribute to project success (Bemanian et al., 2020).

Civil projects always have four main areas, including initial studies, design, implementation, and operation and maintenance. Improper management in any of these stages leads to the waste of substantial national capital. What happens more commonly nowadays and is accompanied by heavy losses is the lack of attention to the first and third stages. Many projects, due to incorrect initial studies and misdefinition of the problem, are unable to meet project goals and do not achieve desirable productivity, leading to substantial cost and time overruns. On the other hand, there are also large projects where, due to lack of precision in implementation, efficient management, and other issues, costs and time are wasted (Shoghi et al., 2021).

In a civil project, the highest level of investment takes place during the project implementation phase, and as mentioned, mistakes in this phase result in the loss of a significant portion of this investment. Therefore, one of the most important issues in implementing civil projects might be the selection of a competent contractor, ensuring that by choosing a competent contractor, the risk of resource wastage, both in terms of cost and time, is minimized. Additionally, the projects should have the highest execution quality and safety during and after implementation (Jaskó et al., 2020).

To achieve this goal, two new solutions have been proposed to address the problem: changing the process of tendering and pre-qualifying contractors before tendering. Recent years' experiences in this regard have proven this claim, and numerous articles since the introduction of this approach indicate individuals' need for these new solutions.

4. Critical Success Factors

Critical success factors (CSFs) were introduced in 1979 as an approach to assist senior managers in defining

their information needs for managing their organizations. Rockart based his work on CSFs on the concept of success factors introduced by Daniel in 1961 (Tuan, 2022). In fact, these factors are not a new concept or application in business, and there are various reasons for the importance of recognizing these factors in every industry. Among these reasons, better understanding of the competitive environment, more appropriate decision-making, assistance to new companies, and cost reduction can be mentioned. Additionally, critical success factors play a fundamental and undeniable role in gathering information needs for managerial decision-making, formulating organizational strategies, and are an important component in modern management systems and strategic planning.

Rockart and Bullen argued for a distinction between goals and success factors through strategic management and planning, as goals and objectives are relatively well known, but the definition of success factors is less, clear, and transparent (Ghaffari et al., 2020). According to Rockart, the first five sources identifying the success factors of each organization in any industry are industry factors, competitive strategy factors, environmental factors, temporal factors, and managerial factors. Daniel and others (1984) believed that in order to avoid excessive information, organizations should concentrate their information systems on factors that guarantee organizational success. In this way, management can use critical success factors as a filter to retain and analyze information crucial for key organizational decision-making (Saghebi & Mohammadi, 2021).

Therefore, decision-making is more robust when based on data that is uniquely related to organizational success. Rockart, in 1979, emphasized this in figure (1).

Figure 1: Formation process of critical success factors

Goals and critical success factors are both necessary for accomplishing the mission of the organization, and both must be adequately addressed. Since the goals and critical success factors are integrated parts of the organization's strategic plan, attention must be paid to their relationship. In this regard, Snavidav defined critical success factors as a set of factors that, if fully satisfied, ensure the successful completion of facilities. They tested seven factors (team facilities, contracts, facilities experience, resources, product information, optimization information, and performance information) that predict the success of sixteen projects (Hashemi et al., 2023). The impact of critical success factors on the project can be divided into five main groups: project-related factors, project manager, team members, organization, and external environment. The classification of factors in this plan identifies the relationship of success or failure with the project, project manager, or external factors.

5. Criteria for the Success of Contractors in Construction

Over the past few decades, numerous studies have highlighted the criteria for success and the impact of critical success factors on the success of contractors' projects. These studies have been developed by industrial and academic worlds. Although these criteria and their influential factors have been discussed from a long-term historical perception, bidding, and pre-qualification, our approach in this article is to research these criteria from an immediate post-construction perspective. The main goal of this work is to record the lessons and identify the impacts of critical success factors on project success before transitioning to the next project (Mirbagheri et al., 2010). Based on the data collected from medium-sized construction projects in Australia, the results of the method showed that technical planning and contractor expertise control are key to achieving success in projects.

