

Impact assessment of critical success factors (CSFs) in public construction projects of Saudi Arabia

CSFs and public construction projects

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Received 22 October 2023
Revised 14 December 2023
4 February 2024
9 March 2024
Accepted 13 March 2024

Abstract

Purpose – There is a limited number of research work on critical success factors (CSFs) in public construction projects in Saudi Arabia. In response to this knowledge gap, the objective of this paper is to assess the impact of CSFs on the government construction projects in Saudi Arabia. The success factors are investigated from a broader consideration of failure criteria, from consideration of most effectiveness in successful project completion and also from consideration of the impact of implementing control processes for successful project completion.

Design/methodology/approach – This study has analysed the impact of success factors on construction projects in Saudi Arabia using a descriptive methodology. An exhaustive literature survey is undertaken to identify the success and failure factors related to government construction projects in Saudi Arabia. The survey data are sorted out and analysed by cost, schedule, technical, context and finance dimensions of the projects based on project types, engineering complexity, size, modality, jurisdictional control and funding approach. To evaluate the influence of success factors implementation, qualitative data were collected in a survey via a web-based questionnaire that was sent to officials working and occupying a responsible position in national project guidelines organizations and in government construction organizations in Saudi Arabia. In all, 28 CSFs were identified, ranked and evaluated for their impact on project success. The four identified factors belong to process categories of construction projects, nine factors belong to management of construction projects and 15 success factors are identified for impact assessment of implementation in construction projects.

Findings – The study's findings have identified and ranked the top five CSFs that significantly influence project outcomes, including meeting time targets, adhering to financial budgets, delivering desired outcomes for all stakeholders, effectively managing risks and assembling the appropriate team while optimizing resource allocation. Additionally, the research indicates that hindrances to projects primarily stem from execution, economic, human and political factors. The study advocates for strict controls over incomplete engineering designs and advises against contractors independently handling design work to ensure project success. Additionally, addressing contractors' qualifications and financial matters is crucial for project success. By highlighting these CSFs and challenges, the research provides actionable insights to enhance project management practices in the construction industry.

Research limitations/implications – This study is limited to the infrastructure projects constructed by governmental bodies with the participation of officials from government organizations. Further study, including private projects and officials working on private projects, may be needed to generalized the research outcome.

Originality/value – Numerous studies have investigated CSFs in construction projects, but few have examined their relevance to Saudi Arabian government projects. This study aims to fill this gap by identifying key CSFs specific to Saudi Arabian public sector construction projects and assessing their impact on project success. It advocates for stringent controls in the Saudi Arabian construction sector, emphasizing the

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The authors acknowledge the Dean of the Faculty of Engineering for his valuable support and help.

Conflicts of interest: The authors declare no conflict of interest.



importance of preventing incomplete or altered engineering designs by contractors to increase the success rate of public sector projects. This research offers practical insights to stakeholders, advancing project management practices in Saudi Arabia's construction sector for improved outcomes and resource utilization.

Keywords Critical failure factor, Critical success factor, MCDMs methods, Public construction projects, Infrastructure projects, Impact assessment

