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Determining success factors in Abu Dhabi health care construction projects: customer and contractor perspectives

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ABSTRACT

The importance of project management and its success has been growing along with increasing investment in the construction field. This study aims to identify, categorize and prioritize the critical success factors for health care construction projects in the Emirate of Abu Dhabi. An extensive literature review was carried out to identify the success factors for health care construction projects. The analytical hierarchical process was then applied to prioritize the main criteria and sub-criteria of health care construction project success factors. This study consists of 10 main criteria and 36 sub-criteria relevant to health care construction projects. The respondents of this study consist of two main groups: customers and contractors. The customers were selected from one of the leading governmental hospitals in the Emirate of Abu Dhabi and the contractors are from a major contracting company operating within the health care industry. From each respondent group, leadership positions were selected from relevant departments, including finance, operations, marketing, engineering and supply chain management. The findings of the study show that the leading critical success factor groups are financial capability and management. Moreover, top management support, adequate funding, availability of resources and effective strategic planning were found to be top factors affecting project success. Differences in priorities were observed between customer and contractor perspectives based on the different roles of each stakeholder. To highlight, customers ranked management and financial capability as the two most important factors, respectively. However, contractor respondents indicated financial capability as most important, followed by management and strategy factors, which scored as equally important. As results shown in this study are obtained from only customers and contractors, future studies could include consultants and regulatory authorities, along with considering more success factors.

KEYWORDS

Project management; success factors; health care; prioritization; AHP; UAE

Introduction

In this age of increased demand for improved organizational and project performance, businesses and organizations are continuously looking for ways to ensure project success in various industries. With a contribution of 7%–10% to gross domestic product (GDP) (Voordijk et al. 2000; Mustaffa 2012), the construction industry is considered one of the primary drivers of the national economy. It therefore receives additional attention from researchers (Nagi et al. 2002; Mustaffa 2012; Razzaq et al. 2016(. As a rapidly developing country, the United Arab Emirates (UAE) has been investing heavily in construction development, which contributes significantly to national growth. According to a recent study conducted by the Dubai Chamber of Commerce, the construction industry contribution to UAE GDP was 10.6% in 2008 and 10.3% in 2011. The national construction industry contribution of $319.1 billion makes it the largest in the region. Furthermore, it is expected to grow 11.1% to 11.5% between 2015 and 2021 (Constructionweekonline 2015). This demands more research on this field in this specific region with the goal of achieving a higher success rate.

According to Mustaffa (2012), the study of critical success factors (CSFs) and project success, in general, is a significant way to improve the effectiveness of project delivery. Therefore, difficulties in running construction projects may be due to a failure to determine the CSFs to focus on during each phase of the project. Factors critical to project success have been extensively investigated by researchers worldwide (Cooke-Davies 2002; Long Duy 2004; Toor & Ogunlana 2009; Mustaffa 2012; Al-Saadi & Abdou 2016). This level of interest confirms the importance of studying the critical factors affecting project success.

Although many papers have been published on similar topics by researchers worldwide (Lan 2004; Mustaffa 2012; Almajed & Mayhew 2013; Al-Saadi & Abdou 2016), none have focused on either the health care sector

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or the Middle East region. The results from other countries are not suitably generalizable to the UAE and other nations in the Middle East. Moreover, the topic has been examined from either the pure quantitative or qualitative level, rather than applying the analytical hierarchical process (AHP). Using the AHP framework and methodology, decision-makers can prioritize the most suitable CSFs to the construction industry. In addition, the AHP method allows the authors to convert the CSFs along with their sub-criteria from qualitative to quantitative data. In turn, this conversion facilitates prioritizing the decision-making choices and provides a clear priority list of the most important success factors for decision-makers in the industry to focus on (Saaty 2012).

In particular, this study focuses on the most important critical construction project success factors from customer and contractor perspectives. Previous studies focused only on customers, whereas contractors were ignored, even though they are crucial stakeholders. This study provides useful managerial implications for practitioners and managers within the field that support increasing the success level of construction projects within the region.

Literature review

Project management and success criteria

With rising demand for ways to improve projects and business operations, CSFs have become increasingly important (Jefferies et al. 2002; Li et al. 2005; Al-Saadi & Abdou 2016). CSFs are defined as 'those few keys areas of activity in which favourable results are necessary for a particular manager to reach his or her goals'. Researchers have focused on different sets of CSFs. Those factors were grouped into different sets according to project phases, types, disciplines and other criteria. Moreover, Rockart (1982) emphasized that CSFs are related characteristics and conditions of an industry that will change depending on industries and countries. As the same industry operates differently in each country depending on laws, regulations and legal constraints, it is essential to remember that CSFs cannot be generalized to all countries. Furthermore, there may be differences depending on changes in the industry or related factors. This understanding provides an additional motive to find suitable industry factors to be used within this part of the world.

The involvement of various stakeholders implies that no single factor will determine the success of a construction project. Construction projects also present numerous challenges regarding evaluation because of the comprehensive assessment of success factors. Various researchers identify cost, time and quality of implementation as three major success criteria (Greenwood & Gledson 2012; Lehtiranta et al. 2012; Hussein & Klakegg 2014). Studies conducted on the nature of budgeting have identified inappropriate cash flow projection techniques as the primary culprit of failure. Budgeting as a financial management technique is crucial in the maintenance of favourable cash flow on a daily basis. Most construction projects stagnate or go bankrupt because the players are unable to draft cash flow projections that can convince lenders to commit their funds to the projects (Greenwood & Gledson 2012).

Construction project success factors

Moving into construction project CSFs, researchers have identified that CSFs impact project success significantly. For example, Al-Saadi and Abdou (2016) identified success factors related to public–private partnership (PPP) infrastructure projects in the UAE. These include a strong and stable economy, available financial markets, political support and stability, opportunities for innovation, a clear project brief and proper risk allocation and sharing (Al-Saadi & Abdou. 2016). Furthermore, in another study by Greenwood and Levin (2007), success factors include an operational concept, financial support, support of top management, project scheduling and the availability of suitable communication channels. In a study by Mustaffa (2012), 37 factors were identified as critical to construction projects in Malaysia. Those factors include financial capability, commitment, competence, monitoring of project progress, shared authority and responsibility, top management support, clarity of project objectives, effective safety and quality programs, competitive procurement, construction technology and political and economic stability. Lan (2004) identified factors related to construction project success in Vietnam. The factors include clear communication channels, systematic control mechanisms, a competent project manager, accurate initial cost estimates, clear objectives and scope, adequate funding throughout the project, availability of resources and effective strategic planning.

Gudienė et al. (2013) propose nine factor groups as essential for project success. They include external factors, institutional factors, internal factors, project-related factors, project management factors, project manager-related factors, contractor-related factors, client-related factors and stakeholders. External factors are outside the control of the company overseeing the construction project. They include economic, technological, social, political and cultural influences (Hussein & Klakegg 2014). Internal factors relate to the technical and performance capabilities of a company in handling a construction project. Project-related factors

Table 1. Thirty-three success factors.

