

Critical Factors Affecting the Success of Construction Projects in Oman

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Construction in Oman is an important sector that contributes greatly to the country's economic growth. Recently, the construction projects in Oman have been delayed which has led to delays in the projects' completion and sometimes to their failure. This study aims to examine the critical factors affecting the success of construction projects in Oman. The extent to which factors related to project parties affect this success was assessed. A quantitative approach based on systematic literature review and questionnaire survey technique was used. The factors were identified and classified into six main categories, namely, time; finance; project designing, planning and scheduling; quality; project progress and development; and environment and nature. The factors are also classified as client-, consultant-, contractor- and external-related factors. This study was conducted by distributing questionnaires to people who experienced working in the public and private construction sectors in Oman. Relative importance index method was used for analysis. Results show that quality is the most important amongst the six investigated categories, followed by time; finance; project progress and development; project designing, planning and scheduling; and environment and nature. The client-related factors have the highest impact on the success of construction projects in Oman, followed by consultant-, contractor- and external environment-related factors. The selection of a low bid, rather than accurate and reliable bids, and the quality and experience of the project team and labour are the most significant factors affecting the success of construction projects in Oman. The contractors' administrative corruption, indiscipline and dishonesty and the frequent equipment breakdowns are the two least important factors affecting the success of construction projects. The government should encourage clients to improve their procurement strategies and force the construction companies to implement innovative approaches to project delivery.

Keywords: construction projects, critical success factors, Oman, project success, relative importance index.

The construction industry is important in the economy of countries (Chan et al., 2004; El-Hallaq & Tayeh, 2016). The different types of construction projects include buildings, roads and bridges. Oman's construction sector has grown from US\$ 4.9 billion in 2013 to US\$ 5.2 billion in 2014 and is estimated to reach US\$ 5.6 billion in 2015 (Mordor Intelligence, 2017). The Omani government's Ninth Five-Year Development Plan 2016–2020 and the Oman Vision 2020 support the growth in the construction industry by focusing on investments in transport infrastructure (e.g. seaports, railway lines and airports), utility facilities, affordable housing and special economic zones (Global Data, 2017; Building and Construction Authority Singapore, 2017). Under the Ninth Five-Year Development Plan 2016–2020, the government is investing OMR 66.0 billion (US\$ 171.7 billion) until 2020 to devel-

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Introduction



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op the overall infrastructures (Global Data, 2018). In addition, the Omani government aims to attract foreign investments by simplifying the relevant rules and regulations (Mordor Intelligence, 2017).

Project success has no accepted universal definition (Nguye & Chovichien, 2013). The definition of the success of construction projects varies amongst stakeholders. A project is considered successful if the objectives and expectations are achieved. These objectives and expectations may include different issues, such as technical, financial, educational, social and professional issues (Parfitt & Sanvido, 1993). In the 1980s, a construction project is considered successful if it is completed within the specified time, budget and required standard of quality in addition to customers' satisfaction (Khosravi & Afshari, 2011).

The success of a construction project is measured using two categories: small and large viewpoints. The former is measured by time, cost and quality of completion in addition to the completion performance and safety; the latter is assessed by completion time, stakeholders' satisfaction and completion facilities and operation (Lim & Mohamed, 1999; Abu Aisheh et al., 2021).

However, defining project success has remained unclear for construction professionals; thus, numerous studies on the critical factors affecting the success of construction projects have been conducted in the past years (Chan et al., 2004; Wang & Huang, 2006; Ramlee et al., 2016; Das & Ngacho, 2017; Tayeh et al., 2018). Different critical success factors (CSFs), such as safety, quality, time and scheduling, planning, resources, cost and finance, technology, environment, organisation, management, experience, size and type of previous projects, have been defined by several researchers; however, no general agreement has been identified (Belassi & Tukel, 1996; Ramlee et al., 2016; Alzahrani & Emsley, 2013; Babu & Sudhakar, 2015; Maliha et al. 2021).

Chan et al. (2004) classified CSFs into five categories: project-related, project procedures, project management actions, human-related and external environmental factors. Babu (2015) categorised CSFs into 10 main groups: cost, time, quality, productivity, client satisfaction, community, people, health and safety, innovation and learning and environmental factors. Ramlee et al. (2016) summarised the CSFs identified by several researchers to include cost, time, quality, satisfaction, management, safety, technology, organisation, environment and resources. All researchers have agreed that cost, time and quality are important CSFs, whereas 50% of these researchers have considered management, technology, organisation and satisfaction as important CSFs. Babu and Sudhakar (2015) summarised the most important CSFs within the project life cycle as clarity of project objectives, top management support, efficiency of project manager, efficiency of project team members, detailed plan of the project activities or schedule, effective communication between client and project team members, quality of suppliers and subcontractors, client approvals, monitoring and feedback, suitable technology and communication network and troubleshooting of unexpected crisis and problems.

Kylindri et al. (2012) summarised the specific success dimensions identified by other researchers and found that cost, time, quality, efficiency, performance and technical success factors have been excessively researched. Other factors, such as client satisfaction, safety, team creativity, knowledge and project management process, must be further explored. Al-Tmeemy & Harun (2011) and Raphael (2016) defined a construction project as successful if it satisfies the specified completion time, total cost, agreed technical specifications of the project and clients' and customers' expectations. These project success measures depend on various factors, such as client, contractor, project team, nature of the project, location and size of the project, technology to be used, contract type and risks involved (Tayeh et al., 2020c).

