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Assessment of supplier selection for critical items in public organisations of Abu Dhabi

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Abstract: This study examines supplier selection using the analytic hierarchy process (AHP) method. The primary objective of this study is to find the best procurement criteria addressing critical items in government organisations in the United Arab Emirates (UAE). The paper includes a thorough review of the literature on current best practices in procurement and supplier selection, focusing on addressing challenges faced by procurement professionals in public organisations during supplier selection. The study will contribute a new practical model for supplier selection based on the AHP method, and the proposed model will employ new proposed stakeholders' interest factors in selection and is customised for needs of public organisations working in the UAE business environment.

Keywords: supplier selection; public organisations; analytic hierarchy process; AHP; United Arab Emirates; UAE.

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Matloub Hussain is currently working as an Associate Professor at Abu Dhabi University, Abu Dhabi, UAE. He holds PhD in Supply Chain Management from University of Liverpool. He has been involved in several research projects in last few years. His research interests pertain to operations and supply chain management, TQM, demand and inventory management, simulation and design of experiments. He has been publishing in several international journals.

Mehmood Khan has been teaching at the university level for the past 12 years and currently is an Associate Professor of Management Science at Abu Dhabi University. He taught as a lecturer of Industrial Engineering and Operations Research at KFUPM from 2001 till 2007. He finished his PhD in Industrial Engineering from Ryerson University, Toronto, Canada in 2011. His research

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1 Introduction

Supplier selection is one of the most important stages/processes of supply chain management, as well as the functioning of organisations. Suppliers can have a major impact on organisation success from three primary angles, which are quality, cost and on delivery time of products and services (Ching-Chow and Bai-Sheng, 2006). Suppliers can also play a major role in building or destroying the competitive advantage for organisations that function in today's highly globalised and competitive business environment (Sarder et al., 2014).

Procurement is one of the most essential functions of government organisations today (Dragos and Neamtu, 2013). In fact, most of what government organisations do today is to channel national funds/budgets into building transportation, telecommunication and infrastructures. Governments in developing countries also channel a large portion of their annual budgets on procurement, estimated at 9%–13% of the gross domestic product (GDP) (Eyaa and Oluka, 2011). Thus, it is very important for a government to put in place supplier selection strategies and working models to be able to spend their budgets efficiently and be a stable economy (Nakabayashi, 2009). Procurement plays a major role in the economic prosperity and national security of the United Arab Emirates (UAE), as it is a developing country. Procurement in the UAE is essential in government sectors, such as utilities, municipalities and road construction authorities, since these government organisations channel huge amounts of money in infrastructure and development projects (Ellinor, 2007). The UAE economy depends largely on such infrastructure and service projects, as the UAE Government aspires to facilitate business and increase its income from non-oil economic activities (Issac, 2013).

Due to the drastic importance of procurement and supplier selection in public organisations, there is a great need for a working supplier selection model that accounts for stakeholder's different interests and the impact on meeting an organisation's own objective in different purchasing situations (critical/noncritical). Thereafter, this study is built around supplier selection using the analytic hierarchy process (AHP) method. The main objective of this study is to determine the best procurement criteria in government organisations in the UAE; specifically, in the power and water sector in Abu Dhabi, which utilises essential assets categorised into critical materials. The water, wastewater and power sector in the emirate of Abu Dhabi is comprised of specific organisations in charge of the diverse phases of the procurement of water and power to clients in addition to the gathering, treatment and transfer of wastewater. The remainder of this paper is organised as follows: the next section provides a survey of the relevant literature, Section 3 details the research methodology and Section 4 presents the research model.

Section 5 addresses analysis and discussion, and Section 6 presents the study's conclusions.

2 Literature review

2.1 Supplier selection criteria

The supplier selection process plays a vital role in the academic and industry experts' day-to-day activities, and many researchers have highlighted the importance of the supplier selection method (Dobler et al., 1990). Other researchers have emphasised the importance of transferring the approach from a formal, regular one to the supplier selection process (Weber et al., 1991). Supplier selection is the most significant process of the purchasing unit. This unit plays a substantial role in selecting the most efficient and effective supplier. Dickson (1966) identified 23 attributes for supplier selection based on a survey of purchasing managers in North America. These attributes included quality, performance, delivery, warranty and technical capabilities. Patil (2014) identifies 48 criteria from distinctive authors between 1966 and 2012.