Paper type Research paper

1. Introduction

The infrastructure in Saudi Arabia is experiencing rapid development through the greater participation of private and government investment in the sectors of housing, transport, energy and respective related industries (Author, n.d.). The value of unsuccessful projects in Saudi Arabia during 2012 amounted to approximately 500bn SAR, representing approximately 20% of Saudi Arabia's gross domestic product (GDP) (Shane *et al.*, 2015). The success factors of the project are defined as the set of environmental factors or facts, measured on some scale, i.e. success criteria, that can influence the outcomes of the project (Kwofie *et al.*, 2016). The critical success factors (CSFs), according to Rockart (1978), who popularized this term, are the activities in which favourable results are absolutely necessary to achieve the target. The failures of projects are nearly at every level and in every stage of project construction, i.e. planning, design, execution, management and commissioning (Morris, 1990). The main reasons for this failure are the lack of a clear methodology for managing infrastructure projects from the planning stage to the closure phase of the project (Flyvbjerg, 2014). According to Emad and Rahman (Al-Emad and Rahman, 2017), construction projects in the Kingdom of Saudi Arabia (KSA) face major weaknesses owing to a lack of experience, poor execution processes/quality control, unskilled human resources and poor project management practices. Egwim *et al.* (2023) have formulated a conceptual framework for BIM-based construction projects to predict the risk of project delays. They have pointed out that contractor-related factors and factors beyond the control of management should be considered in the formulation of delay risk predictive models. Oni *et al.* (2023) have presented the state-of-the-art of the critical success factors related to construction health and safety issues in Malaysia's construction industry. They have also categorized 106 critical successes (3) The most effective factors to in implementing the control process for successful completion of Saudi Arabian construction projects are the approval process of the engineering design of the project and the contractors' identification process and their relationship with the project management team. The Saudi Arabian government construction projects should develop an effective approval system for project successful completion factors into three dimensions (economic, social and environmental) of sustainable construction. Saeed *et al.* (2017) and El Touny *et al.* (2021) have investigated the critical success factors that impact the integration of sustainability into management practices in developing countries. Durdyeve and Hosseini (2019) outline a methodical research review around the globe for causes of delays on construction projects executed from 1985 to 2018. The top ten causes of delay identified by them are environmental conditions, lack of coordination along with conflicts between stakeholders, poor communication, ineffective/improper planning, financial problems, payment delays, material shortages, equipment shortages, labour shortages, a lack of experience/qualification/competence among project stakeholders and poor site management. Kumar *et al.* (2023) have studied the CSFs of large construction projects from the project practitioners' perspectives in terms of a large number of interfaces, complex working systems and uncertainty. They found from the study that senior project managers distinguish differently between the CSFs and project success. The CSFs that allow for value management deployment in the Saudi Arabian construction industry are investigated by Alsolami (Mathar *et al.*, 2020a). The study helps to facilitate CSF

monitoring, improve the efficiency of value management practices and develop future value management policies. [Li et al. \(2019\)](#) have listed the CSFs for green building projects by reviewing the CSFs for building projects in published literature. They have observed that the typically identified CSFs for green building projects are “communication and cooperation between project participants”, “effective project planning and control”, “owner’s involvement and commitment”, “clear goals and objectives” and “project manager’s performance”.

[Marrow \(2011\)](#) presents a white paper on reforming construction in Saudi Arabia to prevent future project failures and proposes a framework for dealing with mega projects in Saudi Arabia. He proposed a reform plan, including recommendations and solutions for immediate implementation of the short- and long-term project objectives. He found fifteen key factors impacting major developments. [Mahamid et al. \(2015\)](#) evaluate the construction projects of Saudi Arabia to determine the delay causes from consultants’ perspectives. They conclude that the most common project delays in construction projects in Saudi Arabia are long periods between design and time of implementation, frequent changes in design, bid award for the lowest price, poor contract management, duration of contract period, changes in material types and specifications during construction, fluctuation of prices of materials, improper planning, inflationary pressure, lack of adequate manpower, payments delay, poor labour productivity and rework. [Alhajri and Alshibani \(2018\)](#) conducted surveys and experts’ interviews to identify, assess and rank the critical factors causing delays during the construction phase of petrochemical projects in Saudi Arabia. They found that the most influencing factors are poor site management and supervision by contractors, conflict between the main contractor and subcontractor, poor planning and scheduling of projects by the contractor, delays in material or equipment delivery and delays in handing over construction sites to the contractor. [Alzaraa et al. \(2016\)](#) report the investigation of university construction project delays through the performance information procurement (PIP) system to minimize the delays caused by Saudi Arabian public projects. [Alsulamy \(2022\)](#) has investigated the critical failure factors (CFFs) of construction projects at the planning stage in Saudi Arabia. He has found that the top CFFs are time disputes over projects, cost overruns and total abandonment. He has also observed that contractors and government management teams are equally responsible for delaying construction projects. [Al-Emad et al. \(2017\)](#) have pointed out that regular changes in construction project design, financial matters and not obtaining construction permits from the authorities hinder the success of Saudi Arabian construction projects. [Sarhan et al. \(2016\)](#) have investigated the 12 CSFs for the application of lean construction in the construction industry of Saudi Arabia to reduce waste and improve value in the construction process. They have suggested that there is a need for education and training about lean concrete implementation. [Al-Tit et al. \(2019\)](#) have studied 28 success factors of small and medium-sized enterprises (SMEs) in Saudi Arabia from a sustainability perspective and group them into six broad factors namely, individual factors, business characteristics, management factors, business support, capital availability and the business environment. Their results showed that business support has the most pronounced effect on the success of SMEs in Saudi Arabia. They also pointed out that business characteristics and business environment factors had no significant impacts on the success of these enterprises. [Alnemr \(2024\)](#) has identified the CSFs of governmental projects in Saudi Arabia from the point of view of project managers. The top five CSFs observed are supportive leadership, prompt change management, strong communication, solid teamwork and competent project managers. [Mathar et al. \(2020b\)](#) have 91 success factors grouped under eight categories as per the common properties of the factors. They have found that the three most significant CSFs from the perspective of contractors are “competency and capability of the contractors’ key personnel in different disciplines”, “adequacy of labour resources and their skills” and “the impact of the project on the public”. While from the point of view of consultants, the three most significant CSFs are “competency and capability of the consultants’ key personnel in