Success factor	References
Top management support	Dezdar & Ainin (2012); Mustaffa (2012); Almajed & Mayhew (2013)
Commitment to project	Dezdar & Ainin (2012); Mustaffa (2012); Almajed & Mayhew (2013)
Project mission	Pinto & Slevin (1988a); Mustaffa (2012)
Monitoring and feedback	Abdul-Aziz & Kassim (2011); Meng et al. (2011); Mustaffa (2012)
Project management	PMI (2004); Dezdar & Ainin (2012)
Process management	Al-Mudimigh (2007); Almajed & Mayhew (2013)
Stakeholder management and involvement	Bourne & Walker (2008); Mustaffa (2012); Almajed & Mayhew (2013).
Clear information and communication channels	Lan (2004); Dezdar & Ainin (2012); Almajed & Mayhew (2013)
Up-to-date technology utilization	Lan (2004); Al-Mudimigh (2007); Almajed & Mayhew (2013)
Clear goals and objectives	Lan (2004); Ng et al. (2012); Tang et al. (2012), Al-Saadi & Abdou (2016)
Effective strategic planning	Hong (2009); Al-Turki (2011); Almajed & Mayhew (2013)
Change readiness	Al-Shamlan & Al-Mudimigh (2011); Mustaffa (2012); Almajed & Mayhew (2013)
Long-term demand of the project	Meng et al. (2011); Osei-Kyei & Chan (2015)
Transparent procurement	Jamali (2004); Mustaffa (2012); Tang et al. (2012)
Systematic control mechanisms	Pinto & Slevin (1988a); Lan (2004)
Competitive procurement	Abdul-Aziz & Kassim (2011); Mustaffa (2012); Almajed & Mayhew (2013)
Technical tasks	Meng et al. (2011); Ng et al. (2012)
Troubleshooting	Pinto & Slevin (1988a); Mustaffa (2012)
Adequate funding throughout the project	Lan (2004); Kamal (2006); Mustaffa (2012)
Availability of resources	Lan (2004); Mustaffa (2012)
Accurate initial cost estimates	Lan (2004); Ralf (2012)
Community involvement/support	Jacobson & Choi (2008); Mustaffa (2012)
Stable economy	Li et al. (2005); Mustaffa (2012); Al-Saadi & Abdou (2016)
Political stability	Abdul-Aziz & Kassim (2011); Mustaffa (2012); Al-Saadi & Abdou (2016)
Competent project manager	Dezdar & Ainin (2012); Mustaffa (2012)
Multidisciplinary/competent project team	Dezdar & Ainin (2012); Mustaffa (2012); Almajed & Mayhew (2013)
Training and education	Mandal & Gunasekaran (2003); Finney & Corbett (2007)
Implementing an effective safety program	Mustaffa (2012)
Implementing an effective quality assurance program	Pinto & Slevin (1988b); Mustaffa (2012)
Appropriate risk allocation and sharing	Kemppainen et al. (2012); Almajed & Mayhew (2013); Al-Saadi & Abdou (2016)
Client acceptance/satisfaction	Pinto & Slevin (1988b)
Client consultation	Pinto & Slevin (1988b)
Public/community acceptance	Li et al. (2005); Mustaffa (2012)
Technology innovation	Mustaffa (2012); Ng et al. (2012); Al-Saadi & Abdou (2016)
Environmental impact of the project	Tiong (1996); Jefferies et al. (2002)
Social needs considerations	Murphy et al. (1974); Mustaffa (2012)

include the size, value, complexity, risks and goals of a particular project, among others. Project-related factors remain a constant danger to any project irrespective of the measures employed to counter the threat posed by other factors. Project management team factors and project manager-related factors are controllable by the company in charge of the construction project. Many researchers agree that client-related factors have a greater influence on the success of projects than previously assumed. For example, the type of client (whether private or public) often determines their experience and thus the ability to make timely decisions, express precise goals, tolerate risks and adopt to different phases of the project (Gudienė et al. 2013). Stakeholders have the ability to influence the project positively or negatively depending on the effectiveness of communication, which determines the manner in which different demands from various stakeholders are met (Lehtiranta et al. 2012).

A comprehensive review of existing literature was conducted by the authors to identify suitable factors critical to the success of construction projects. The most suitable 36 factors in the context of UAE health care projects in this study were identified from the literature and are described in Table 1. Although more factors exist in the literature, the factors in Table 1 were found to be the most suitable for this analysis and are used in the following stages to formulate the AHP model.

Health care sector and construction projects in the UAE

Gulf Cooperation Council countries have accounted for more than 80% of project financing in the Middle East and North Africa countries since 2007. More than $54.4 billion have been spent on PPP infrastructure projects with the UAE leading the Middle East market for such projects with a share of around 36% (Salisu et al. 2012). As part of the overall development, the health care sector has undergone significant improvements and growth as well. According to the Abu Dhabi Health Authority (HAAD) 2014 Health Statistics Report, Abu Dhabi Emirate, the capital of the UAE, contains 2.76 million residents with 18% of them being nationals. The main health care provider in the emirate is Abu Dhabi Health Services Company (SEHA), which covers 56% of all inpatient episodes and 36% of all hospital outpatients. Furthermore, the private sector is experiencing growth in the market with more than 12 hospitals constructed and

operative in the past five years. In 2014, the emirate health care sector had over 33,000 health care professionals and 1811 licensed facilities for both public and private sectors (Abu Dhabi 2015). With an average annual population growth of 7.9% and a life expectancy of 75.2 for men and 78.7 for women, HAAD expects demand for an additional 2200 beds by 2020 based on current occupancy rates. This immense growth indicates that substantial construction and expansion projects will be needed to satisfy this demand. This demand, in turn, demonstrates the significant need for this study.

As shown in the literature, many researchers have identified various success factors related to construction projects, as well as projects in general, and have discussed their importance (Lan 2004; Greenwood & Levin 2007; Mustaffa 2012; Al-Saadi & Abdou 2016). However, as most of these factors are intended for general construction projects or public–private partnership projects, this causes a gap in the literature for other types of projects. Furthermore, as discussed in the literature, the business environment of each country, along with its culture, has an impact on the factors, as well. Therefore, this study aims to minimize the gap by identifying suitable CSFs related to health care construction projects in the Emirate of Abu Dhabi. This study is expected to be beneficial for both academics and industry professionals within the region.

Research design and setting

Research context

Project management in the construction field and specifically the health care sector has shown remarkable growth lately. Although CSFs are considered to be of significant importance toward project success, there is a gap in the literature on this particular topic and within the Middle East. Moreover, similar papers were done with conventional quantitative or qualitative methods, whereas this study aims to apply the AHP. As the UAE has been investing heavily in this field, the industry will benefit from a priority list to follow as a guideline toward better success in project management. Therefore, this study applies a multi-criteria decision-making process by using the AHP method developed by Saaty (1980). This study is applied to contractor and customer stakeholder groups to provide more comprehensive results.

Although the emerging analytical networking process (ANP) is considered competitive to AHP methodology, AHP has been commonly used and known to be an appropriate method in similar studies. To clarify, this method has been used by many scholars to identify and rank critical parameters in different sectors (Chung & Lee 2009; Barzekar et al. 2011; Bereketli & Erol Genevois 2013; Ren et al. 2013; Dinarvandi et al. 2014). It also has the advantage of incorporating both qualitative and quantitative data into the process (Ghodsypour & O'Brien 1998; Kurttila et al. 2000; Korpela et al. 2001; Wrisberg et al. 2002; Lee & Hsu 2004; Masozera et al. 2006).

Overview of AHP

The AHP decision-making method structures the process into a form of hierarchy and the model outputs suggest choosing an option from among the different alternatives. A matrix can be developed through a set of pairwise comparisons at the various levels of the hierarchy in which the strength of each element in the matrix is ranked from 1 to 9 and compared to another element (Saaty 1980). A judgement is then made depending on a specifically given attribute. Figure 1 illustrates the process of AHP employed in this study to select the best alternatives toward a given objective, which is, in this case, CSFs for construction projects within the region of Abu Dhabi. Overall, the AHP process is used to transform the qualitative data into quantitative data for a more straightforward analysis to provide a prioritized ranked list of the analysed factors.

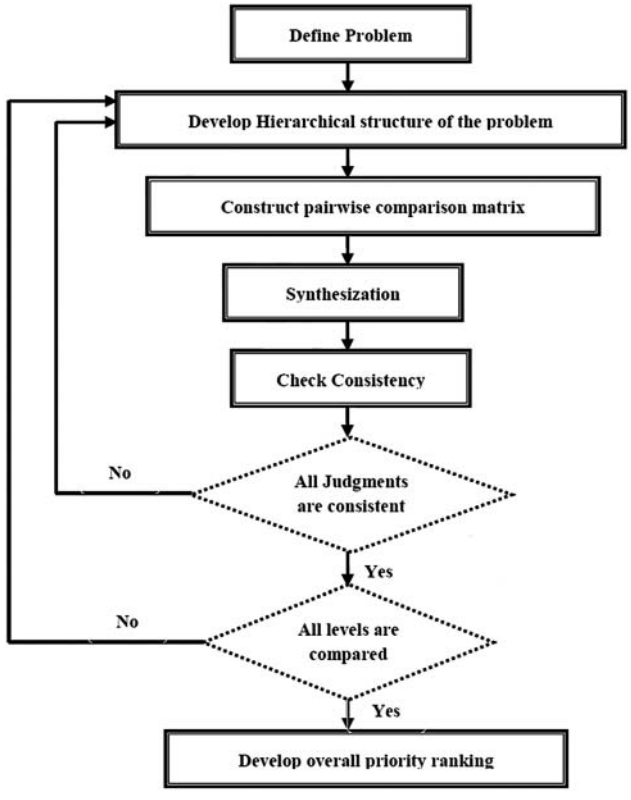

Figure 1. Summary of AHP steps.

Research model

To analyse the collected factors with AHP methodology, it was necessary to place them into different groups (criteria). The factor grouping was performed by three experts in the field of project management and research: two associate professors of management and one senior project manager. Categories were suggested and reviewed carefully to place each factor with the proper grouping. Table 2 shows the grouping of the factors along with the sub-factors, in addition to a general description of each factor (references provided in Table 1). When the factor groups were completed, the hierarchy of the AHP consisting of 10 main criteria and 36 sub-criteria was prepared as shown in Figure 2.