Various organisations are seeking long-term relationships with suppliers in a bid to improve production processes (Ho et al., 2011). In such situations, companies aim to achieve certain strategic business objectives at the expense of being unable to satisfy interests of some stakeholders. Usually, if the quality is not considered in the purchasing process, the appraiser will depend on the price. The importance of supplier practitioners towards strategic thinking and taking proper design has been highlighted in the research (Knight et al., 2005). These studies indicate that many institutes in England, such as the NHS purchasing and supply agency, have developed capability structures for the procurement process. Today, it is becoming increasingly important for organisations to develop their own supplier selection methodologies that are tailored to the particular organisation's needs, industry, business environment and other unique attributes.

Public procurement is an important government activity, as it produces 15% of the world's GDP (Bergman and Lundberg, 2013). In such countries as the USA, public procurement is very strict, and the contracts are awarded to the most cost-effective qualified bidder. In the European Union, an optimal mix of price and quality is what is mostly used to choose the supplier. Waara and Bröchner (2006) noted that while in the past, most public sectors have used the lowest bid as the only award criterion for awards, these sectors are slowly changing their regulations. Other factors that have been considered are environmental characteristics, functional characteristics and technical merit. Using price and quality can improve the process of public procurement, but this unfortunately increases complexity to the purchasing situation. There has been very limited research regarding public procurement systems (Snider and Rendon, 2008). Public compared to private procurement has a stronger emphasis on rules and predictability. However, it is not easy to come up with a good scoring rule because, in the public sector, procurement involves a number of steps. These steps vary from the identification of needs, to the choice of supplier methods, to post-control mechanisms and methods (Bergman and Lundberg, 2013).

Previous research has been conducted in regards to the supplier selection process and the best scenario to adopt the optimum supplier for the materials or services. Weber et al., (1991) studied 74 articles presenting supplier selection criteria. They concluded that

supplier selection is a multi-decision problem with different attributes prioritised according to the nature of the material. While price proves to be the most important factor in many organisations, many other organisations, especially in the public sector, pay attention to other important factors such as quality, past suppliers' performance, financial performance, manpower, facilities and cost. This is in consideration of adaptation of Kraljic's (1983) measurements which incorporate the complexity of the acquiring product and the vital significance of the procurement. A distinction is made by this study between critical and noncritical purchasing situations.

However, previous studies have only rarely adopted conflicts of interest as an attribute in the supplier selection. There are articles which illustrate how influential stakeholders are in the contractual failure (Rose, 2004) and organisation performance. Therefore, the next section will illustrate the optimal supplier selection methodology and theoretical framework towards stakeholders' interest used in this research.

2.2 Quality and safety

According to a literature review conducted by Rajesh et al. (2012), quality was mentioned as the first of five main criteria in evaluation and selection of suppliers. These criteria are product quality, price, delivery time, services and warranty. Additionally, Parthiban et al. (2013) mentioned quality as being one of "the most widely used criteria for vendor selection". Rajesh et al. (2012) concluded that the Taguchi loss function is an important method in explaining supplier selection by using fundamental criteria including product quality, offer price, delivery lead time, service, warranty, experience, and financial stability. Furthermore, Dickson (1966), Karpak et al. (1999), Amid et al. (2011), Parthiban et al. (2013) all indicate that supplier selection decisions include several criteria with one of them being the quality of product/serveries. The following sub-criterion has been used in this paper for quality and safety criteria of supplier selection.

2.2.1 Quality system implementation and certification

According to a study conducted by Ng (2010) in which many interviews with supply chain professionals were conducted, the quality system and process factor was among the most frequently mentioned attribute/factor for supplier selection in interviewees own firms. According to Ng (2010) "having adequate quality systems and processes (e.g., control procedures, ISO standards, quality manuals) in place could help; ensuring that products services were delivered with the highest quality standards, which could lead to greater customer satisfaction". Marufuzzaman and Ahsan (2009) found that the quality system ranked the top main criteria while the AHP analysis is used. Karpak et al. (1999) highlighted the importance of third party certification in the selection process as a means for quality implementation assurance. Third-party certification is an important mechanism for buyers to verify suppliers' implementation of quality systems. The International Standardization Organization (ISO), for example, provides auditing and certification services for vendors applying ISO quality standards and controls.

2.2.2 Process control capability

Marufuzzaman and Ahsan (2009) present the important of process control capability while utilising the AHP methodology.

2.3 Performance

For a number of years, many researchers such as Dickson (1966), Sevkli et al. (2007), Athawale et al. (2009), have specified performance as a main attribute of supplier selection and a means for product process improvement. Past performance of supplier is measured using the following sub-criteria.