According to the existing literature for this study, ten success criteria and 35 influential CSFs have a significant and meaningful relationship with contractors' performance and have a significant impact on the overall success of projects. To achieve this, where criteria are considered as a principle or standard for judgment, any factor that contributes to the result in any situation is considered. Therefore, the aim of this article is to discover the criteria for success and their influential factors that affect project success.

6. Research Method

The adopted method for this research consisted of two main components: literature review, as discussed in the previous section, and self-assessment. The assessment was formulated in a way that required respondents to rank the impact of contractors' critical success factors on construction projects' success. The level of impact was measured on a 5-point Likert scale: 5 indicating strongly agree, 4 agree, 3 neutral, 2 disagree, and 1 strongly disagree. Respondents were required to answer the questions based on the actual experiences in ongoing or recently completed projects.

Table 2: Success Criteria and Critical Success Factors

Number	Success Criteria	Critical Success Factors
1	Financial Criteria	Sales and transaction history Credit history Bonding capacity Cash flow forecasting
2	Management Criteria	Personnel qualifications Management ability Site organization Documentation (records)
3	Technical Criteria	Contractor's IT knowledge Knowledge of construction methods Work planning Technical staff experience
4	Past Experience Criteria	Type of completed past projects Size of completed past projects Duration of involvement in the business Experience in the region
5	Performance History Criteria	Inability to complete contracts Contract time overrun Exceeding contract costs Past records of challenges and disputes
6	Organizational Criteria	Company size Company image Business age Willingness to litigate
7	Environmental Criteria	Waste disposal during construction Environmental program during construction Materials used in the project
8	Health and Safety Criteria	Health and safety records Occupational safety and health administration (OSHA) compliance Experience modification rating (EMR)
9	Quality Criteria	Quality control Quality policy or guidelines Quality insurance and assurance
10	Resource Criteria	Sufficiency of human resources Sufficiency of plant resources

The first part of the study involves items for collecting background information from respondents and their projects, such as the respondents' location, experience in the construction industry, company/organization type, procurement type, and the primary project type within the organization. In the second part of the study, the respondent was asked to rank the impact of the shown CSFs in Table 2 on the success of the projects.

The construction industry emphasizes quality management not only during the construction phase but throughout the project's entire lifecycle (Monazzami et al., 2021). Research and investment in quality are valuable strategies that lead to various benefits. It is concluded that the ratio of direct benefits to investment in terms of savings from internal and external failures in the absence of quality methods is 1:2 or greater.

Clients must ensure that the work is in line with the specified project requirements. In fact, low-cost and rapid construction should not come at the expense of the project's quality. Contractors play a crucial role in shaping project quality. The standard of skill, harmony, and compliance with specifications is the key contribution of the contractor to project quality.

7. Logistic Regression Analysis of Key Success Factors

Logistic regression analysis of key success factors results in more accurate and valid outcomes because it is

designed to fit variables in a natural order and rank the dependent variable. The use of logistic regression does not require any assumptions about predictor variables, so there is no need for normal distribution of independent variables, linear relationships, or equal variance.

The purpose of applying logistic regression is to predict the probability of an event occurring. In this study, the event is an agreement that influences the success of projects based on contractors' criteria. Construction professionals respond to the assessment of the project's status. Then, the model estimates the probability of the impact of contracting with a specific set of criteria on a particular project, transforming it into a successful project. The relationship can be expressed as follows:

$$logit\ (p) = a + b_1x_1 + b_2x_1 + \cdots + b_ix_i$$

In this relationship, 'p' represents the probability of project success, and $x_1, x_2, \ldots, x_i$ are the explanatory variables.