Data collection

A nine-point scale questionnaire was developed on the 10 main criteria and 36 sub-criteria according to the AHP process developed by Saaty (1980). The questionnaire was tested by experts within the field before beginning the data collection. This study collected data from

Table 2. AHP criteria and sub-criteria.

Sub-factor	Description
Factor 1: Management	
Top management support	Willingness of top management to provide the necessary resources and authority/power for project success
Commitment to project	Management of the project shows their commitment and focus toward achieving the project with appropriate time, quality and cost
Project mission	Initial clarity of goals and general directions
Monitoring and feedback	Timely provision of comprehensive control information at each phase of the implementation process
Project management	The application of knowledge, skills, tools and techniques to project activities to meet the project requirements
Process management	Management of all processes throughout the project driving toward overall project completion
FACTOR 2: Information and communication technology (ICT)	
stakeholders management and involvement	Actions are taken to communicate and influence all parties who have interests or roles in the project or are affected by the project
Clear information and communication channels	The provision of an appropriate network and necessary data to all key factors in project implementation
Up-to-date technology utilization	The usage of modern equipment and systems toward better achieving the project goals
Clear goals and objectives	Briefly defining the main objective and goals of the project to be achieved
Factor 3: Strategy	
Effective strategic planning	Envisioning the projected future by having in place proper goals, objectives and steps to complete the project
Change readiness	The perceived ability to absorb, adapt and assimilate the changes throughout the project
Long-term demand of the project	The actual need of the completed projects and its final results by the customer
Factor 4: Supply chain management (SCM)/operation	
Transparent procurement	Clear known and ethical methods of managing the procurement processes of the project
Systematic control mechanisms	The provision of sound controlling mechanisms to ensure keeping the project progress on the right track
Competitive procurement	Creating a fair and competitive environment among the participating suppliers to gain best prices and quality
Technical tasks	Availability of the required technology and expertise to accomplish the specific technical action steps
Troubleshooting	Ability to handle unexpected crises and deviations from the plan
Factor 5: Financial capability	
Adequate funding throughout the project	Consistency of cash flow throughout the project to ensure paying all involved parties
Availability of resources	The availability of manpower resources, materials, funding and related resources to ensure completion of the project
Accurate initial cost estimates	Sound and reasonable budgetary estimation of all project phases at the planning stage
Factor 6: External factors	
Community involvement/support	The involvement of the community in the project objectives and their support toward its completion
Stable economy	A clear anticipation of the country economy to avoid unexpected crises or changes
Political stability	A stable political state of the country of the project regarding rules and policies, international agreements, etc.
Factor 7: Competency and experience	
Competent project manager	A project manager with the sufficient capabilities, education, experience and personality traits to manage all aspects of the project toward its completion
Multidisciplinary/competent project team	Project team with the required set of skills, education and experience to ensure fulfilment of the project requirements and tasks
Training and education	Providing the necessary training and education to the project team to enable them to achieve the assigned tasks
Factor 8: Risk and quality management	
Implementing an effective safety program	Having an appropriate safety program in place to ensure avoiding any safety incidents, injuries and resource damage throughout the project
Implementing an effective quality assurance program	An appropriate quality assurance program to improve the quality aspects of the project
Appropriate risk allocation and sharing	Risk to be fairly shared between the main stakeholders of the project
Factor 9: Satisfaction	
Client acceptance/satisfaction	The act of selling the final project to its ultimate intended users
Client consultation	Communication, consultation and active listening to all impacted parties
Public/community acceptance	The act of selling the project to the community and keeping them informed of the project objectives and aims
Factor 10: Sustainability	
Technology innovation	Maintaining a certain level of innovation and creativity in the project team toward better achieving the project goals
Environmental impact of the project	The project effect on the environment regarding pollution, landscaping, design, etc.
Social needs consideration	Having in mind social needs and translating them into the project design and plan

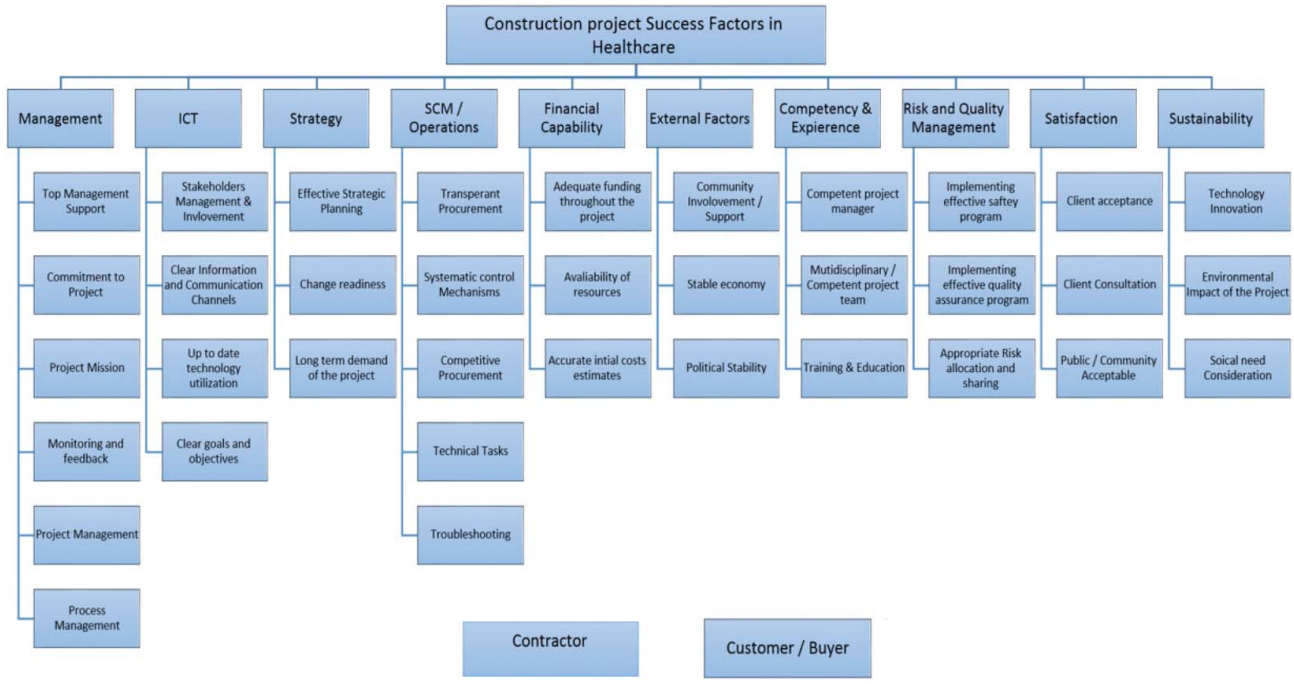

Figure 2. AHP model.

two stakeholders: a large tertiary governmental hospital in Abu Dhabi with a minimum 460-bed capacity and a contractor company with more than 30 years' experience in the health care construction sector. The data in each organization were collected from top-level division and department heads from areas such as operations, facility/engineering, supply chain management (SCM), and finance and the chief executive officer (CEO). Due to the complexity of these surveys, the data were collected during in-depth interviews with the targeted audience to ensure accurate results; seven questionnaires were collected from each stakeholder group to satisfy the requirements of the methodology of this study. Each category included seven respondents – a sufficient sample for such detailed questionnaires, according to Saaty (2008).

Analysis and findings

Next, a pairwise comparison was conducted using the nine-point scale developed by Saaty (1980). As an example, if a respondent identified the management main criteria as moderately important compared to information and communication technology (ICT), the rating is '3', whereas if it is the opposite, the reciprocal is taken as '1/3', and so on. After the matrix was prepared, the consistency index (CI) was calculated. The CI is defined by Saaty (1980) as follows:

$$\mathrm{CI} = (\lambda\max - n)/(n-1) \tag{1}$$

where λmax is the maximum eigenvalue of the matrix and n is the number of factors used in the model. The consistency ratio (CR) is then applied to identify whether the matrix is sufficiently consistent:

$$\mathrm{CR} = \mathrm{CI}/\mathrm{RI} \tag{2}$$

where RI is the random index, identified by Saaty (1980) as the number of factors used in the model, as shown in Table 3. If the CR is below 10%, it is found to be acceptable. If it is higher, the collected data consistency is unacceptable.