2.3.1 Past performance

It was found that past performance is the most important attribute for supplier selection according to Aretoulis et al. (2010). Vijayvagy (2012) indicates that without being able to provide past standard production such as technical documents, company activity performance and all required documents will result in the supplier failing to meet the standard. Furthermore, Kannan and Tan (2002) and Ku et al. (2010) use past and current supplier relationship along with performance history as essential criteria for selection of vendors.

2.3.2 Product quality

Rajesh et al. (2012), Narasimhan et al. (2006) consider using product quality criteria in supplier selection, which is an importance attribute to satisfy the end users through meeting standard requirements.

2.3.3 Post sales services

The product improvements and customer's satisfaction is essential for researchers while conducting supplier selection. This approach is employed to meet user's requirements after delivery (Rajesh et al., 2012).

2.3.4 Delivery lead time

Rajesh et al. (2012) stated that delivery lead time is an important aspect in supplier stability and acceptability. Amid et al. (2011) identified several criteria and sub-criteria for supplier selection. Quality net cost and services were proposed as the main criteria and then segregated into sub-criteria. For example, under services, it was proposed to determine the on-time deliveries percentage. Athawale et al. (2009) presented the delivery performance one of the most important criteria from 23 attributes and measured it as the percentage of purchase orders delivered within the required delivery time. Sevkli et al. (2007) considered that lead time must meet the confidentiality of the customer. A recent survey noticed that the major distrust for time lead is transportation delay (Min, 1994). Xia and Wu (2007) produce the multi objective model which maximises on time delivery.

2.4 Manpower/organisation

Organisational structure is considered to be an important criterion for supplier selection (Amid et al., 2011; Sevkli et al., 2007; Parthiban et al., 2013). Vijayvagy (2012) includes organisation culture in the research model. Quality and experience of the personnel is also important and Kannan and Tan (2002) present several suppliers' assessment criteria

to make the best supplier communication relationship including capability and the supplier's technical expertise.

2.4.1 Organisation structure

Sevcli et al. (2008) and Marufuzzaman and Ahsan (2009) illustrate the importance of human capital capacity and impact of organisation structure on its ability to deliver products/services on time and with high quality.

2.4.2 Reputation

Chan and Kumar (2007), Sevcli et al. (2007) present reputation as sub-criterion in the supplier selection process. Suppliers with a high good reputation take drastic measures to maintain their reputation derived equity, which results in better service and a higher quality product provided to customers.

2.5 Financial performance

2.5.1 Last year turnover

Marufuzzaman and Ahsan (2009) produce the importance of last year turnover and financial information in the supplier selection process. Supporting the above; Hong et al. (2013) tested five criteria and ten sub-criteria, such as financial situation of enterprises, production capacity, delivery efficiency and cost.

2.5.2 Financial stability

Koksai (2011) indicated qualification criteria for business and procurement processes where the most important aspects were financial capability, the documents issued by the banks, the balance sheet of the tenderer, the documents showing the business volume of the contractor, and professional and technical capability. Supporting the above, Rajesh et al. (2012), Min (1994) highlight the importance of financial stability and capability.

2.6 Facilities – offices/equipment

2.6.1 Adequacy of office space

Adequacy of office space/automation/hardware and software, manufacturing capabilities and supplier's logistics are considered to be primary criteria while selecting suppliers (Sevcli et al., 2007; Cebi and Bayraktar, 2003).

2.6.2 Production capacity

Sevcli et al. (2007, 2008) introduce production capacity as a sub-criterion in the research proposed model. Parthiban et al. (2013) indicate that production capacities are vital while selecting the supplier. This finding is observed because these researchers recognise machine capacity and process flexibility.

2.6.3 Continuous improvement

Parthiban et al. (2013) found that it is important to evaluate the supplier based on their challenges and opportunities to solve them. Sevkli et al. (2007), Perçin (2006), Kannan and Tan (2002) introduced the importance of continuous improvement of the product and its process, and use it as main and sub-criteria in the proposed models of optimal supplier judgement.

2.7 Cost

2.7.1 Total cost

It is usual to select a supplier without paying attention to total cost, which indicates direct and indirect cost. Nonetheless, many researchers illustrate the importance of total cost in the supplier selection process (Nadeem et al., 2014; Min, 1994; Ku et al., 2010; Sevkli et al., 2008, Kannan and Tan, 2002; Rajesh et al., 2012).