different disciplines”, “clear communication channels between the owner/PM and the designer” and “PM competency, authority and involvement. [Ahmad *et al.* \(2023\)](#) have identified the critical success factors for construction projects of process industry plants in the context of Saudi Arabia. Based on their findings, it is suggested that Saudi Arabian construction companies need to recruit professionally qualified project managers, establish a project management office (PMO), revisit supply chain strategies and provide alternate working hours during tough weather conditions.

It is clear from the published literature that a limited number of research studies are conducted for dedicated and focussed work on CSFs in government construction projects in Saudi Arabia. In response to this knowledge gap, the objective of this paper is to assess the impact of key failure factors and success factors in the government construction projects of Saudi Arabia, which help in preventing project failure and in dealing with the public projects of Saudi Arabia. The success factors are investigated from a broader consideration of failure criteria, from consideration of most effectiveness in successful project completion and also from consideration of the impact of implementing control processes for successful project completion. This study has analysed the impact of success factors in construction projects on the KSA using a descriptive methodology. An exhaustive literature survey is undertaken to identify the success and failure factors related to government construction projects in Saudi Arabia. The survey data are sorted out and analysed by cost, schedule, technical, context and finance dimensions of the projects based on project types, engineering complexity, size, modality, jurisdictional control and funding approach. To evaluate the influence of success factors implementation, qualitative data was collected in a survey via a web-based questionnaire that was sent to officials working and occupying a responsible position in national project guidelines organizations and in government construction organizations in Saudi Arabia.

1.1 Research question

The research question posed to the present study is given below:

- RQ1.* What are the various factors affecting the success of the construction projects in Saudi Arabia?
- RQ2.* How do the major success factors influence the government construction projects in Saudi Arabia?

2. Methodology

The descriptive methodology has been used in the present work for project success factor impact analysis. An exhaustive literature survey is undertaken to identify the success and failure factors related to government construction projects in Saudi Arabia. The survey data are sorted out and analysed by cost, schedule, technical, context and finance dimensions of the projects based on project types, engineering complexity, size, modality, jurisdictional control and funding approach. In all, 28 CSFs were identified, ranked and evaluated for their impact on project success. The four identified factors belong to process categories of construction projects, nine factors belong to management of construction projects and 15 success factors were identified for impact assessment of implementation in construction projects. To evaluate the influence of success factor implementation, qualitative data was collected in a survey via a web-based questionnaire to study the impact of success factors influencing the government construction projects in Saudi Arabia. The survey was distributed to a selected sample of officials working and occupying responsible positions in national project guidelines organizations and in construction organizations in Saudi Arabia

(Table 1). The quality of the data received by around 100% of the respondents (16 respondents out of 16), has achieved the aim of the survey. The flowchart depicting the methodology adopted in the present study is shown in Figure 1.

2.1 Web-based survey details

Qualitative data were collected in a survey via a web-based questionnaire and sent to 16 selected officials working and occupying responsible positions in national project guidelines organizations and in construction organizations in Saudi Arabia. Participants were selected based on their background and their employment position. The segment to which the study was applied was chosen from several project managers and engineers working in the field of project management in government agencies. The following tables show the details of the survey participants.

2.2 Questionnaire

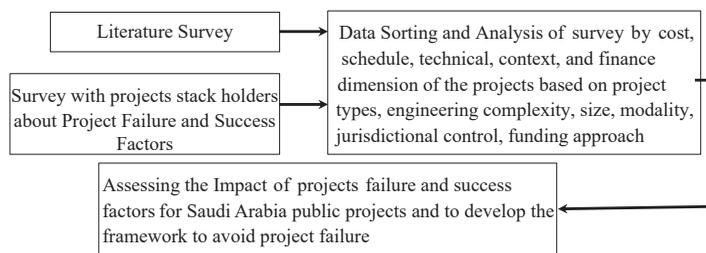
The participants are asked to give answer the question about the success and failure factors, and impact of success factors for the government construction projects of Saudi Arabia through the questionnaire provided to them. The questions that were directed to them were as follows:

- Q1. In which of the following failure criteria fit for project monitored by construction team?
- (1) Human Nature: Excessive ambition, grandiose visionary, optimism bias among government officials
 - (2) Economical: Deliberate underestimation, inadequate funding of projects, inefficient use of resources, lack of resources, dedicated funding process
 - (3) Execution: Forecasting errors, poor estimation, poor project design, poor planning, scope changes, inappropriate organizational structure, inadequate decision-making process.
 - (4) Political/Bureaucratic: Manipulation of forecasts, private information.