Abdul-Rahman et al. (2011) identified the possible causes of financial-related problems that contribute to project delays and found that the instability of the contractor's financial background, the unavailability of a project financier and poor cash flow management are major factors contribute to project delays. A well-managed cash flow improves the time performance of the project; con-

versely, poor cash flow leads to project failure (Abdul-Rahman et al., 2011). Tanzi and Davoodi (1998) and Gillanders (2014) stated that countries with high corruption rate have worse infrastructures than other countries. Tayeh et al. (2018) confirmed that the availability of funding and regularity of payments affect the project's progress and success considerably. Abdul-Rahman et al. (2009) revealed that project delay depends greatly on the client's poor financial management and difficulties in obtaining funding from financiers. Homthong and Mounngnoi (2016) stated that clients should pay contractors on time to eliminate any delay in the project. Yong and Mustafa (2012) determined that the client's financial capability and delay of progress payments are the two top client-related factors affecting the construction projects in Malaysia. The contractor's unstable financial situation and inability to perform the work and pay salaries, subcontractors and other expenses affect the project progress negatively and thus lead to project failure (Tayeh et al., 2018). Oyewobi et al. (2015) stated that variations during construction are time consuming and costly because they increase construction costs and time by 34% and 29.5%, respectively. These variations also increase project rework and demolition and thus lead to client dissatisfaction and project failure. Frequent equipment breakdowns in construction sites are a common problem that increases the downtime and requires costly repair (Tsado & Theophilus, 2014).

Chan et al. (2004) (and Akanni et al. (2015) reported that the external factors that affect the construction projects include economic, social, political, physical, industrial, legal, cultural and technological factors. Physical factors include climatic condition, weather, natural disaster (e.g. storm, fire and landslide) and unexpected geological conditions. Akanni et al. (2015) found that climatic condition and weather factors are the most important amongst all 29 external factors investigated.

Fong and Choi (2000) stated that the selection process of reliable bids is critical for clients who are seeking for successful projects. This process must not be based on under- or overweighed quality, time and cost criteria. Muhwezi et al. (2014) identified the CSFs related to clients and arranged them in the following order: corruption, poor cash flow, change orders, delay in payments and changes in materials and design. Yong and Mustafa (2012) reported that the client's excessive variations during construction are the third most important factor that affects the construction projects in Malaysia.

Tayeh et al. (2018) emphasised the importance of the time of the design stage for the successful implementation of projects. Delays during the design stage lead to an overall delay in the work and thus affect the success of the project. Muhwezi et al. (2014) ranked the client's delay in approving design documents as the sixth top client-related factor. Tayeh et al. (2018) observed that the quality and experience of the design team considerably affect the quality and outcomes of the project. Homthong and Mounngnoi (2016) determined that the adequate experience of project participants is the second highest critical affecting factor of the success of a project because successful projects require an experienced team to execute the work.

Muhwezi et al. (2014) identified the CSFs related to contractors and arranged them in the following order: dishonesty, inadequate contractor experience, incompetent project manager, inappropriate construction methods and poor site management. Tayeh et al. (2018) stated that the contractor's experience in performing the work is the highest contractor-related affecting factor of construction project success. Yong and Mustafa (2012) determined that the quality of subcontractors and skills of workers are two top contractor-related factors affecting the success of construction projects in Malaysia. Homthong and Mounngnoi (2016) suggested that the availability of skilled and experienced personnel is the second highest human resource-related affecting factor of project operations and progress.

The external factors that affect construction projects are economic, social, political, physical, industrial, legal, cultural and technological factors. Muhwezi et al. (2014) stated that identifying the occurrence of external factors and controlling them are difficult because these factors originate from sources outside the project. Abdul-Rahman et al. (2009) confirmed that financial market instability,

including inflation of material prices, wages and transportation cost, significantly affects cash flow and leads to project delays. Yong & Mustafa (2012) reported that the weather condition factor is the least significant amongst 15 critical factors affecting the success of construction projects in Malaysia. Al Harthi (2005) investigated the effect of variation orders in construction projects in Oman. It was found that costly and time-consuming variation orders appear during construction work and are considered the primary causes of delays and disputes; thus, serious cost impacts and project failure occur. Oyegoke and Al Kiyumi (2017) identified the most important factors affecting the success of mega construction projects in Oman; these factors include selecting the lowest price tendering, rather than the optimal value tender; the financial situation of the main contractor; delay in decision making by clients; poor contractor planning; and cost and time overruns in projects. Al Maktoumi et al. (2020) studied the causes of the delays in construction project in Oman and investigated the effects of such delays. It was found that the delay of construction project completion in Oman was mainly due to client-related factors followed by equipment-related factors, and material related factors. The Client's delay in providing the contractors with the necessary facilities, equipment and sufficient time and the delay in making decisions are the most important factors affecting the construction project progress in Oman. Al Adawi et al. (2020) studied the impact of governmental stakeholders on the progress of projects in Oman. It was found that governmental authorities, through lengthy approval processes, have a crucial effect on delaying the projects completion and hence lead projects to fail. The approval process in Oman is very slow, and the average duration needed for obtaining a single approval from governmental authorities is two to four weeks.