Table 1 Criteria and sub-criteria of supplier pre-qualification

<i>Main criteria</i>	<i>Sub-criteria</i>	<i>References</i>
Quality and safety policy (QS)	1 Quality system implementation and certification (QS1)	Marufuzzaman and Ahsan (2009), Ng (2010), Nadeem et al. (2014), Perçin (2006), Karpak et al. (1999), Sevkli et al. (2007, 2007), Min (1994), Chan and Kumar (2007)
	2 Quality assurance (QS2)	
	3 Process control capability (QS4)	
Performance (PR)	1 Past performance (PR1)	Aretoulis et al. (2010), Vijayvagy (2012), Ng (2010), Ku et al. (2010), Kannan and Tan (2002), Rajesh et al. (2012), Narasimhan et al. (2006), Karpak et al. (1999), Amid et al. (2011)
	2 Product specialisation (PR2)	
	3 Post sales services (PR3)	
	4 Delivery lead time (PR4)	
Manpower and organisation (MO)	1 Quality and experience of manpower (MO1)	Kannan and Tan (2002), Sevkli et al. (2007, 2008), Marufuzzaman and Ahsan (2009), Chan and Kumar (2007)
	2 Organisation structure (MO2)	
	3 Reputation (MO3)	
Financial performance (FP)	1 Last year turnover (FP1)	Hong et al. (2013), Marufuzzaman and Ahsan (2009), Rajesh et al. (2012), Koksai (2011), Min (1994)
	2 Financial stability (FP2)	
Facilities – offices/equipment (FO)	1 Adequacy of office space (FO1)	Sevkli et al. (2007, 2008), Cebi and Bayraktar (2003), Parthiban et al. (2013), Chan and Kumar (2007), Xia and Wu (2007)
	2 Production capacity (FO2)	
	3 Continuous improvement (FO3)	
Costs (CO)	1 Total cost (CO1)	Nadeem et al. (2014), Min (1994), Ku et al. (2010), Sevkli et al. (2008), Kannan and Tan (2002), Rajesh et al. (2012), Nadeem et al. (2014)
	2 Payment terms (CO2)	

2.7.2 Payment term

Many researchers illustrated that payment terms is one of the most important attributes while selecting an optimal supplier (Nadeem et al., 2014; Min, 1994). Table 1 presents the full criteria and sub-criteria of supplier selection used in this research.

3 Overview of AHP

The AHP method is a highly popular and widely adopted supplier selection model due to its many advantages (Salem, 2012; Mardle et al., 2004; Yoo et al., 2008). The consistent verification system of the AHP process acts as a feedback loop, which enables decision makers to review and revise their decisions (Görener, 2012). The judgments that are made are guaranteed to be consistent. The AHP approach is a popular MCDM technique applicable to many areas including the engineering, finance, education, industry, manufacturing, management, sports and social sectors literature (Ho et al., 2011; Bayazit, 2005; Forman and Gass, 2001). The wide-spread use of this method is due to its simplicity and flexibility. It can also be used to make consistent decisions with respect to quantitative and qualitative criteria. Using this method, organisations avoid making inconsistent decisions caused by subjective and personal judgments (Sharma and Bhagwat, 2007; Hussain et al, 2015).