As suggested by Saaty (1980), the geometric mean approach was applied instead of the arithmetic approach to combine the individual pairwise comparison judgement matrices to attain the consensus pairwise comparison judgement for all evaluators. The next step was to define the relative priorities of criteria by computing 'priority vectors'. Saaty (1990) introduced a 'consistency principle' for calculating priority vectors. The consistency principle is defined as $a_{ik} = a_{ij}.a_{jk}$ with subsequent arguments for using the special case of the consistency matrix formed by elements $a_{ik} = w_i/w_j$, where w_i and w_j are the elements of the priority weight vector corresponding to criteria i and j.

Table 3. Random index.

N	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.48

Table 4. Pairwise comparisons of main criteria.

	Management	ICT	Strategy	SCM/ operations	Financial capability	External factors	Competency and experience	Risk and quality management	Satisfaction	Sustainability	Priority weight
Management	0.30	0.40	0.28	0.39	0.38	0.18	0.19	0.23	0.11	0.11	**0.26**
ICT	0.05	0.06	0.05	0.05	0.07	0.16	0.08	0.09	0.10	0.10	**0.08**
Strategy	0.07	0.09	0.07	0.05	0.04	0.15	0.20	0.11	0.14	0.12	**0.10**
SCM/operations	0.07	0.12	0.12	0.09	0.07	0.16	0.11	0.11	0.15	0.16	**0.12**
Financial capability	0.18	0.21	0.39	0.29	0.23	0.24	0.23	0.23	0.15	0.16	**0.23**
External factors	0.05	0.01	0.01	0.02	0.03	0.03	0.08	0.05	0.05	0.08	**0.04**
Competency and experience	0.09	0.05	0.02	0.04	0.06	0.02	0.06	0.12	0.11	0.12	**0.07**
Risk and quality management	0.06	0.03	0.03	0.03	0.04	0.03	0.02	0.04	0.12	0.12	**0.05**
Satisfaction	0.07	0.02	0.01	0.02	0.04	0.02	0.01	0.01	0.02	0.02	**0.02**
Sustainability	0.07	0.02	0.01	0.02	0.04	0.01	0.01	0.01	0.04	0.03	**0.03**
						CR = 0.07					

Customer

Table 4 shows the pairwise comparison for the 10 main criteria; the last column shows the priority weight of each criterion. As shown in the table, the top two factors are found to be management with 26%, followed by financial capability with 23%. As the CR of the main criteria analysis is found to be 7%, it means the matrix is consistent and meeting the AHP requirement of being below 10%. The top ranking of management meets expectations, as this is derived from customers mainly responsible for managing and overseeing project progress. Moreover, customers are responsible for the financing of projects; therefore, it follows that the financial factor is also expected to be high. This indicates that decision-makers should put more attention into the overall management of the project and assurance of project funding and proper utilization to ensure a higher success rate.

Table 5 provides the priority ranking of the pairwise comparisons for the first main criteria, management. Top management support is found to be the most important sub-factor with 40%, followed by commitment to project at 21%, whereas the least important factor is process management with 6%. This indicates that industry decision-makers must put more focus on top management support by backing decisions and the project plans of project managers, as well as provide higher commitment, which should result in a higher success rate of projects.

Table 6 shows the priority ranking of the pairwise comparisons for the second criteria, ICT. The two most

Table 5. Pairwise comparison of management sub-criteria.

Priority	Top management support	Commitment to project	Project mission	Monitoring and feedback	Project management	Process management	Priority weight
Top management support	0.43	0.63	0.44	0.39	0.23	0.26	**0.40**
Commitment to project	0.11	0.16	0.28	0.27	0.25	0.18	**0.21**
Project mission	0.10	0.05	0.10	0.18	0.10	0.16	**0.11**
Monitoring and feedback	0.08	0.05	0.04	0.08	0.25	0.10	**0.10**
Project management	0.19	0.06	0.10	0.03	0.10	0.24	**0.12**
Process management	0.10	0.05	0.04	0.05	0.06	0.06	**0.06**
			CR = 0.05				

Table 6. Pairwise comparison of ICT sub-criteria.

	Stakeholders management and involvement	Clear Information and communication channels	Up-to-date technology utilization	Clear goals and objectives	Priority weight
Stakeholders management and involvement	0.37	0.43	0.28	0.30	**0.35**
Clear information and communication channels	0.28	0.33	0.51	0.32	**0.36**
Up-to-date technology utilization	0.15	0.07	0.12	0.22	**0.14**
Clear goals and objectives	0.20	0.16	0.09	0.16	**0.15**
		CR = 0.03			

Table 7. Pairwise comparison of strategy sub-criteria.

	Effective strategic planning	Change readiness	Long-term demand of the project	Priority weight
Effective strategic planning	0.62	0.68	0.52	**0.61**
Change readiness	0.20	0.22	0.33	**0.25**
Long-term demand of the project	0.17	0.10	0.14	**0.14**
		CR = 0.03		

important sub-factors were found to be clear information and communication and stakeholders management and involvement with importance of 36% and 35%, respectively. These close rankings indicate that management should focus equally on ensuring proper distribution of information to both project teams and stakeholders. This can be done by arranging regular meetings or other effective communication methods.

Table 7 provides the priority rankings for the strategy criteria. The most important sub-criterion is found to be effective strategic planning with a percentage of 61%. Therefore, decision-makers and project managers should take steps to improve strategic planning and maintain long-term project plans to avoid project failure. Change readiness is also emerging as an important factor with the increase of technology use.

Table 8 provides the priority ranking of the SCM/operation criteria. The leading sub-criterion is found to be systematic control mechanisms with 38%, followed by competitive procurement at 32%. The least important sub-criteria is troubleshooting with a score of 6%. Controlling mechanisms are vital in these projects to control overall progress and work. Although, troubleshooting scored the lowest of these criteria, this might vary depending on the type and size of the project.

Table 9 provides the priority ranking of the financial capability criteria. The most important sub-criteria are found to be adequate funding throughout the project followed by the availability of resources with 51% and 31%, respectively. It is expected that the smooth continuity of funding is a main factor, as this affects all other factors of the project. With fluctuating financial markets, funding could be an issue after starting a project. Moreover, availability of resources is sometimes an issue even when funding is available, due to the limited experience of personnel in countries such as the UAE and the high cost of ongoing projects.

Table 10 provides the priority ranking of the external factors criteria. The highest sub-criterion is found to be community involvement with 52%, followed by stable economy at 32%. As the survey respondents are from governmental hospitals, this might lead to more

Table 8. Pairwise comparisons of supply chain management/operation sub-criteria.

	Transparent procurement	Systematic control mechanisms	Competitive procurement	Technical tasks	Troubleshooting	Priority weight
Transparent procurement	0.13	0.15	0.09	0.14	0.19	**0.14**
Systematic control mechanisms	0.36	0.42	0.50	0.33	0.30	**0.38**
Competitive procurement	0.39	0.23	0.28	0.41	0.27	**0.32**
Technical tasks	0.09	0.12	0.06	0.09	0.17	**0.11**
Troubleshooting	0.04	0.08	0.06	0.03	0.06	**0.06**
			CR = 0.04			

Table 9. Pairwise comparison of financial capability sub-criteria.

	Adequate funding throughout the project	Availability of resources	Accurate initial costs estimates	Priority weight
Adequate funding throughout the project	0.53	0.61	0.40	**0.51**
Availability of resources	0.24	0.27	0.41	**0.31**
Accurate initial costs estimates	0.24	0.12	0.18	**0.18**
		CR = 0.03		

Table 10. Pairwise comparisons of external factors sub-criteria.

	Community involvement and support	Stable economy	Political stability	Priority weight
Community involvement and support	0.53	0.57	0.47	**0.52**
Stable economy	0.28	0.30	0.37	**0.32**
Political stability	0.19	0.13	0.16	**0.16**
		CR = 0.03		

Table 11. Pairwise comparison for competency and experience sub-criteria.

	Competent project manager	Multidisciplinary/competent project team	Training and education	Priority weight
Competent project manager	0.54	0.57	0.46	**0.52**
Multidisciplinary/competent project team	0.33	0.35	0.43	**0.37**
Training and education	0.13	0.09	0.11	**0.11**
		CR = 0.03		

Table 12. Pairwise comparison for risk and quality management sub-criteria.

	Implementing effective safety program	Implementing effective quality assurance program	Appropriate risk allocation and sharing	Priority weight
Implementing effective safety program	0.60	0.73	0.43	**0.59**
Implementing effective quality assurance program	0.15	0.18	0.39	**0.24**
Appropriate risk allocation and sharing	0.24	0.08	0.18	**0.17**
		CR = 0.03		

Table 13. Pairwise comparison for satisfaction sub-criteria.

