An AHP Approach for Consultant Selection in Real Estate Mega Projects in the Middle East

Mohamed M. G. Elbarkouky[1], M. A. El Deeb[2], M. M. Marzouk[2].
[1] School of Science and Eng. and School of Business, the American University in Cairo.
[2] Structural Engineering Department, Faculty of Engineering, Cairo University, Egypt.

Abstract: Selection of a competent consultant is vital to the success of any Real Estate construction project, as it is based on a set of criteria, which rely heavily on subjective judgment. Quite often, selection is carried out depending on lowest bidding price for consultant. However, consultant submitting lowest bid price may not necessarily be able to complete the work satisfactorily. This paper proposes an AHP-based design consultants' selection model framework, based on clients' needs that would improve Real Estate construction project time and cost effectiveness for developers in the Middle East region. First, a list of developers' (clients) generic requirements is prepared using literature review. Those requirements are then aligned with the common consultant selection criteria that are recommended by Middle Eastern experts and literature review. A questionnaire assists in reaching consensus among experts with regard to the finalized selection criteria that are detailed to the level of the selection attributes. Experts are then requested to suggest individual scales to measure the selection attributes. A verification questionnaire that uses a 5-point Likert scale helps experts to allocate the appropriate measuring scale for each attribute. The relative importance of the selection criteria is then determined using the Analytical Hierarchy Process (AHP) and Expert Choice[TM] software through a structured survey. Finally, a validation strategy is proposed that incorporates a case study in Egypt to implement and evaluate the proposed model. The research recommends incorporation of selection criteria of consultants in evaluating their competence, as the success of any Real Estate construction project depends upon obtaining the most capable, experienced, and dependable expertise at an appropriate cost. The results exhibit the development of a multi-criteria decision framework for evaluation and selection of Real Estate consultants using AHP.

Keywords: Real Estate, AHP, Multi Criteria Decision Analysis, Consultant Selection Criteria.

1   Introduction and Problem Statement

One of the most prominent challenges facing the Real Estate industry in the Middle East Region is that of selecting consultants who have the ability to execute the required task in a cost-effective, quality-conscious and timely manner. Identifying the client's needs is the first step in developing a model which would assist in the selection of consultants. Clients should become more aware of the importance of consultant selection, and of the impact of the choice of the consultants on the overall quality of the completed project. In building construction, Ng et al. (2001) asserted that selecting consultants through a combined technical and fee assessment approach can be classified into two categories: cost-oriented and quality-oriented. The cost-oriented method focuses on the competitiveness of consultancy based on their requested fees rather than other non-fee related criteria, whereas the quality-oriented method places an emphasis on the quality standard, suitability, and capabilities of consultants. The World Bank (2004) recommended that the selection criteria should have financial focus for construction consultants, whereas FIDIC (2011) recommended that the selection criteria should be more skewed towards their technical capabilities. According to FIDIC (2003), consultant selection based on quality attributes or technical capabilities is highly critical to the success of the entire project because saving a small percentage, perhaps 1% or less of project cost, is not worthwhile, considering other project risks, such as scope, time and quality related risks.
The capabilities of consultants for Real Estate Mega projects, however, may differ from that of building construction projects. This is attributed to the distinction between the Real Estate

construction and building construction Projects in several aspects. For example, as opposed to common building construction consultants, the consultants of Real Estate Mega Projects (Multi Use Projects) must possess all the internal capabilities to conduct market analysis, and evaluate findings and land use to assess issues of viability and compatibility. They should have the competencies of planning, organizing, and coordinating a variety of projects. For example, they should be able to design master plans, conduct land use studies, prepare evaluation reports for water production, treatment, wastewater collection, and recycled water projects. They should be also capable of applying innovative master planning procedures and monitoring the budget and schedules of the projects to achieve the client's targets. Furthermore, they should be familiar with meeting the requests of the regulators that would provide oversight of utilities, in addition to coordinating environmental health services, evaluating fire hazards, and complying with other local agency regulations departments. Additionally, they should be able to make effective and professional presentations to a wide variety of audiences, such as community groups and government representatives. Although the literature discussed most of the selection criteria of consultant in building construction projects, it was very scarce in identifying the essential criteria relevant to consultants' selection in Real Estate Mega projects, especially in the Middle East Region. In order to tailor a selection model to the needs of the Real Estate industry in the Middle East, the criteria of selecting consultants must align the client's needs with the commonly applied selection methods worldwide (Bennett et al. 1990), while the model should provide a simple but effective approach to enable the selection of capable consultants in Real Estate projects.