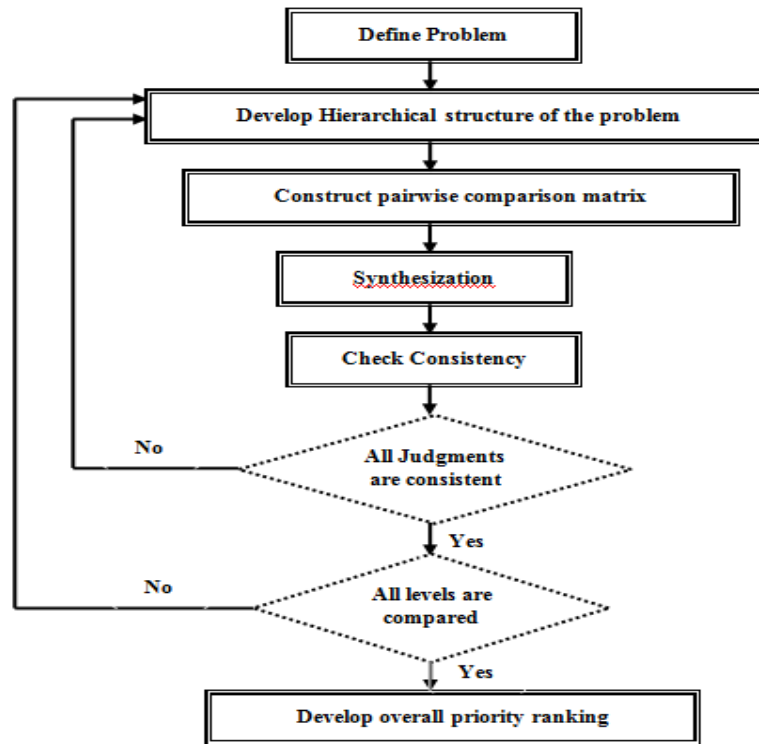
In the AHP, the decision process is structured using different levels. The highest level represents the ultimate goal, while other decisions represent the alternatives. AHP enables the researcher to come up with a structure that is similar to a family tree, and enables the analyst to end up with the best decision possible (Sevcli et al., 2007). Using analytical techniques and decision-making tools will make a contribution to the subjective and objectives criteria used in supplier selection (Rajesh, et al., 2012; Hussain and Malik, 2016). AHP can also help organisations demonstrate transparency in their supplier selection methods by automating a multi-criteria selection framework that is unbiased and systematic. Therefore, AHP is a proven mechanism for improving the consistency and performance of an organisation (Gupta et al., 2013).

Saaty (2012) described eight steps when using the AHP model. The first is an outline element of the problem; second, developing a hierarchical structure of the problem. Third, building up pairwise comparison among elements; Fourth, gathering judgments; Fifth, priorities are collected and consistency tested; Sixth, perform the three previous steps for each level; Seventh, calculate geometric means of pair-wise comparison of all criteria, and use an indicator to weigh the vectors of priorities; finally, user will evaluate consistency for the entire hierarchy by multiplying each consistency index by the priority of the corresponding criterion. The use of the AHP model as a decision aid is highly important because of the stress it places on the importance of the judgment that will affect the outcome of the final project. The AHP makes the decision transparent in all aspects helps decision maker gain visibility into why a supplier is to be selected among his competitors (Triantaphyllou and Mann, 1995; Drake et al, 2013; Malik et al, 2016).

The cited work in this section describes the suitability of AHP as a decision making framework to facilitate the supplier prequalification process, however, as noted earlier, there are substantive difference in the AHP implementation mechanism. Furthermore, the supply management practices for the UAE construction industry have not attracted sufficient academic attention. Therefore, this study aims to contribute to the literature by

implementing the AHP for the contractor/supplier pre-qualification designed for the local environment of the UAE public utility companies.

Figure 1 Outline of AHP method employed in this research



Source: Hussain et al. (2015)

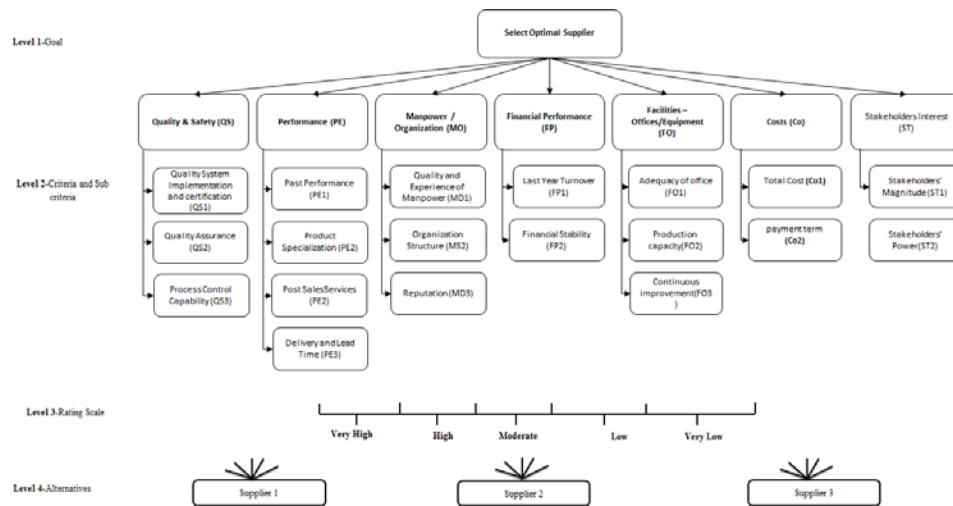
4 Research model

The purpose of this research is to identify supplier selection criteria to evaluate the satisfaction of stakeholder's interests. To this end, the study refines current academic research on the attributes of the evaluation criteria of supplier selection and integrates them with stakeholders' interest. The next step is to develop a hierarchical model (see Figure 2). AHP categorises the goal and all decision criteria and variables into different levels. The first level of the hierarchy is the main goal, that is, the selection of an optimal supplier. Level 2 represents the criteria and sub-criteria used in the pre-qualification of contractors. Level 3 contains the suppliers that require evaluation. Figure 2 represents the hierarchy of the proposed AHP model.