	Client acceptance	Client consultation	Public/community acceptance	Priority weight
Client acceptance	0.56	0.62	0.45	**0.54**
Client consultation	0.25	0.28	0.40	**0.31**
Public/community acceptance	0.19	0.10	0.15	**0.15**
		CR = 0.03		

consideration to community needs. Political stability may have ranked lowest as a result of operating in a politically stable country, the UAE.

Table 11 provides the priority ranking of the competency and experience criteria. The leading sub-criterion is found to be a competent project manager with 52%, whereas the least important is training and education with only 11%. Depending on the length of the project, training might be undesired where obtaining already trained staff could be more rewarding. The project manager is the leader of the team and involved in all activities; therefore, his or her competency has a significant impact on the project.

Table 12 provides the priority ranking of the risk and quality management criteria. The top sub-criterion is found to be Implementing an effective safety program with 59%, whereas appropriate risk allocation and sharing has only 17%. Risk is always considered a top factor in construction projects due to the intensive regulations in this field. Major projects have dedicated teams for safety programs and are usually inspected regularly by regulatory parties.

Table 13 provides the priority ranking of the satisfaction criteria. The leading sub-criterion is found to be client acceptance with 54%, whereas the least important is public/community acceptance with 15%. Achieving client acceptance requires more attention from decision-makers to complete projects successfully. Therefore, having the client involved throughout the process might help avoid any negative shocks at completion.

Table 14 provides the priority ranking of the sustainability criteria. The highest factor is found to be technology innovation with 46%, followed by the environmental impact of the project with 36%. Focusing on technology innovation may lead to more effective ways of completing projects, which in turn may reduce cost and completion time.

Contractor

Table 15 shows the pairwise comparison for the 10 main criteria, with the last column showing the priority weight of each criterion. As shown in the table, the top factor is found to be financial capability with 21%, whereas management and strategy both scored 17% as the second most important factors. Meanwhile, external factors are the least important with only 2%. As the contractor is responsible for paying suppliers and achieving profits

Table 14. Pairwise comparison for sustainability sub-criteria.

	Technology innovation	Environmental impact of the project	Social need consideration	Priority weight
Technology innovation	0.48	0.59	0.30	**0.46**
Environmental impact of the project	0.24	0.30	0.53	**0.36**
Social need consideration	0.28	0.10	0.17	**0.18**
		CR = 0.03		

Table 15. Pairwise comparison of main criteria.

	Management	ICT	Strategy	SCM/ operations	Financial capability	External factors	Competency and experience	Risk and quality management	Satisfaction	Sustainability	Priority weight
Management	0.15	0.13	0.42	0.20	0.05	0.16	0.21	0.16	0.14	0.06	**0.17**
ICT	0.04	0.04	0.03	0.11	0.03	0.12	0.01	0.01	0.19	0.10	**0.07**
Strategy	0.06	0.18	0.16	0.22	0.37	0.07	0.25	0.12	0.11	0.13	**0.17**
SCM/operations	0.08	0.03	0.08	0.11	0.22	0.10	0.08	0.17	0.03	0.12	**0.10**
Financial capability	0.48	0.22	0.07	0.08	0.17	0.13	0.35	0.29	0.15	0.17	**0.21**
External factors	0.02	0.01	0.06	0.03	0.03	0.03	0.01	0.01	0.03	0.00	**0.02**
Competency and experience	0.04	0.19	0.04	0.09	0.03	0.12	0.06	0.17	0.20	0.16	**0.11**
Risk and quality management	0.04	0.18	0.06	0.03	0.03	0.14	0.02	0.04	0.10	0.12	**0.07**
Satisfaction	0.04	0.01	0.05	0.12	0.04	0.03	0.01	0.02	0.04	0.13	**0.05**
Sustainability	0.06	0.01	0.03	0.02	0.02	0.13	0.01	0.01	0.01	0.02	**0.03**
						CR = 0.08					

from the project completion, financial capabilities are of primary importance from the contractor point of view. Management and strategy skills are also important, as it is the contractor's responsibility to manage, plan and oversee all activities of the project.

Table 16 provides the priority ranking of the pairwise comparison for the first main criterion, management. Project management is found to be the most important sub-factor with 37%, followed by top management support at 23%. The least important factor is project mission with 7%. The contractor is responsible for project management activities, making this a primary focus. The project mission is likely the lowest factor because this may be a greater customer and stakeholder issue.

Table 17 shows the priority ranking of the pairwise comparison for the second criterion, ICT. The most important sub-factor was found to be stakeholders management and involvement with a significant lead at 55%. The leading sub-factor indicates the importance of the contractor's ability to manage and keep stakeholders of the project involved throughout the project, which could result in higher satisfaction and support from all parties.

Table 18 provides the priority ranking for the strategy criteria. The most important sub-criterion is found to be effective strategic planning with a percentage of 58%, with long-term demand of the project as the least important at 20%. This proves that contractors should put more focus on strategic project planning, which could improve the operation of the project per the arranged plan.

Table 19 provides the priority ranking of the SCM/ Operation criteria. The leading sub-criterion is found to be systematic control mechanisms with 36%, followed

Table 16. Pairwise comparison of management sub-criteria.

	Top management support	Commitment to project	Project mission	Monitoring and feedback	Project management	Process management	Priority weight
Top management support	0.23	0.12	0.24	0.17	0.21	0.38	**0.23**
Commitment to project	0.17	0.09	0.25	0.23	0.09	0.01	**0.14**
Project mission	0.05	0.02	0.05	0.13	0.05	0.10	**0.07**
Monitoring and feedback	0.08	0.02	0.03	0.06	0.06	0.13	**0.06**
Project management	0.42	0.36	0.40	0.37	0.38	0.31	**0.37**
Process management	0.04	0.39	0.03	0.03	0.20	0.07	**0.13**
			CR = 0.05				

Table 17. Pairwise comparison of ict sub-criteria.

	Stakeholders management and involvement	Clear Information and communication channels	Up-to-date technology utilization	Clear goals and objectives	Priority weight
Stakeholders management and involvement	0.57	0.50	0.67	0.48	**0.55**
Clear information and communication	0.17	0.15	0.13	0.10	**0.14**
Up-to-date technology utilization	0.13	0.18	0.15	0.31	**0.19**
Clear goals and objectives	0.14	0.17	0.06	0.11	**0.12**
		CR = 0.03			

Table 18. Pairwise comparison of strategy sub-criteria.

	Effective strategic planning	Change readiness	Long-term demand of the project	Priority weight
Effective strategic planning	0.57	0.81	0.35	**0.58**
Change readiness	0.09	0.13	0.45	**0.22**
Long-term demand of the project	0.34	0.06	0.21	**0.20**
		CR = 0.04		

Table 19. Pairwise comparison of supply chain management/operation sub-criteria.

	Transparent procurement	Systematic control mechanisms	Competitive procurement	Technical tasks	Troubleshooting	Priority weight
Transparent procurement	0.25	0.39	0.10	0.25	0.34	**0.27**
Systematic control mechanisms	0.21	0.33	0.55	0.40	0.29	**0.36**
Competitive procurement	0.39	0.09	0.15	0.21	0.13	**0.19**
Technical tasks	0.07	0.05	0.05	0.06	0.10	**0.07**
Troubleshooting	0.09	0.14	0.15	0.08	0.13	**0.12**
			CR = 0.04			

by transparent procurement at 27%. This indicates that contractor management should focus more on systematic control mechanisms to ensure effective flow of all tasks. Interestingly, technical tasks were of low importance despite the many technical contractor responsibilities during construction projects. This could be attributed to the dependence on sub-contractors and suppliers for such tasks.

Table 20 provides the priority ranking of the financial capability criteria. The most important sub-criteria are found to be adequate funding throughout the project and accurate initial costs estimates with 60% and 25%, respectively. Adequate funding throughout the project is obviously very important for contractors to be able to sustain the project requirements from different resources. Achieving accurate initial cost estimates is also important to prevent issues caused particularly when the initial cost was underestimated.

Table 21 provides the priority ranking of the external factors criteria. The highest sub-criterion is found to be stable economy with 51%, followed by political stability at 41%. Note that community involvement was significant from the customer perspective, whereas it is low for contractors. As a stable economy is an important factor, contractors may wish to research the economy stability prior to projects to prevent financing issues.

Table 22 provides the priority ranking of the competency and experience criteria. The leading sub-criterion is found to be a competent project manager with 50%, whereas the least important is training and education with only 6%. These results are similar to those of the

Table 20. Pairwise comparison of financial capability sub-criteria.