29 variables obtained from the varimax rotation were entered into the model as independent variables (covariates) and used to determine predictive ability in relation to project success. The general method for estimating model parameters is called maximum likelihood. Logarithm of the likelihood (LL) represents the probability of predicting observed values of dependent variables from observed values of independent variables. The likelihood ratio of the logarithm of (-2LL) is the likelihood function (LL), and because it has a chi-square distribution, it can be used to evaluate the importance of logistic regression. A small value of (-2LL) indicates a good model, similar to the coefficient of determination R-squared in linear regression models; pseudo R-squared attempts to determine the proportion of explained variation in the logistic regression model. In logistic regression analysis, two types of R-squared exist. The first is R-squared Cox and Snell, which cannot reach a maximum value of 1, and the second is R-squared (Nagelkerke), which is widely reported when interpreting the logistic regression model. A goodness-of-fit test statistic is employed to evaluate model adequacy in contingency tables.

8. Model Development

Factor analysis of the nine basic clusters described and discussed in the previous section is indicated. However, there is no direct relationship that can be demonstrated using factor analysis. Therefore, logistic regression analysis was conducted to estimate the probability of project success and evaluate the impact of contractor criteria on project success. Using the entire dataset, logistic regression models were developed to estimate the probability of project success based on 29 listed independent variables and four dependent variables: (1) probability of project completion according to the schedule, (2) probability of project completion according to the allocated budget, (3) probability of project achieving the necessary quality, and (4) probability of the impact of contractor criteria on project success. These four criteria were ranked by respondents in the third section, requiring them to explain the outcome of completed projects. The analysis was performed using the enter method, which is the default method for implementing logistic regression in SPSS 19.0 for Windows.

9. Discussion and Regression Results

According to the results of logistic regression, it is inferred that project success has a significant relationship with seven supported variables. The findings indicate that contractors with sufficient human resources have a significant impact on project success. The variable of sufficiency or adequacy of human resources in scheduling, budget, and contractor influence models emerges as a statistically significant predictor of project success. The results also show that contractors with sufficient factory resources are an important and influential statistical factor for project success. In the scheduling model, the factory resource sufficiency factor is considered a statistically significant predictor of project success. Logistic regression tests also demonstrate that examining the company's image and contractor history affects project success. These two variables have been identified as statistically significant in the scheduling model. This model shows a positive relationship between these two predictor variables and on-time project delivery. Although the overall model quality test findings are not statistically valid, the predictor variable of past completed project size is statistically significant. The results indicate that quality and waste disposal policy are important predictor variables for project success in the contractor influence model, leading to the conclusion that quality is a specific issue that should be prioritized for 21st-century construction sites. The results also show that contractors who comply with environmental regulations and implement waste disposal plans during construction have a greater impact on project success.

10. Conclusion

In project management research, there are many discussions about the determinants of project success. Although this issue has been debated in the long term, a consensus has not been reached. Furthermore, when it comes to defining project success, there is no comprehensive and complete list. However, the concept of Critical Success Factors (CSF) indicates a smarter way to identify specific factors that may lead to project success or failure. Construction projects and their success are closely related to contractors. They commence their main duties when the project moves into the construction or implementation phase, where the real project work is carried out. Furthermore, identifying the right and wrong in post-construction evaluation before moving on to the next project is a valuable exercise in construction projects.

This research reports statistical findings aiming to gather the perceptions of construction stakeholders in post-construction assessments regarding contractor CSFs, which significantly impact project success. Four logistic regression models were constructed to examine the impact of contractor criteria on project success and identify a meaningful relationship between success criteria and the construction base cluster. According to the results of logistic regression, it is inferred that project success has a significant relationship with seven supported variables, as follows: sales and transaction history, quality policy or line, sufficiency of human resources, sufficiency of factory resources, waste disposal, size of previous completed project, and company image. The model fit efficiency with -2LL tests, pseudo R-square, and parallel lines were confirmed, indicating the statistical stability of the models.

The findings indicate that emerging new criteria such as safety and environment, in addition to the classic iron triangle perspective on time, cost, and quality, are transforming into success criteria. Assuming project success is repeatable, the findings provide a clear understanding of contractor performance and contribute to improving the existing knowledge and awareness of construction project success.

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