Although Building Information Modeling (BIM) technology is not new to the construction industry, limited research on BIM implementation had been conducted in developing countries, such as GCC countries. Results of the few research studies conducted in KSA, UAE, Turkey and Iraq revealed that most of the construction companies lack knowledge and awareness of Building Information Modeling (BIM) technology. The implementation of BIM technology in construction projects is still at slow rate in the Middle East, especially in Sultanate of Oman (Darwish et al., 2020; Al-Ashmori et al., 2020; Umar, 2021). Only 20% of construction companies in Middle East are using BIM in their projects (Gerges et al., 2017). Due to the lack of knowledge and implementation of BIM, the authors did not consider the implementation of BIM technology as a critical factor affecting the success of construction projects in Oman.

Limited works have been conducted to analyse the success of construction projects in Oman and define the critical factors affecting the success of the Omani construction industry (Oyegoke and Al Kiyumi, 2017; Al Maktoumi et al., 2020). There are contradictions in the research results and lack of common agreement amongst researchers on the critical factors affecting the construction projects. It is evident that there is a high need to conduct more research studies to investigate the main factors which lead to success or failure of construction projects in the Sultanate of Oman. Additional studies should be conducted to examine the impact of these factors on the Omani economy for improving the efficiency of construction projects in Oman. In the present study, the critical success factors affecting the success of construction projects in Oman and their impact on the Omani construction sector are investigated using a quantitative approach based on systematic literature review and questionnaire survey technique. The criteria to measure the success of a project are evaluated in terms of time and scheduling, finance and cost, design and planning, quality, progress and productivity, and environment. The extent to which factors related to clients, consultant, contractor and external environment affect the success of construction projects in Oman is also assessed.

Table 1 summarizes the critical factors used in the current study with their references from the previous studies. According to the literature review, the studied factors were classified into four broad categories, namely, client-, consultant-, contractor- and external-related factors.

Category	Factors related to	Factors	References
Time	Client	Client delay in decision-making	Oyegoke & Al Kiyumi, 2017; Das & Ngacho, 2017; Al Maktoumi et al.,2020.
	Client	Client delay in payments	Abdul-Rahman et al., 2009; Abdul-Rahman et al., 2011.
	Client	Delay in providing temporary utilities of water, electricity, and A/C for construction site	Tayeh et al., 2018; Al Adawi et al., 2020; Al Maktoumi et al.,2020.
	Client/ Consultant	Delay in design (drawings) approval.	Muhwezi et al., 2014; Tayeh et al., 2016; Das & Ngacho, 2017; Oyegoke & Al Kiyumi, 2017.
	Client/ Consultant	Delay in approving materials	Babu, 2015; Tayeh et al., 2016; Das & Ngacho, 2017.
	Contractor	Project manager delay in making and issuing decisions	Babu, 2015; Das & Ngacho, 2017;
	Contractor	Unrealistic project timelines	Oyegoke & Al Kiyumi, 2017; Das & Ngacho, 2017; Al Maktoumi et al.,2020.
	Contractor	Shortage and delay in material supply	Akanni et al., 2015; Al Maktoumi et al.,2020.
	External	Delay in issuing approvals by authorities	Tayeh et al., 2016; Al Adawi et al., 2020.
Finance	Client	Lack of project financing	Abdul-Rahman et al., 2009; Abdul-Rahman et al., 2011.
	Client/ Contractor	Poor cash flow (irregular cash flow)	Abdul-Rahman et al., 2009; Abdul-Rahman et al., 2011; Albhaisi, 2016.
	Client/ Contractor/ Consultant	Financial corruption	Abdul-Rahman et al., 2009; Abdul-Rahman et al., 2011; Gillanders, 2014; Albhaisi, 2016.
	Contractor	Contractor's unstable financial situation	Abdul-Rahman et al., 2009; Abdul-Rahman et al., 2011; Alzahrani & Emsley, 2013; Tayeh et al., 2016.
	External	Poor economic conditions	Abdul-Rahman et al., 2009; Abdul-Rahman et al., 2011.
	External	Inflation (material prices, labor, and transportation costs)	Abdul-Rahman et al., 2009; Abdul-Rahman et al., 2011; Akanni et al., 2015.
Project Designing, Planning and Scheduling	Client	Inadequate information provided by a client during feasibility studies	Chan et al., 2004; Babu & Sudhakar, 2015; Das & Ngacho, 2017; Tayeh et al., 2017; Al Maktoumi et al.,2020.
	Consultant	Misunderstanding of owner requirement and project objectives	Muhwezi et al., 2014; Homthong & Mounghoi, 2016; Das & Ngacho, 2017; Tayeh et al., 2018; Tayeh et al., 2019.
	Consultant	Insufficient data collection and survey prior to design	Muhwezi et al., 2014; Babu & Sudhakar, 2015; Das & Ngacho, 2017; Tayeh et al., 2018.
	Consultant	Errors in design and failure to satisfy design objectives	Muhwezi et al., 2014; Babu & Sudhakar, 2015; Babu, 2015.
	Contractor	Ineffective project planning and schedule	Al-Tmeemy & Harun, 2011; Das & Ngacho, 2017; Oyegoke & Al Kiyumi, 2017.