	Adequate funding throughout the project	Availability of resources	Accurate initial costs estimates	Priority weight
Adequate funding throughout the project	0.60	0.63	0.58	**0.60**
Availability of resources	0.14	0.14	0.16	**0.15**
Accurate initial costs estimates	0.26	0.23	0.26	**0.25**
		CR = 0.03		

Table 21. Pairwise comparison of external factors sub-criteria.

	Community involvement and support	Stable economy	Political stability	Priority weight
Community involvement and support	0.08	0.11	0.06	**0.08**
Stable economy	0.41	0.54	0.57	**0.51**
Political stability	0.51	0.35	0.37	**0.41**
		CR = 0.03		

Table 22. Pairwise comparison for competency and experience sub-criteria.

	Competent project manager	Multidisciplinary/competent project team	Training and education	Priority weight
Competent project manager	0.50	0.51	0.49	**0.50**
Multidisciplinary/competent project team	0.43	0.43	0.45	**0.44**
Training and education	0.07	0.06	0.06	**0.06**
		CR = 0.03		

Table 23. Pairwise comparison for risk and quality management sub-criteria.

	Implementing an effective safety program	Implementing an effective quality assurance program	Appropriate risk allocation and sharing	Priority weight
Implementing an effective safety program	0.47	0.46	0.49	**0.47**
Implementing an effective quality assurance program	0.29	0.29	0.27	**0.28**
Appropriate risk Allocation and sharing	0.24	0.26	0.24	**0.24**
		CR = 0.03		

Table 24. Pairwise comparison for satisfaction sub-criteria.

	Client acceptance	Client consultation	Public/community acceptance	Priority weight
Client acceptance	0.53	0.55	0.43	**0.51**
Client consultation	0.38	0.39	0.50	**0.43**
Public/community acceptance	0.08	0.05	0.07	**0.07**
		CR = 0.03		

Table 25. Pairwise comparison for sustainability sub-criteria.

	Technology innovation	Environmental impact of the project	Social need consideration	Priority weight
Technology innovation	0.39	0.20	0.76	**0.45**
Environmental impact of the project	0.53	0.27	0.08	**0.29**
Social need consideration	0.08	0.53	0.16	**0.26**
		CR = 0.04		

customer view. It shows that more effort should be spent selecting the project manager and project team to ensure project success, whereas training is not a main factor. Again, this might depend on the duration and complexity of the project being undertaken.

Table 23 provides the priority ranking of the risk and quality management criteria. The top sub-criterion is found to be implementing an effective safety program with 47%, followed by implementing an effective quality assurance program at 28%. An effective safety program is critical, as it falls under the responsibility of the contractor to ensure the safety of all personnel on the worksite. Moreover, contractors must provide quality assurance to ensure smooth handing over of the project.

Table 24 provides the priority ranking of the satisfaction criteria. The leading sub-criterion is found to be client acceptance with 51%, whereas the least important is public/community acceptance with 7%. Therefore, contractors should focus on client acceptance, as this is crucial to project completion. Moreover, client consultation should be a regular component of the project, as it will help achieve client acceptance and avoid any handing-over issues.

Table 25 provides the priority ranking of the sustainability criteria. The highest factor is found to be technology innovation with 45%, followed by environmental impact of the project with 29%. As the implementation of technology innovation in the project could have a positive impact on both the project cost and duration of execution, this should be pursued by decision-makers.

Discussion

The results of this study have identified 10 main CSF groups and 36 factors applicable to the construction projects in the region. The ranking of those factors by AHP is provided in Tables 4–25. The study showed a significant difference in the view of the problem by each stakeholder, as shown in Figure 3. This difference could result from the different thinking roles and responsibilities of each stakeholder in the project. Moreover, the study showed that the top two CSF groups to focus on are management and financial capability, whereas the most important factors (sub-criteria) under the leading criteria were found to be adequate funding, effective strategic planning and top management support consecutively as per the averaged ranking of the factors shown in Figure 4. This finding is justified, as sufficient cash flow will ease the facilitation of other resources (Greenwood & Gledson 2012). Interestingly, many published studies ranked top management support as one of the highest among CSFs (Mustaffa 2012; Almajed & Mayhew 2013).

Effective strategic planning was found to be the second most important factor, with 8% of the average weight being more important to the contractor than the customer. In most cases, the customer should be more concerned with long-term strategic planning. However, this difference in weight could be driven by contractor focus on strategic planning to finish the project on time.

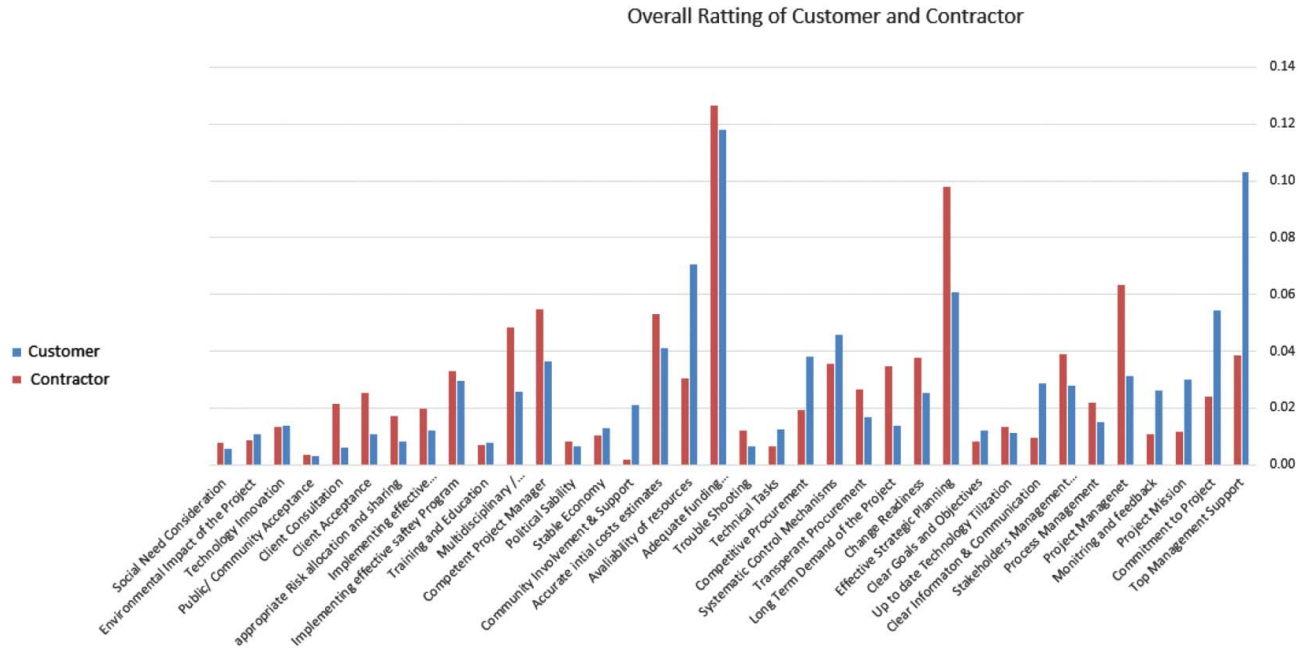

Figure 3: Overall comparison.

This difference contradicts the results of Lan (2004) where this factor was ranked 12 out of 20, which may be due to the different region and performance in the health care sector. Moving forward, top management was found to be the third highest factor in this study, matching similar studies conducted in Saudi Arabia, where it was ranked as a top factor by Almajed and Mayhew (2013).