In this research, six principal criteria will be described: quality and safety; performance; manpower and organisation (MO); financial performance (FP); facilities, offices and equipment (FC); and cost criteria. These six criteria and associated sub-criteria (see Table 1) were selected from the literature review and after meeting top

decision makers in selecting suppliers in public sector in Abu Dhabi. The decision makers inject one more item, which will add value to this model, as well as test any new methodology which has been taken where the organisation will not allow any company to do business if there is stakeholders' interest. Stakeholders' interest is comprised first of the magnitude and direction of stakeholders' particular interest in a specific deal or projects. The second component is the extent of stakeholders' interest in power.

Figure 2 Proposed model



5 Analysis and discussion

After building the AHP hierarchy, the next phase is the measurement and data collection. Particulars of the prequalification criteria were collected from the three public organisations of Abu Dhabi. In line with Saaty's (1990) recommendations, the questionnaire was designed on a nine-point scale based on the six main criteria and 19 sub-criteria for supplier pre-qualification. The questionnaire was pilot tested using industry experts and academics, and some of the items had to be rephrased to make them more representative of the intended constructs. Evaluation teams including the heads of procurement departments completed the survey. Since the respondents are the key persons in their organisations and have sufficient experience in subject matter, therefore, we can be confident about the responses validity. The recommended geometric mean approach, instead of the arithmetic approach, is used to combine the individual pair wise comparison judgment matrices to obtain the consensus pair wise comparison (Saaty, 1990). The measure of importance is a nine point scale ranging from the two attributes being equally important to one attribute being absolutely important over other as Table 2. For example, if a evaluator identifies that financial performance is moderately more important than experience, then the former is rated '3' and the latter '1/3' in this comparison and so on.

Table 2 Pair-wise comparison

<i>Intensity of importance</i>	<i>Definition</i>	<i>Explanation</i>
1	Equal importance	Two criteria contribute equally to the objective
3	Moderate importance	Judgment slightly favour one over another
5	Strong importance	Judgment strongly favour one over another
7	Very strong importance	A criterion is strongly favoured and its dominance is demonstrated in practice
9	Absolute importance	Importance of one over another affirmed on the highest possible order
2, 4, 6, 8	Intermediate values	Used to represent compromise between the priorities listed above

To check the consistency of responses, the consistency index (CI) is applied (Saaty, 1990):

$$CI = (\lambda_{\max} - n) / (n - 1) \quad (1)$$

where, $\lambda_{\max}$ is the maximum Eigen value of the matrix of the importance ratios and n is the number of factors. Then, the consistency ratio (CR) is used to assess whether a matrix is sufficiently consistent. This is the ratio of the CI to the random index (RI), which is the CI of a matrix of comparisons generated randomly:

$$CR = CI / RI \quad (2)$$

Random pair-wise comparisons have been simulated to produce average random indices for different sized matrices. The values of RI are given in Table 3 and according to Saaty (2008), if the value of CR is smaller or equal to 0.10, the inconsistency is acceptable.

Table 3 Random index

<i>n</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.48

Source: Saaty (2012)

The geometric mean methodology, instead of the arithmetic approach, has been proposed by Saaty (1990) to consolidate the individual pairwise comparison judgment matrices to obtain the compromise pairwise comparison matrices for all evaluators. Table 4 displays the geometric means of pair-wise comparison for main criteria. The next step is to define the relative priorities of criteria (the final column of Table 4) by computing 'priority vectors'.