Table 1

Factors used in the questionnaire

Category	Factors related to	Factors	References
Quality	Client	Selection of a low bid, rather than an accurate and reliable bid	Fong & Choi, 2000; Chan et al., 2004; Meland et al., 2011; Oyegoke & Al Kiyumi, 2017.
	Contractor/ Consultant	Unqualified/inadequate experienced labor and team	Muhwezi et al., 2014; Babu, 2015; Das & Ngacho, 2017; Al Maktoumi et al., 2020.
	Contractor	Incompetent project manager	Babu & Sudhakar, 2015; Babu, 2015; Tayeh et al., 2020a.
	Contractor	Unqualified suppliers	Al Maktoumi et al., 2020; Alzahrani & Emsley, 2013.
	Contractor	Unqualified sub-contractors	Das & Ngacho, 2017; Al Maktoumi et al., 2020.
	Contractor	Poor quality of materials	Homthong & Mounгноi, 2016; Al Maktoumi et al., 2020; Tayeh et al., 2020b.
Project Progress and Development	Client	Design changes and variations during construction work	Al Harty, 2005; Oyewobi et al., 2016; Das & Ngacho, 2017; Al Maktoumi et al., 2020.
	Client	Lack of incentives for contractors to follow project schedule	Chan et al., 2004; Chen et al., 2021.
	Client/ Consultant/ Contractor	Poor communication and coordination with other project parties	Chan et al., 2004; Wang & Huang, 2006; Babu & Sudhakar, 2015; Homthong & Mounгноi, 2016; Das & Ngacho, 2017; Nguye & Chovichien, 2013; Tayeh et al., 2018; Malik et al., 2021.
	Consultant	Inadequate project management assistance	Al-Tmeemy & Harun, 2011; Babu & Sudhakar, 2015.
	Consultant	Poor supervision of consultant to contractor activities	Chan et al., 2004; Homthong & Mounгноi, 2016.
	Contractor	Poor site management and supervision by a project manager	Belassi & Tukul, 1996; Homthong & Mounгноi, 2016.
	Contractor	Poor risk management and inappropriate handling of unexpected problems and crises	Alzahrani & Emsley, 2013; Homthong & Mounгноi, 2016.
	Contractor	Inadequate implementation of health and safety procedures	Chan et al., 2004; Homthong & Mounгноi, 2016; Tayeh et al., 2018; Mahfuth et al., 2019.
	Contractor	Lack of materials	Akanni et al., 2015; Al Maktoumi et al., 2020.
	Contractor	Frequent equipment breakdowns	Tsado & Theophilus, 2014; Homthong & Mounгноi, 2016; Al Maktoumi et al., 2020.
Environment	External	Administrative corruption, indiscipline, and dishonesty	Alzahrani & Emsley, 2013; Gillanders, 2014; Muhwezi et al., 2014.
		Shortage of labor and equipment	Belassi & Tukul, 1996; Akanni et al., 2015; Al Maktoumi et al., 2020.
		Emergence of natural factors, such as rainstorms, windstorms, and floods	Akanni et al., 2015; Das & Ngacho, 2017; Tayeh et al., 2018.

Date Collection Method

Quantitative research is usually conducted to quantify a problem by creating numerical data or data that can be converted into applicable statistics (Fellows & Liu, 1997). In this study, a quantitative approach was used as the main method to obtain appropriate and accurate data. Data collection was conducted by distributing questionnaires to people who have a long work experience in the public and private construction sectors in Oman. Data analysis was conducted using relative importance index method.

These respondents were clients, sponsors, project managers, project team members, contractors and people involved in the project implementation. The questions in the questionnaires were formulated based on the data collected from the literature review and interviews conducted with key people in the construction industry. The critical factors used in designing the questionnaire are summarized in Table 1. The studied factors are classified into four broad categories, namely, client-, consultant-, contractor- and external-related factors.

Research Location and Duration

This study was conducted in Muscat Governorate during two different periods from October 2017 to March 2018 and from January to April 2021.

Sample Size and Population

One Hundred Fifty questionnaires were distributed. The total number of the collected questionnaires was 77, which represents 51% of the total distributed copies. The number and classification of the respondents were 17 client representatives, 23 contracting engineers, 10 project managers, 23 architects and consulting engineers and 4 site supervisors. The respondents had 5–28 years of experience in the construction industry.

Questionnaire Design

The questionnaires were designed on the basis of the objectives of the study, literature review outcomes and personal interviews with experts in the Omani construction sector. The questionnaire has 43 questions, which were divided into two main groups, namely, general and specific questions. General questions include multiple-choice questions about personal and organisational information (four items). Subject-related specific questions include five-point Likert scale questions, which measure the level of agreement of respondents on the proposed factors of project success. The levels of agreement used were presented as follows: 1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree and 5 = Strongly agree. A total of 39 factors affecting the success of construction projects were identified and divided into the following main categories.