Number of applicants	Professional position of the applicants
3	Managers of project management offices for government agencies
5	Project managers working for government agencies
9	Project engineers working on infrastructure projects in government agencies

Source(s): Table by authors

Table 1.
Survey participant details



Source(s): Figure by authors

Figure 1.
Methodology to study the impact of success factors in government construction projects of Saudi Arabia

FEBE

Q2. The out of total project constructed by organization which of the following success factor found failure by construction team.

- (1) Manage relationships with various stakeholders (project participants, partners, governments, Owners, and internal stakeholders)
- (2) Produce the outcomes/benefits required by the organization, its delivery partners and other stakeholder organizations.
- (3) Consider the needs of staff and other stakeholders who will be impacted by the changes brought about the project
- (4) Include all the right people and make best use of resources in the organization and elsewhere.
- (5) Create and implement deliverables that meet agreed requirements.
- (6) Meeting time targets.
- (7) Stay within financial budgets.
- (8) Take account of changes in the way the organization operates.
- (9) Manage any risks that could jeopardize the success.

Q3. Which of the following guidelines/or some other guidelines are implemented in construction project to assess the effect of implementation on project success achievement (aspects as mentioned above in Q1)

1) Unrealistic classifications of contractors

Solution: Technical evaluation of contractors on project per project basis.

2) Contractors poor qualifications

Solution: Reintroduction of western contractors for near term.

3) Delay of payment to contractors

Solution: Mandatory 45 days for paying contractors.

4) Design work by contractors

Solution: Prohibit contractors from undertaking engineering design.

5) Unnecessary preparation of shop drawings by contractors

Solution: Specific list of deliverables (including shop drawings) be developed by the engineering design.

6) Absence of project management companies

Solution: Appointment of project management companies.

7) Lack of transparency at all levels

Solution: Creation of ombudsman office.

8) Changes to design during execution

Solution: Permission to change only in case of "errors or omissions".

9) Incomplete engineering design

Solution: Ensuring complete engineering design is issued to contractors.

10) Open specifications

Solution: Specify a minimum three brand for each equipment and materials.

11) Weak supply chain system

Solution: Creation of high-quality local supply chain.

12) Widespread use of substandards construction materials

Solution: Enforcement of standard specifications for materials and products.

13) Unskilled labour

14) False handover and absence of testing and commissioning (T&C)

Solution: T&C must be fully defined in contracts and specifications.

15) Other contributing factors to stall the projects

3. Results and discussion

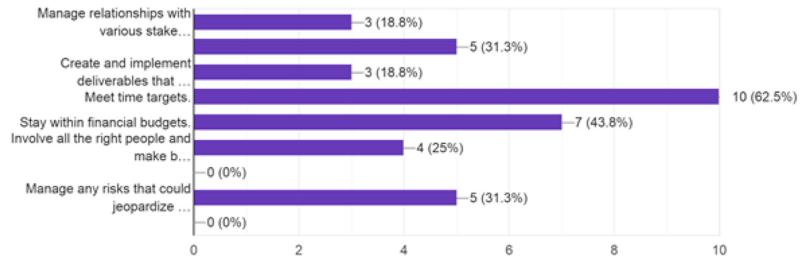
3.1 Critical success factors for construction projects of Saudi Arabia

The survey also includes questions related to the impact of CSFs on Saudi Arabian construction projects as viewed by the national project guidelines organizations. The factors are: (1) Managed relationships with various stakeholders, (2) Deliver the outcomes and benefits required by all stakeholder organizations, (3) Create and implement deliverables that meet agreed requirements, (4) Meet time targets, (5) Stay within financial budgets, (6) Involve all the right people and making best use of resources, (7) Take account of changes in the way the organization operates, (8) Managing risks and (9) Considering the needs of staff and other stakeholders. The questionnaire is based on a five-point Likert scale.