Saaty (1990) presented a 'consistency principle' for calculating priority vectors. Consistency principle says that $a_{ik} = a_{if} \cdot a_{jk}$ and subsequent argument 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 4 Pair-wise comparison matrix for primary criteria with priority weight

	Quality and safety	Performance	Manpower/organisation	Financial performance	Facilities office/equipment	Cost	Stake holders interest	Priority weight
Quality and safety	0.48	0.79	0.42	0.21	0.24	0.15	0.14	0.35
Performance	0.07	0.12	0.47	0.35	0.25	0.21	0.14	0.23
Manpower/organisation	0.08	0.02	0.07	0.37	0.24	0.17	0.14	0.16
Financial performance	0.10	0.02	0.01	0.05	0.24	0.20	0.20	0.12
Facilities office/equipment	0.07	0.02	0.01	0.01	0.04	0.22	0.15	0.07
Cost	0.09	0.02	0.01	0.01	0.01	0.03	0.20	0.05
Stake holders interest	0.09	0.02	0.01	0.01	0.01	0.00	0.02	0.02

Note: CR = 0.08 < 0.10 (acceptable)

Table 4 reveals that the quality and safety policy (QS) criterion is considered as most important by the respondents with a priority weight of 35% followed by the performance (PP) which had a competitive priority of 23%. Manpower/organisation (MP), financial performance (FP), facilities office/equipment and cost were ranked 3rd, 4th 5th and 6th respectively with the stake holders interest's (SI) being considered as the least important criterion 2% by the consensus feedback of the three teams of the evaluators. Notably, the consensus responses fulfil the acceptable consistency ratio (CR) requirement.

To characterise the priorities reported in Table 4, a pairwise comparison of the sub-criteria within each criteria is also carried out based on the consensus responses of the evaluators (Tables 5 to Table 11). As shown in Figure 2, each criterion was further divided in level 2 into common indicators (sub-criteria) of the main criteria. For quality and safety (QS), quality system implementation and certification (QS1), quality assurance (QS2) and process control capability (QS3) were the two sub-criteria. Table 5 gives the priority listing of the consensus pairwise comparison for the three QS sub-criteria. The quality system implementation and certification (QS1) is heavily favoured 70% over quality assurance (QS2) which was given a priority ranking of 24%. This indication is important for the manufacturer as the assurance of quality begins with requirements generation and cascades, in stages, throughout the products or services life-cycle followed by process control capability (QS3) which ranked the least. This may result because of the complicated process and systems which used within the process to measure the production over time.

Table 5 Geometric means of pair-wise comparison for quality and safety

	<i>QS1</i>	<i>QS2</i>	<i>QS3</i>	<i>Priority weight</i>
QS1	1	9	7	0.70
QS2	1/9	1	9	0.24
QS3	1/7	1/9	1	0.06

Note: CR = 0.04 < 0.10 (acceptable)

Table 6 Geometric means of pair-wise comparison for performance

	<i>PE1</i>	<i>PE2</i>	<i>PE3</i>	<i>PE4</i>	<i>PE5</i>	<i>Priority weight</i>
PE1	1	6	7	6	7	0.51
PE2	1/6	1	6	5	6	0.24
PE3	1/7	1/6	1	6	5	0.15
PE4	1/6	1/5	1/6	1	4	0.07
PE5	1/7	1/6	1/5	1/4	1	0.04

Note: CR = 0.03 < 0.10 (acceptable)

Similarly, within the performance (PE) criteria, past performance (PE1), delivery lead time and past cost overruns (PE2) are considered very important with a priority score of 51% and 24% respectively (Table 6). The importance of the fourth and fifth sub-criterion of the attitude towards the claim (PE4) and (PE5) were low at almost 45% in comparison to the (PE1), (PE2) and (PE3). This is understandable as past performance, delivery lead and post sales services are considered as the main performance measures of utility supplier special in gulf sector.

Table 7 Geometric means of pair-wise comparison for manpower/organisation

	<i>MO1</i>	<i>MO2</i>	<i>MO3</i>	<i>Priority weight</i>
MO1	1	8	7	0.71
MO2	1/8	1	7	0.22
MO3	1/7	1/7	1	0.06

Note: CR = 0.02 < 0.10 (acceptable)

For the manpower/organisation (MO), quality and experience of manpower (MO1) were evaluated as the most important sub-criterion at 71% (Table 7). This is because of positive connection between labour and demand. The next important consideration was found to be the recent activity of the suppliers as measured by the organisation structure (MO2) with a rating of 22%. With consideration the public organisation is tall organisation which required a very well organisation structure to perform the services. Reputation (MO3) was ranked the least important at 6%. However, the trust and confidence through good reputation will affect selection process.