- _ Time
- _ Finance
- _ Project designing, planning and scheduling
- _ Quality
- _ Project progress and development
- _ Environment and nature

Data analysis

The contribution and ranking of each of the factors as perceived by the respondents are analysed using relative importance index (RII) method (Muhwezi et al., 2014). Equation (1) is used to calculate the RII, and the results are summarised in Table 2.

$$RII = \frac{\sum W}{A \cdot N}, \quad (1)$$

where W – weight given to each factor by the respondents and ranges from 1 to 5

A – highest response weight (5)

N – total number of respondents

Table 2

RII, Mean Score and Rank for all Factors used in the Study

Category	Factors related to	Factors	Rank	Mean Score	Std. Dev.	RII
Time	External	Delay in issuing approvals by authorities.	1	3.51	1.02	0.702
	Client Consultant	Delay in design (drawings) approval	2	3.41	1.19	0.682
	Client	Client delay in payments.	3	3.38	0.98	0.676
	Client	Client delay in decision-making.	4	3.35	0.98	0.670
	Client Consultant	Delay in approving materials.	5	3.32	1.23	0.664
	Contractor	Delay and shortage in material supply.	6	3.32	1.08	0.664
	Contractor	Unrealistic project timelines.	7	3.24	1.14	0.648
	Client	Delay in providing temporary utilities of water, electricity, and A/C for construction site.	8	3.11	1.26	0.622
	Contractor	Project manager delay in making and issuing decisions.	9	3.05	1.08	0.610
	Overall				3.30	
Finance	Contractor	Contractor's unstable financial situation.	1	3.41	1.21	0.682
	Client	Lack of project financing.	2	3.35	1.32	0.670
	External	Inflation (material prices, labor, and transportation costs).	3	3.19	1.17	0.638
	Client Contractor Consultant	Financial corruption.	4	3.00	1.53	0.600
	External	Poor economic conditions.	5	2.95	1.29	0.590
	Client Contractor	Poor cash flow (irregular cash flow).	6	2.95	1.10	0.590
	Overall				3.14	
Project Designing, Planning and Scheduling	Client	Inadequate information provided by a client during feasibility studies.	1	3.19	1.22	0.638
	Consultant	Errors in design and failure to satisfy design objectives.	2	3.08	1.19	0.616
	Consultant	Insufficient data collection and survey prior to design.	3	3.00	1.33	0.600
	Contractor	Ineffective project planning and schedule.	4	2.92	1.38	0.584
	Consultant	Misunderstanding of owner requirement and project objectives.	5	2.84	1.30	0.568
	Overall				3.01	
Quality	Client	Selection of a low bid, rather than an accurate and reliable bid	1	3.65	1.46	0.730
	Contractor consultant	Unqualified/ inadequate experienced labor and team	2	3.65	1.25	0.730
	Contractor	Unqualified sub-contractors	3	3.54	1.02	0.708
	Contractor	Unqualified suppliers	4	3.46	1.30	0.692
	Contractor	Poor quality of materials	5	3.19	1.13	0.638
	Contractor	Incompetent project manager	6	2.86	1.25	0.572
	Overall				3.39	

Category	Factors related to	Factors	Rank	Mean Score	Std. Dev.	RII
Project Progress and Development	Client	Design changes and variations during construction work.	1	3.54	1.14	0.708
	Consultant	Inadequate project management assistance	2	3.30	1.18	0.660
	Client	Lack of incentives for contractors to follow project schedule	3	3.22	1.20	0.644
	Contractor	Poor site management and supervision by a project manager.	4	3.16	1.14	0.632
	Contractor	Lack of materials	5	3.11	1.20	0.622
	Contractor	Shortage of labor and equipment	6	3.08	1.04	0.616
	Client Consultant Contractor	Poor communication and coordination with other project parties.	7	3.08	1.26	0.616
	Consultant	Poor supervision of consultant to contractor activities	8	3.05	1.10	0.610
	Contractor	Poor risk management and inappropriate handling of unexpected problems and crises	9	3.05	1.13	0.610
	Contractor	Inadequate implementation of health and safety procedures	10	2.95	1.18	0.590
	Contractor	Administrative corruption, indiscipline, and dishonesty	11	2.73	1.22	0.546
	Contractor	Frequent equipment breakdowns	12	2.62	1.01	0.524
Overall				3.08		0.615
Environment	External	Emergence of natural factors, such as rainstorms, windstorms, and floods	1	2.78	1.18	0.556

Study Limitation

The first limitation of the current study is the relatively small number of respondents. Although there are significant conclusions made based on the responses obtained from the survey respondents, the findings may not accurately reflect the opinion of the entire professionals in the Omani construction sector. Secondly, this study was conducted in the Muscat Governorate and all questionnaires were distributed amongst professionals who are working in Muscat. The limitations identified by this study suggest that further studies should be conducted targeting the construction professionals who are working in cities other than Muscat to increase the sample size and maximise the accuracy of the current results.