Furthermore, a competent project manager and multi-disciplinary/competent project team were found to be the most important factors in other studies such as Lan (2004), where he ranked them as first and second. In the results of this study, they were ranked as being of

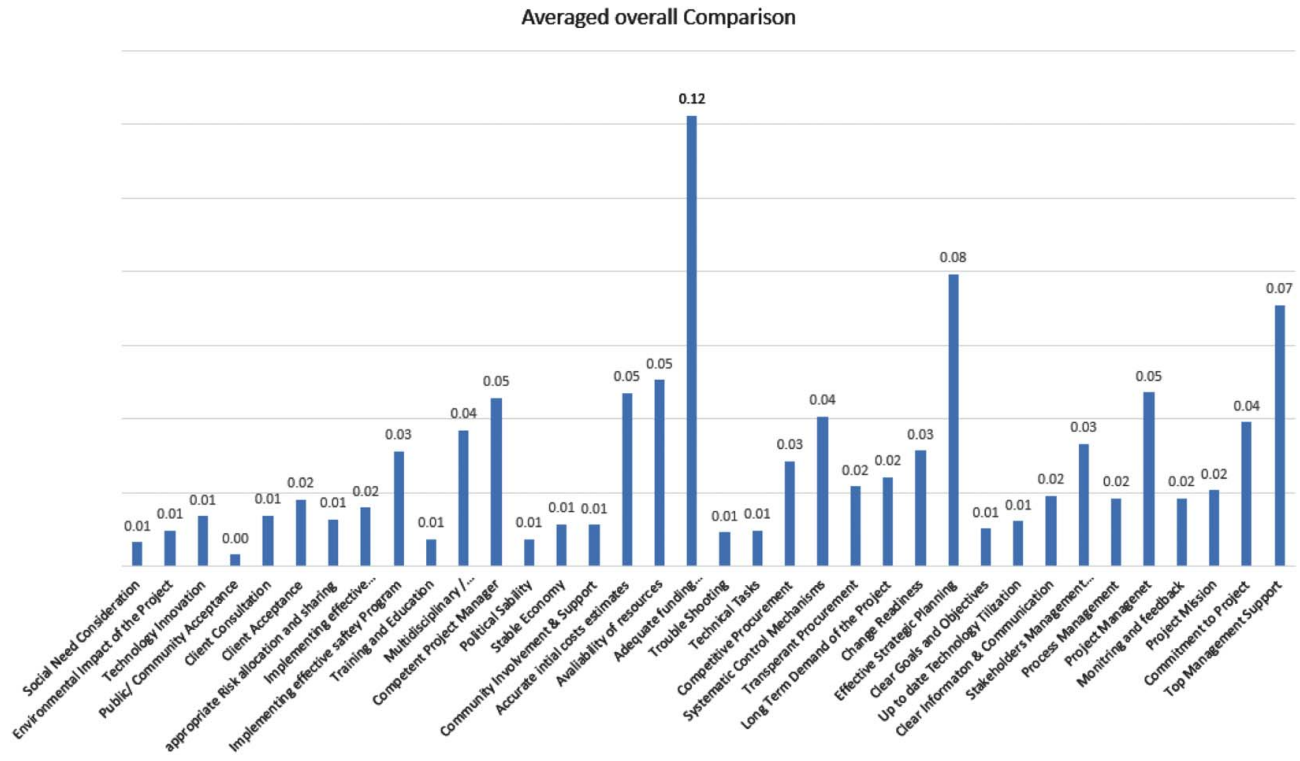

Figure 4: Average score for sub-criteria.

medium importance. This could be driven by the different culture and focus on education and training in this part of the world. The study also showed that both stakeholders assign low priority to sustainability factors, satisfaction and external factors. However, regulators have been enforcing the role of sustainability, which should influence decision-makers to put more focus on this field. Although satisfaction is normally considered a success criterion of any project, it scored low on importance in this study. Keeping in mind that the UAE is still a developing country, such focus is expected to change with further advancement in the field. Operations and SCM factors, in general, were found to have medium to low importance in this part of the world. This finding could be caused by a variety of factors, including focusing primary attention on project financing and management.

As a final step of the AHP analysis, an overall relative priority ranking of the 36 sub-factors was prepared along with an average score by multiplying each sub-criterion score by its main criteria rating. This ranking is shown in Figure 4, which provides a general overview of the importance of the factors.

Conclusion and recommendations

Conclusion

The aim of this study was to identify and prioritize the most important success factors related to health care construction projects in the Emirate of Abu Dhabi. An additional goal was to identify the difference in perspectives between customers and contractors as two important stakeholders. A detailed literature review identified suitable success factors related to project management (PM) in the construction field.

The results reveal a significant difference in the findings between stakeholders, as shown in Figure 3. There is a consensus between both groups in the perceived importance of the top two criteria – financial capability and management – although in a different order. Furthermore, both stakeholders agreed that satisfaction, sustainability and external factors are among the least important criteria. Such differences can be understood in light of different responsibilities, aims and concerns related to each project completion. Contractors are usually focused on delivering the project on time and per requirements to ensure complete payment, whereas customers are more concerned about the quality and strategic objectives of the project.

Although both parties agreed on some of the sub-factors such as adequate funding through the project being the most important, the remaining factors and sub-factors were ranked differently. The top three important sub-factors for customers were adequate funding throughout the project, top management support and availability of resources, respectively. As it is the responsibility of the customer to ensure financing of the project, it is justified to have this as a leading factor toward project success. Moreover, top management involvement has always been a leading factor in encouraging staff toward investing more commitment in the project. Availability of resources is necessary from the customer point of view and involves having the right personnel for the tasks, proper contractor, financial resources and required equipment.

From the contractor point of view, adequate funding throughout the project, effective strategic planning and PM activities were ranked as the three most important sub-factors. As mentioned earlier, the first is a justified sub-factor, as all other activities and resources are linked to having sufficient financing. Surprisingly, effective strategic planning was ranked as the second most important sub-factor, possibly because, in many cases, this is more important to the customer than the contractor. This could be a result of the detailed planning required from the contractor to ensure smooth flow and utilization of all activities and resources during the project duration. Finally, effective project management activities and processes are essential to contractors in carefully planning, executing and monitoring the overall project toward completion.

Numerous challenges are currently being faced during major construction projects related to the health care industry in the UAE. The results of this study should be used as a guideline of what to focus on in such projects to achieve a higher success rate. However, as this country is still developing, there is a dependency on foreign companies and professionals to run those projects, which might cause issues as the number of projects increase. Furthermore, there is a lack of available information regarding such projects, including lessons learned and recommendations, which could be helpful for future similar projects.

Recommendations

This study will be useful for project managers, project owners and decision-makers in the health care construction field in the UAE. It achieved its aim of providing a prioritized list of factors for health care construction projects in the region and identifies what should be focused on to achieve higher success. From a customer perspective, more focus and efforts should be spent on management, financial capabilities and SCM/operations, as these were found to be the leading factor groups in this study. The three leading sub-factors for the customer stakeholders were found to be adequate funding throughout the project, top management support and availability of resources. Additional attention should be given to those specific factors, as they are perceived to drive success in health care construction projects.

From the contractor perspective, the three leading factor groups were found to be financial capability, management and strategy. Contractor management should invest more in planning and controlling each sub-factor within those groups to ensure a higher success rate. The leading sub-factors were found to be adequate funding, effective strategic planning and project management. This indicates that adequate funding must be ensured to obtain desirable project results. Moreover, additional efforts must be spent in the strategic planning and project management processes in the planning stage and throughout the project.

In general, the combined scoring showed that the leading sub-factors were adequate funding throughout the project, effective strategic planning and top management support. Those are the key areas to focus on when working toward higher success rates. Funding is essential and required to ensure smooth progress of activities and availability of resources. Furthermore, although sustainability was ranked as low in importance in this study, current trends indicate its growing impact. To clarify, the government of the UAE has been emphasizing and mandating further implementation of sustainability innovation in projects toward saving resources and the environment. Finally, as there is a lack of information related to health care construction projects in this part of the world, it would benefit researchers and professionals to have relevant study results and data accessible to help improve future projects.

Limitations and future studies

Although this study included a sufficient number of respondents, it only covered one major company from each stakeholder. Moreover, the factors could be expanded to provide a comparison of different countries in the region. Furthermore, because the ANP is emerging as a suitable methodology for such studies, it could be used to extend this research. Overall, future studies could cover additional stakeholders such as consultants and regulatory authorities. Finally, multiple stakeholder companies could be added while applying ANP as the research methodology.

Disclosure statement

No potential conflict of interest was reported by the authors.

References

Abdul-Aziz A, Kassim J. 2011. Objectives, success and failure factors of housing public–private partnerships in Malaysia. Habitat Int. 35:150–157.

Abu Dhabi HA. 2015. Health statistics 2014. Abu Dhabi: HAAD.

Almajed A, Mayhew PM. 2013. An investigation of the critical success factors of IT projects in Saudi Arabian Public Organizations. IBIMA Bus Rev 2013:Article ID 260919.

Al-Mudimigh AS. 2007. The role and impact of business process management in enterprise systems implementation. Bus Process Manage J. 13:866–874.

Al-Saadi R, Abdou A. 2016. Factors critical for the success of public–private partnerships in UAE infrastructure projects: experts' perception. Int J Constr Manage. 16:234–248.

Al-Shamlan HM, Al-Mudimigh AS. 2011. The change management strategies and processes for successful ERP implementation: a case study if MADAR. Int J Comput Sci. 8:431–435.

Al-Turki UM. 2011. An exploratory study of ERP implementation in Saudi Arabia. Prod Plan Control. 22:403–509.

Barzekar G, Aziz A, Mariapan M, Ismail MH, Hosseni SM. others. 2011. Using analytical hierarchy process (AHP) for prioritizing and ranking of ecological indicators for monitoring sustainability of ecotourism in northern forest, Iran. Ecologia Balkanica. 3:59–67.