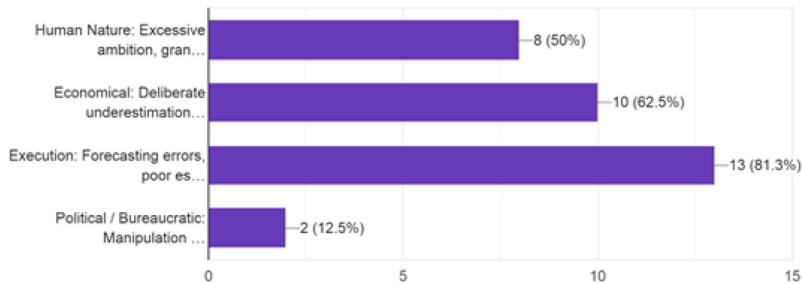
From the ranking analysis of success factors for Saudi Arabian construction projects, it is shown in Figure 2(a) that the most important critical success factor for Saudi Arabian construction projects is the “meeting time target of project schedule” (63%). The second most important critical success factor for Saudi Arabian public construction projects is the “stay within financial budgets of project” (44%). The results agree with previous research studies related to Saudi Arabian construction projects. The equally important critical success factors are to deliver the outcomes and benefits required by all stakeholders and manage risks (31%). The insignificant critical success factors for Saudi Arabian construction projects are “consideration of the needs of staff and other stakeholders” and “take account of changes in the way the organization operates” (0%).

3.2 Impact assessment of critical success factors in Saudi Arabia public construction projects

The questionnaire includes 15 factors to evaluate the impact of CSFs in Saudi Arabian construction projects. The factors are: (1) unrealistic classifications of contractors, (2) contractor poor qualifications, (3) delay of payment to contractors, (4) design work by contractors, (5) unnecessary preparation of shop drawings by contractors, (6) absence of project management companies, (7) lack of transparency at all levels, (viii) changes to design during execution, (9) incomplete engineering design, (10) open specifications, (11) weak supply chain system, (12) widespread use of substandards construction materials, (13) unskilled labour, (14) false handover and absence of testing and commissioning (T&C) and (15) other contributing factors to stalling of projects such as delay in approval of dispute resolution, contractor’s payment certificates by clients, poor mechanism for control of



Critical Success Factors
(a)



Key Failure Factors (Alzaraa *et al.*, 2016)
(b)

Figure 2. Criticality order of influencing key failure and success factors for public construction projects of Saudi Arabia

Source(s): Figure by authors

changes to projects, etc. About the validity of factors having an impact on projects in Saudi Arabia, it is shown by survey findings that most of the respondents (81%) agree that suggested factors, critical success factors of public construction projects in Saudi Arabia, will have an impact on stalled or new construction projects.

The survey-based assessment of the impact of the CSFs of Saudi Arabia construction projects findings, presented in Figure 3, show that the *incomplete engineering design* (62%) is the most important factor in the failure of the construction projects. The second most important factor (56%) is the *changes to design during execution* due to the failure of the construction projects. Survey findings show that *design work by contractors* is also a major

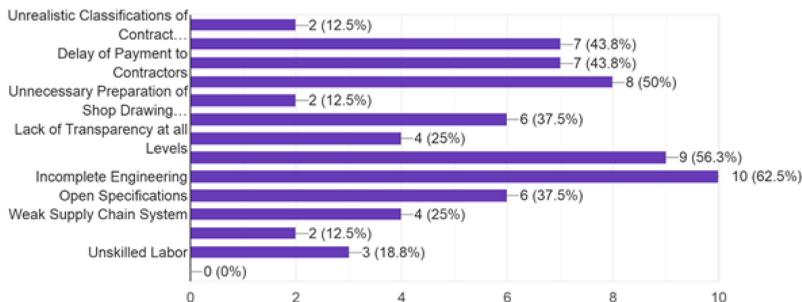


Figure 3. Ranking of impact of critical success factors of Saudi Arabia construction projects

Source(s): Figure by authors

factor (50%) that is responsible for the failure of projects. Two equally important factors (45%) that have an impact on preventing future project failures are the *contractors poor qualifications* and *delay of payment to contractors*. It is also clear from the survey that the absence of *project management companies* and *open specifications* for the projects also have a noticeable impact (38%) on preventing project failures. The framework guidelines should give importance to incomplete engineering design and frequent changes to the design of the projects. The framework should include guidelines for tenders, including the qualification of the contractor and payment according to contract conditions.