General Information of the Respondents

The respondent sample includes 17 client representatives, 27 contracting engineers and supervisors, 10 projects managers and 23 consulting architects/engineers. A total of 58% of the respondents work in various government construction projects, whereas 42% of them work in private construction projects. A total of 27, 23, 19, 5 and 3 of the respondents have total years of experience of 1–5, 6–10, 11–15, 16–20 and above 20 years, respectively. Therefore, the respondents are adequately qualified to answer the distributed set of questions.

Critical Factors affecting the Success of Construction Projects in Oman

Table 2 lists the RIIs for all factors used in this study. These factors, which affect the success of construction projects in Oman, are classified into six main categories, namely, time; finance; project designing, planning and scheduling; quality; project progress and development; and environment and nature. The overall RII of the main categories is presented in Table 3.

Results and Discussion

Table 3Overall Mean RIIs
of Main Categories

Category	RII	Rank
Quality	0.678	1
Time	0.660	2
Finance	0.628	3
Project Progress and Development	0.615	4
Project Designing, Planning and Scheduling	0.601	5
Environment	0.556	6

Table 3 shows that quality factors are the most important factors amongst the six investigated categories, whereas the environmental category is the least. The mean RII of quality factors category is 0.678, followed by time; finance; project progress and development; project designing, planning and scheduling; and environmental factors with the RIIs of 0.66, 0.628, 0.615, 0.601

and 0.556, respectively. This finding is consistent with the findings of Ramlee et al. (2016) in which cost, time and quality were found the three main important CSFs of construction projects, whereas safety, environment and resources were the least important ones.

Quality Factors

The results, presented in Table 2, show that selecting a low bid, rather than an accurate and reliable bid, is a significant quality-related affecting factor of the success of construction projects in Oman with an RII of 0.73. Similarly, the quality of project team and experience of labour significantly affect the success of construction projects in Oman, followed by the quality of subcontractors, suppliers and materials with RIIs of 0.73, 0.708, 0.692 and 0.638, correspondingly. Although the quality and efficiency of the project manager are crucial, they rank the least quality-related factor that affects the success of construction projects in Oman with an RII value of 0.572. Values exceeding 0.5 are considered of large effects.

These findings are consistent with the previous studies in which the selection criteria and tendering evaluation are considered important success factors of construction projects (Fong & Choi, 2000; Chan et al., 2004; Meland et al., 2011; Oyegoke & Al Kiyumi, 2017). Meland et al. (2011) argued that a high focus on price in the tendering evaluation of construction projects deteriorate the project outcome in terms of cost and quality.

Time Factors

Table 2 shows that the delay in obtaining approvals from government authorities and the delay of clients and consultants in approving the drawings are two major time-related factors affecting the success of Omani construction projects with RIIs of 0.702 and 0.682, respectively. These findings are consistent with the results obtained from previous studies in which the delays in obtaining the approvals of local authorities are considered a dominant affecting factor of the success of any development (Ratcliffe & Stubbs, 2003; Evans, 2004; Al Adawi et al., 2020).

Although the delay in obtaining the approval of project management on critical issues, such as scope, resources and major tasks, is considered a significant factor that can derail a project from the beginning. The results show that the delay in obtaining internal approvals of the project manager is the least important time-related affecting factor of the overall success of the construction projects in Oman with an RII of 0.610.

Finance Factors

The results of the present study, as summarised in Table 2, confirm that the instability of the contractor's financial background and the unavailability of a project financier are the two major financial-related factors affecting the success of construction projects in Oman. The two factors have RIIs of 0.682 and 0.670, which imply high significance. These findings are consistent with the results obtained by Abdul-Rahman et al. (2011) who found that the client's insufficient financial resources and the contractor's unstable financial background are the most significant factors that lead to project delay.

Although the client and contractor's poor cash flow management is a significant reason for project failure, the results show that this factor with an RII of 0.59 is the least important financial-related affecting factor of the success of construction projects in Oman. This factor ranks the least, but its RII exceeds 0.5 indicating that this factor is as important as the other factors.

Project Progress and Development Factors

The results of the present study, as summarised in Table 2, show that the design changes and variations during the construction work exhibit a significant negative impact on the project performance and progress, thereby leading to project failure. This factor has an RII of 0.708.

This finding is consistent with the findings of Oyewobi et al. (2015) who found that variations during construction are time consuming and costly because they increase construction costs and time by 34% and 29.5%, respectively.

The consultant shares advice, makes recommendations, solves problems and determines the optimal actions to be undertaken during the project duration to improve the project progress. Poor project management assistance provided by the consultant to the project team leads to a disastrous result in the construction projects. This finding is confirmed by the survey results, where it ranks as the second significant factor that leads to construction project failure in Oman with an RII of 0.66.

However, the failure of equipment has subsequent impacts on the progress of the work and delivery of the services, this factor ranks the least project progress and development-related factors affecting the success of construction projects in Oman with an RII of 0.524.

Project Designing, Planning and Scheduling Factors

The study results, as presented in Table 2, indicate that inadequate information provided by the client during feasibility studies ranks the major factor related to project designing, planning and scheduling with an RII of 0.638. The pre-construction information provided by the client to the contractors and designers during tendering, designing and planning stages must be clear, understandable, concise and in a convenient form to enable distinct performance of duties. Consultants' errors in design and failure to satisfy the design objectives rank the second factor with an RII of 0.616, whereas consultants' misunderstanding of the client's requirements and the project objectives is the least important with an RII of 0.568.