Bereketli I, Erol Genevois M. 2013. An integrated QFDE approach for identifying improvement strategies in sustainable product development. J Cleaner Prod. 54:188–198. Available from: http://doi.org/10.1016/j.jclepro.2013.03.053

Bourne L, Walker DH. 2008. Project relationship management and the stakeholder circle. IntJ Manag Proj Bus. 1:125–130.

Chung E-S, Lee KS. 2009. Prioritization of water management for sustainability using hydrologic simulation model and multicriteria decision making techniques. J Environ Manage. 90:1502–1511.

Constructionweekonline. 2015. Constructionweekonline. TP Business Publishing Ltd.. Available from: http://www.constructionweekonline.com/article-20183-construction-to-add-111-to-uaes-gdp-in-2015/

Cooke-Davies T. 2002. The 'real' success factors on projects. Int J Proj Manage. 20:185–190.

Dezdar S, Ainin S. 2012. Examining successful ERP projects in Middle-East and South-East Asia. Am J Sci Res. 13–25.

Dinarvandi M, Jafari H, Mohamadi M, Hosseini A. 2014. Improving the quality of service to the urban environment for sustainable development. In: Proceedings of the 3rd International Geography Symposium, GEOMED; 2013 June 10–13; Antalya. p. 487–495. Available from: http://doi.org/10.1016/j.sbspro.2014.02.128

Finney S, Corbett M. 2007. ERP implementation: a compilation and analysis of critical success factors. Bus Process Manage J. 13:329–347.

Ghodsypour SH, O'Brien C. 1998. A decision support system for supplier selection using an integrated analytic hierarchy process and linear programming. Int J Prod Econ. 56–57:199–212. Available from: http://doi.org/10.1016/S0925-5273(97)00009-1.

Greenwood D, Gledson Barry J. 2012. The efficient scheduling of resources in engineering construction projects: reflections on a case study from Iran. J Constr Manage Econ. 30:687–695.

Greenwood DJ, Levin M. 2007. Introduction to action research: social research for social change. Thousand Oaks (CA): Sage Publications.

Gudienė N, Audrius B, Nerija B, Jorge L. 2013. Development of a conceptual critical success factors model for construction projects: a case of Lithuania. In: Proceedings of the

11th International Conference on Modern Building Materials, Structures and Techniques. Elsevier.
Hong EK. 2009. Information technology strategic planning. IT Professional. 11:8–15.
Hussein BA, Klakegg OJ. 2014. Measuring the impact of risk factors associated with project success criteria in early phase. Procedia – Soc Behav Sci. 119:711–718.
Jamali D. 2004. Success and failure mechanisms of public private partnerships (PPPs) in developing countries, insights from the Lebanese context. Int J Public Sect Manage. 17:414–430.
Jefferies M, Gameson R, Rowlinson S. 2002. Critical success factors of the BOOT procurement system: reflections from the Stadium Australia case study. Eng Constr Archit Manage. 9:352–361.
JJacobson C, Choi S. 2008. Success factors: public works and public private partnerships. Int J Proj Manage. 21:637–657.
Kamal MM. 2006. IT Innovation adaptation in the government sector: identifying the critical success factors. J Enterp Inf Manage. 19:192–222.
Kemppainen J, Tedre M, Parviaainen P, Sutinen E. 2012. Risk identification tool for ICT in international development cooperation projects. Electron J Inf Syst Developing Countries. 55.
Korpela J, Lehmusvaara A, Tuominen M. 2001. Customer service based design of the supply chain. Strateg Plan Prod Syst. 69:193–204.
Kurttila M, Pesonen M, Kangas J, Kajanus M. 2000. Utilizing the analytic hierarchy process (AHP) in SWOT analysis – a hybrid method and its application to a forest-certification case. Forest Policy Econ. 1:41–52.
Lan LD. 2004. A study on project success factors in large construction projects in Vietnam. Eng Constr Archit Manage. 11:404–413.
Lee C-E, Hsu S-C. 2004. Outsourcing capacity planning for an IC design house. Int J Adv Manuf Technol. 24:306–320.
Lehtiranta L, Sami K, Juha-Matti J, Paivi J. 2012. The role of multi-firm satisfaction in construction project success. J Constr Manag Econ. 30:463–475.
Li B, Akintoye A, Edwards P, Hardcastle C. 2005. Critical success factors for PPP/PFI projects in the UK construction industry. Constr Manage Econ. 23:459–471.
Long Duy N, Stephen OO, Do Thi Xuan L. 2004. A study on project success factors in large construction projects in Vietnam. Eng Const Architec Manage. 11(6):404–413.
Mandal P, Gunasekaran A. 2003. Issues un implementing ERP: a case study. Eur J Oper Res. 146:274–283.
Masozera MK, Alavalapati JRR, Jacobson SK, Shrestha RK. 2006. Assessing the suitability of community-based management for the Nyungwe forest reserve. Rwanda Forest Policy Econ. 8:206–216. Available from: http://doi.org/10.1016/j.forpol.2004.08.001
Meng X, Zhao Q, Shen Q. 2011. Critical success factors for transfer-operate-transfer urban water supply projects in China. J Manage Eng. 27:243–251.
Murphy D, Baker B, Fisher D. 1974. Determinants of project success. Chestnut Hill (MA): Boston College, School of Management.
Mustaffa YC. 2012. Analysis of factors critical to construction project success in Malaysia. Eng Constr Archit Manage. 19:543–556.
Nagi S, Drew D, Lo H, Skitmore M. 2002. A theoretical framework for determining a the minimum number of bidders in construction bidding competitions. Constr Manage Econ. 20:473–82.
Ng S, Wong Y, Wong J. 2012. Factors influencing the success of PPP at feasibility stage – a tripartite comparison study in Hong Kong. Habitat Int. 36:423–432.
Osei-Kyei R, Chan A. 2015. Review of studies on the critical success factors for public-private partnership (PPP) projects from 1990 to 2013. Int J Proj Manage. 33:1335–1346.
Pinto JK, Slevin DP. 1988a. Project success: definitions and measurement techniques. Proj Manage J. XIX:67–70.
Pinto JK, Slevin DP. 1988b. Critical success factor across the project life cycle. Proj Manage J. 14:5–18.
[PMI] Project Management Institute. 2004. A guide to the project management body of knowledge: PMBOK guide. 4th ed. Project Management Institute.
Ralf M. 2012. Critical success factors in projects. International Journal of Managing projects in Business. 5:757–775.
Razzaq A, Muhammad Jamaluddin T, Ahsen M, Hamza Farooq G. 2016. Critical external risks in international joint ventures for construction industry in Pakistan. Int J Civ Eng. doi:10.1007/s40999-016-0117-z
Ren J, Manzardo A, Toniolo S, Scipioni A. 2013. Sustainability of hydrogen supply chain. Part II: prioritizing and classifying the sustainability of hydrogen supply chains based on the combination of extension theory and AHP. Int J Hydrogen Energy. 38:13845–13855.
Rockart J. 1982. The changing role of information system executive: a critical success factor prospective. Sloan Manage Rev. 24:3–13.
Saaty T. 1980. The analytic hierarchy process. New York (NY): McGraw Hill International.
Saaty TL. 1990. The analytic hierarchy process in conflict management. Int J Conflict Manage. 1(1):47–68.
Saaty TL. 2008. Decision making with the analytic hierarchy process. IntJ Serv Sci. 1:83–98.
Saaty TL. 2012. Decision making for leaders. Pittsburgh (PA): RWS Publications.
Salisu M, Bousrih L, Harrabi S. 2012. Public private partnerships in the GCC region. In What went wrong? Manama: Gulf One Investment Bank.
Tang L, Shen Q, Skitmore M, Cheng E. 2012. Ranked critical factors in PPP briefings. J Manage Eng. 29:164–171.
Tiong R. 1996. Critical success factors in wining BOT contracts. J Constr Eng Manage. 118:217–228.
Toor S, Stephen OO. 2009. Construction professionals' perception of critical success factors for large−scale construction projects. Constr Innov. 9:149–167.
Voordijk H, De Haan J, Joosten G. 2000. Changing governance of supply chains in the building industry: a multiple case study. Eur J PurcSupply Manage. 6:217–225.
Wrisberg N, de Haes HAU, Triebswetter U, Eder P, Clift R. 2002. Analytical tools for environmental design and management in a systems perspective: the combined use of analytical tools. The Netherlands: Kluwer Dordrecht. Available from: http://library.wur.nl/WebQuery/clc/1743035