Table 8 Geometric means of pair-wise comparison for financial performance

	<i>FP1</i>	<i>FP2</i>	<i>Priority weight</i>
FP1	1	8	0.88
FP2	1/8	1	0.12

Note: CR = 0.00 < 0.10 (acceptable)

Within the financial performance (FP) criterion (Table 8), the evaluators rated the last year turnover (FP1) as the most desired sub-criterion at 88% followed by the financial stability (FP2) at 12%. This is understandable, as last year turnover is considered to be the main financial performance measures of utility suppliers as the last ranked least due consideration of market inflation for stability purposes.

Table 9 Geometric means of pair-wise comparison for facilities office/equipment

	<i>FO1</i>	<i>FO2</i>	<i>FO2</i>	<i>Priority weight</i>
FO1	1	6	5	0.67
FO2	1/6	1	5	0.24
FO2	1/5	1/5	1	0.09

Note: CR = 0.04 < 0.10 (acceptable)

Table 9 explain the facilities office/equipment (FO) main criterion was sub-divided into adequacy of office space (FO1), the production capacity (FO2) and continuous improvement (FC3). The evaluators rated FO1 at 67%, which is understandable because the supplier with proper spaces and facilities can be access to proper management operation. Subsequently, the production capacity measures the capacity of the supplier in producing the product with the current resources and on time. The least is the need for the continuous improvement, warrants the use of art technology which can only be possible for improving products, services and delivery. This is can be explained as not all plants and supplier can have such facilities due to the expenses and they may dependent on outsourcing.

Table 10 Geometric means of pair-wise comparison for cost

	<i>CO1</i>	<i>CO2</i>	<i>Priority weight</i>
CO1	1	5	0.83
CO1	1/5	1	0.17

Note: CR = 0.00 < 0.10 (acceptable)

Table 10 explain the cost (CO) main criterion was sub-divided into total cost (CO1) and the payment terms (CO2). The evaluators rated CO1 at 83% which is higher than total payment terms which is reasonable because the most important for any organisation is the total cost as the terms can be negotiable special the one without the liability.

Table 11 Geometric means of pair-wise comparison for stakeholder's interest

	<i>TS1</i>	<i>ST2</i>	<i>Priority weight</i>
ST1	1	5	0.89
ST2	1/5	1	0.11

Note: CR = 0.00 < 0.10 (acceptable)

Table11 explain the stakeholder's interest (SI) main criterion was sub-divided into stakeholder's magnitude (SI1) and stakeholders power (SI2). The evaluators rated SI1 at 89% which is higher than stakeholder's power. This can be articulate their perception of what value the product and suppliers represent to them and to the organisation toward their interest and touch their issues. Considering that the stakeholder's power is important even if it is ranked least as it is influence the purchasing situation. As a result, evaluators highlight the proper stakeholders thinking in reaching organisation objectives, rather than using their power to influence the purchasing situation.

6 Discussion and conclusions

The fact that supplier selection is very important, especially in public organisations, made it important for developing a comprehensive selection model. To this end, a distinction must be made from within the model to two main opposing purchasing situations; critical and non-critical. AHP model is one of the most popular and widely adopted models for supplier selection today. This is because of its ability to possess unique advantages over other techniques (Ho et al., 2011). In this study, various areas will be assessed concerning quality, delivery, performance, manpower, financial performance, equipment, cost, and Stakeholders interests. The AHP model will be constructed using these factors. The study also encompasses the selection process in the public sector. Public organisations face unique challenges, such as stringent regulations and intensive audits/controls. Therefore, proposed model will account for most of such unique characteristics of organisations in public sector to give procurement practitioners a working model helping them to enhance supplier selection processes in their organisations.

The results conclude that most important factors for supplier evaluation in the UAE public sector are quality and safety policy followed by the suppliers' performance. This indicates that procurement specialists in the public organisations of UAE see the reliable quality and performance of its suppliers as the most important factor in delivering their own services/products. Suppliers own facilities, cost and stakeholders interests are

considered as the least important criteria by the consensus feedback of the three teams of the evaluators. The validated AHP framework now can easily be applied to the procurement decisions of the public organisation performing similar activities for better supply outcomes of critical product. However, there are several limitations to this research that could be addressed as future research directions. Firstly, a comparison of supplier pre-qualification criteria in public and private organisations may yield a more robust framework. Secondly, priorities reflected in the AHP evaluations in this study pertain to the UAE only and extending this study to the other Middle Eastern and North African (MENA) countries may highlight the similarities or differences in the purchasing practices of a region with a similar cultural heritage. This research has focused on utility organisations only; however, in the future and for a wider coverage of the proposed AHP framework, other public organisations may also be included.

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