Environment and Nature Factors

In the present study, the effect of bad weather conditions, such as rainstorms, winds, tornadoes and floods, is one of the least factors affecting the success of construction projects in Oman. This factor has an RII of 0.556, which exceeds 0.5 and thus indicates that it is as important as the remaining factors. This finding contradicts with the results of previous research studies. Chan et al. (2004) and Akanni et al. (2015) stated that climatic condition and weather factors rank as the second most important amongst all external factors investigated in their studies.

Contribution of the Project Team in the Success of Construction Projects in Oman

The results presented in Tables 4–6 indicate that the factors related to the client have the highest impact on the success of construction projects in Oman, followed by those related to the consultant and contractor with overall RIIs of 0.655, 0.635 and 0.624, respectively.

Client-Related Factors affecting the Success of Construction Projects in Oman

The summary of results in Table 4 indicates that quality, time and project progress are the most important categories related to the client's role in the success of construction projects. The results of the current study are similar to the findings obtained in previous studies (Fellows & Liu, 1997; Fong & Choi, 2000; Yong & Mustafa, 2012; Al Maktoumi et al., 2020). Specifically, the respondents agree that the client's selection of a low bid, rather than an accurate and reliable bid, is the key

Table 4
RIIs of Client-Related Factors

Category	Factors	RII
Time	Delay in approving the design drawings	0.682
	Client delay in payments	0.676
	Client delay in decision-making	0.670
	Delay in approving materials	0.664
	Delay in providing temporary utilities of water, electricity, and A/C for construction site	0.622
	Overall	0.663
Finance	Lack of project financing	0.670
	Financial corruption	0.600
	Poor cash flow (irregular cash flow)	0.590
	Overall	0.620
Project Designing, Planning and Scheduling	Inadequate information provided by a client during feasibility studies	0.638
	Overall	0.638
Quality	Selection of a low bid, rather than an accurate and reliable bid	0.730
	Overall	0.730
Project Progress and Development	Design changes and variations during construction work	0.708
	Lack of incentives for contractors to follow project schedule	0.644
	Poor communication and coordination with other project parties	0.616
	Overall	0.656
Client Related Factors-Overall		0.655

client-related affecting factor of the construction projects in Oman with an RII of 0.73, followed by the client's design change and variation orders during a construction work with an RII of 0.708.

Delays during the design stage lead to an overall delay in the work and thus affect the success of the project. The findings of previous research studies carried out by Muhwezi et al. (2014) and Tayeh et al. (2018) are supported by the current results, which show that the client's delay in design approvals is the third highest client-related factor with an RII of 0.682.

The availability of funding, regularity of payments, and the client's poor financial management affect the project's progress and success considerably (Abdul-Rahman et al., 2009; Yong and Mustafa, 2012; Homthong and Mounngnoi, 2016; Tayeh et al., 2018). These findings are consistent with the current results, where a lack of project financing and the client's delay in payments are highly important with RIIs of 0.67 and 0.676, respectively.

Consultant-Related Factors affecting the Success of Construction Projects in Oman

Similar to client-related factors, quality- and time-related factors are the most important categories related to the consultant's role in construction project success. The respondents of the current survey agree that the quality and the experience of the consultant team and designers are crucial success factors with an RII of 0.73, as summarised in Table 5. This finding matches with the findings of previous studies conducted by Homthong and Mounngnoi (2016) and Tayeh et al. (2018), where the quality, experience of the design team and experience of project participants considerably affect the quality and outcomes of the project because successful projects require an experienced team to execute the work.

The current results indicate that the consultant's delays in approving the design drawings and materials significantly affect the overall delay of the construction project and thus the project success.

The RIIs of these factors are 0.682 and 0.664, respectively. The design activity is broadly conducted by consultants to translate the client's goals and concepts into workable construction systems. Muhwezi et al. (2014) analysed the consultant's misunderstanding of the client's requirement; this factor is significant with an RII of 0.742. In the present study, the consultant's misunderstanding of the client's requirement and project objectives has been found as the least important consultant-related affecting factor of the success of construction projects in Oman. The RII of this factor is 0.568, which exceeds 0.5 and thus indicates that it is as important as the remaining factors.

Category	Factors	RII
Time	Delay in approving the design drawings	0.682
	Delay in approving materials	0.664
	Overall	0.673
Finance	Financial corruption	0.600
	Overall	0.600
Project Designing, Planning and scheduling	Errors in design and failure to satisfy design objectives	0.616
	Insufficient data collection and survey prior to design	0.600
	Misunderstanding of owner requirement and project objectives	0.568
	Overall	0.595
Quality	Unqualified/ inadequate experienced team	0.730
	Overall	0.730
Project Progress and Development	Inadequate project management assistance	0.660
	Poor communication and coordination with other project parties	0.616
	Poor supervision of consultant to contractor activities	0.610
	Overall	0.629
Consultant Related Factors-Overall		0.635

Table 5

RIIs of Consultant-Related Factors

Contractor-Related Factors affecting the Success of Construction Projects in Oman

Similar to consultant-related factors, Table 6 shows that quality, time and finance factors are the most important categories related to the contractor's role in construction project success.