3.3 Key failure factors for construction projects in Saudi Arabia

The survey includes questions related to factors responsible for the failure of construction projects as found by the national project monitoring organization. The question is framed to categorize the failure of Saudi Arabian projects by four factors namely, failure by human nature, economical, execution or political influence. The survey results are shown in [Figure 2\(b\)](#). Most of the respondents (81%) agree that the execution factor (poor estimation, poor project design, poor planning, scope changes, inadequate decision-making process, etc.) is responsible for the failure of the projects in Saudi Arabia. The second most responsible reason for the failure of the projects (62.5%), as shown by the survey, is economical (deliberate underestimation, inadequate funding of projects, inefficient use of resources, lack of resources, etc.). Half of the respondents considers the failure of projects by human nature (excessive ambition, grandiose visionary and optimism bias among government officials) whereas political influence (manipulation of forecasts and private information) is not the reason for the failure of Saudi Arabian construction projects.

The ranking of critical success factors to increase the probability of success of government construction future projects by implementing control measures presented in this study is also compared with the previous studies ([Mahamid et al., 2015](#)) related to the influence order of CSFs in construction projects in Saudi Arabia. The identified success factors in the published work are based on the consultant's point of view. The results show a more or less similarity of findings on CSFs. The identified top six CSFs of the present study and published literature CSFs are given in [Table 2](#). The results show a more or less similarity of findings on CSFs. The slight deviation from the present study may be due to the focus on project delays in the previous study. The first identified factor of the present study is ranked sixth in the published study. The first identified factor in the published literature is ranked third in the present study. The sixth identified factor of the present study is ranked second in the published study. The findings of the study will provide valuable insights for construction managers in focusing on the CSFs for building projects.

Construction projects success factors ranking
Present study

Published study ([Mahamid et al., 2015](#))

Incomplete engineering design
Design work by contractors
Contractors poor qualifications
Delay of payment to contractors
Project management companies
Open specifications

Bid award to lowest price
Changes in material and specifications
Contract management
Duration of contract period
Fluctuation in price of materials
Frequent changes in design

Source(s): Table by authors

Table 2.
Comparison of
published studies
related to impact of
implementation of
construction projects
success factors

4. Conclusions

The present study was undertaken to identify the success factors of the government construction projects in Saudi Arabia and to evaluate their impact on project success. The study has analysed the impact of success factors on government construction projects in the KSA using the descriptive methodology. From the literature review and the developed questionnaire survey, 26 factors contributing to the success of a project were identified. The success factors are investigated from a broader consideration of failure criteria, from consideration of most effectiveness in successful completion and also from consideration of the impact of implementing control processes for successful project completion. The findings of the study will provide valuable insights for construction managers in assessing and addressing success factors in building projects.

The significant conclusions of the project work are summarized below:

- (1) The key factor contributing to the failure of construction projects, as identified by the national project monitoring organization, lies in the execution process, including poor estimation, project design, planning, scope changes and decision-making. Economic and human factors also play significant roles in project failures, indicating a need for greater attention to the initial phases of projects, such as conceptual and feasibility studies and engineering design.
- (2) The CSFs for construction projects in Saudi Arabia, in descending order of influence, are meeting time targets, adhering to financial budgets, delivering desired outcomes for stakeholders, managing risks and assembling the appropriate team while optimizing resource allocation.
- (3) The most effective factors to consider in implementing the control process for successful completion of Saudi Arabian construction projects are the approval process of the engineering design of the project and the contractors' identification process and their relationship with the project management team. The Saudi Arabian government's construction projects should develop an effective approval system for successful completion.
- (4) Framework guidelines recommend strict control over incomplete or altered engineering designs and prohibiting contractors from independently handling design work to ensure project success. Additionally, addressing contractors' qualifications and financial matters is crucial for success.
- (5) Project management companies' absence and the lack of well-managed construction practices, along with open specifications for materials and equipment, also contribute to project failures, underscoring the importance of addressing these factors to prevent future failures.
- (6) The study also highlights the significance of addressing the absence of project management companies with well-managed construction practices and the lack of open specifications for materials and equipment. These factors require careful consideration to mitigate the risk of project failure.

List of abbreviations

Abbreviation	Terms
GDP	Gross domestic product
CSF	Critical success factors
CFF	Critical failure factors

SAR	Saudi Arabia Riyal
T & C	Testing and commissioning
PIP	Performance information procurement
BIM	Building information modelling

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