The respondents of the current survey agree that the quality and experience of the contractor team and labour are the most important factors related to the contractor's role in ensuring the success of the construction project. This result is consistent with the findings obtained in previous studies (Yong & Mustaffa, 2012; Muhwezi et al., 2014; Homthong & Mounnoi, 2016; Tayeh et al., 2018). Unqualified/inadequately experienced labour, unqualified subcontractors and unqualified suppliers are identified as the key factors related to contractors with RIIs of 0.73, 0.708 and 0.692, respectively, Tayeh et al., 2018 stated that the contractor's financial situation and inability to perform the work affect the project progress negatively and thus lead to project failure. This finding is nearly similar to the current results, where the contractor's unstable financial situation with an RII of 0.682 is the fourth highest contractor-related factor. Contrary to the findings of Muhwezi et al. (2014), the current results show that several contractor-related factors slightly influence the success of construction projects in Oman; these factors include incompetent project manager with an RII of 0.572, administrative corruption, indiscipline and dishonesty with an RII of 0.546 and frequent equipment breakdowns with an RII of 0.524.

Table 6

RIIs of Contractor-Related Factors

Category	Factors	RII
Time	Shortage and delay in material supply	0.664
	Unrealistic project timelines	0.648
	Project manager delay in making and issuing decisions	0.610
	Overall	0.641
Finance	Contractor's unstable financial situation	0.682
	Financial corruption	0.600
	Poor cash flow (irregular cash flow)	0.590
	Overall	0.624
Project Designing, Planning and Scheduling	Ineffective project planning and schedule	0.584
	Overall	0.584
Quality	Unqualified/ inadequate experienced labor and team	0.730
	Unqualified sub-contractors	0.708
	Unqualified suppliers	0.692
	Poor quality of materials	0.638
	Incompetent project manager	0.572
	Overall	0.668
Project Progress and Development	Poor site management and supervision by a project manager	0.632
	Lack of material	0.622
	Shortage of labor and equipment	0.616
	Poor communication and coordination with other project parties	0.616
	Poor risk management and inappropriate handling of unexpected problems and crises	0.610
	Inadequate implementation of health and safety procedures	0.590
	Administrative corruption, indiscipline, and dishonesty	0.546
	Frequent equipment breakdowns	0.524
Overall	0.595	
Contractor Related Factors-Overall		0.624

External Factors

The current study states that the delay of government authorities in issuing approvals with an RII of 0.702 is the key external affecting factor of the success of construction projects in Oman.

The Financial Stability Report of Oman indicated that the inflation rate increased from 0.1% in 2015 to 2.8% in March 2017, and the rate is expected to increase to an average of 4.1% in 2017 and stabilise at approximately 3% in 2020 (Central Bank of Oman, 2017). This increase in the inflation rate significantly affects the construction sector in Oman, as confirmed by the current study. Table 7 shows that the respondents of the survey agree that inflation rate, increase in material prices and labour and transportation costs greatly affect the success of construction projects in Oman with an RII of 0.638 which is matching the finding of Abdul-Rahman et al. (2009). The severe weather condition, which is a physical factor with an RII of 0.556, is the least external affecting factor of the success of construction projects in Oman. This finding is consistent with that of Yong & Mustaffa

(2012), who reported that the weather condition factor is the least significant amongst 15 critical factors affecting the success of construction projects in Malaysia.

Category	Factors	RII
Time	Delay in issuing approvals by authorities	0.702
	Overall	0.702
Finance	Inflation (material prices, labor, and transportation costs)	0.638
	Poor economic conditions	0.590
	Overall	0.614
Environmental	Emergence of natural factors, such as rainstorms, windstorms, and floods	0.556
	Overall	0.556
External Related Factors- Overall		0.622

Table 7

RIIs of External Factors

Based on the above-mentioned discussions and the opinions of the respondents, the following conclusions can be drawn based

1. Factors related to quality rank the most important amongst the investigated factors that affect the success of construction projects in Oman
2. Factors related to clients are the most important, followed, in sequence, by those related to consultant, contractor and external environment.
3. The most important factor affecting the success of projects in Oman are the selection of the lowest bid, and the quality and experience of the project team.
4. The least important factors affecting the success of construction projects in Oman are the contractors' administrative corruption, indiscipline and dishonesty and the frequent equipment breakdowns.

To improve the construction industry in Oman, the following actions are recommended by the authors:

1. A non-profit independent organisation should be established to conduct workshops for sharing best practices and strengthening public awareness on the impact of construction on the national economy.
2. The government should force the construction companies to improve both procurement strategies and approaches to project delivery.
3. The government should facilitate the foreign direct investment by simplifying procedures and providing a smooth investment environment.

Recommendation for Future Studies

1. Further studies that target the construction professionals working in cities other than Muscat should be conducted to increase the sample size and maximise the accuracy of the current results.
2. Future studies on the government's responsibilities in ensuring the success of construction projects should be performed.

Conflict of Interest

The authors declare that they have no conflict of interest.

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Declared none.

Conclusions and Recommendations

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