2   Research Objectives

The objectives of this research can be summarized as follows:

- To develop a consultant selection model tailored to the needs of Real Estate industry that combines clients' needs with consultant selection criteria to improve Real Estate construction project time and cost effectiveness for developers in the Middle East region.
- To make use of the available intuitive information of Real Estate experts in the Middle East to deliver qualitative and quantitative results regarding the modeling and validation of the consultant selection process, using both structured and unstructured interviews.
- To breakdown the consultant selection criteria into its smaller parts (main criteria, sub criteria, and attributes), using literature review, expert judgment, and the Analytical Hierarchy Process (AHP) in Multi Criteria Decision Analysis (MCDA).
- To determine the respective weights of the consultant selection criteria using the pairwise comparison method of the AHP.
- To construct and verify a measuring scale for each attribute of consultant selection to enable ranking consultants' proposals, numerically, and selecting the suitable consultant based on its numerical ranking.
- To propose a validation strategy for the model using a case study approach.

3   Literature Review

In recent years the notion of constructing Real Estate Projects in the Middle East region has become an impacting factor on its global economy. However, one of the most prominent challenges facing the Real Estate industry is the selection of consultants who are capable of handling the required task in a cost effective, quality conscious and timely manner. Identifying the clients' needs is the first step in developing a model which would assist in the selection of the most capable consultant. Bennett et al. (1983) defined eleven fundamental clients' needs for building construction projects, which can be summarized as follows: maintaining a functional building, ensuring quality, attaining speedy construction, maintaining balance between capital expenditure and long term ownership costs, identifying risks and uncertainties, acquiring innovative design and providing high technology building, maintaining accountability, maximizing benefits, keeping flexibility in design, reflecting client's activities and image, and keeping clients informed about the project throughout its life. Similarly, Hewitt (1985) identified six clients' needs: certainty of cost and time, reduction in unanticipated extra costs and time over-runs, flexibility to change the design, desire to be actively involved in the project, be kept informed throughout the design and construction processes, and be approached with positive and constructive advice. A comprehensive study was further carried out by Chinyio (1998) that identified 50 clients' needs specific to building construction projects. Unfortunately, the literature was scarce when it came to determining specific clients' needs for Real Estate projects. As such, in order to establish a model that can help in the selection of consultants for Real Estate Projects, the generic needs of the clients in building construction should be modified to match the process of modeling the

consultant selection criteria in Real Estate Projects, as building construction projects may overlap in many aspects with Real Estate Projects.

In a recent research study by Lewis (2004), he proposed a structured and consistent method of consultants' evaluation for building construction projects, based on a predefined set of selection criteria, sub criteria, and attributes. He concluded, however, that value for money is the prime consideration influencing the selection of consultants. Value for money, however, is not necessarily synonymous with the lowest price concept. It rather reflects a balance between price, performance, and quality. In the viewpoint of Lewis (2004), *"a low price can be seductive but it can also tempt into false economies,"* as it is best practice not to award a contract, based on price only. The fee paid to consultants is just a fraction of the total costs of achieving the goal of the client, yet the cost-effectiveness and sustainability of plans may depend critically on the quality of the advice obtained from the consultant (Lewis 2004). Lewis (2004) also listed 6 main criteria along with 36 attributes to judge the proposals of consultants as follows: compliance, price, work plan, competence, performance and management, and Quality of proposal. In a more comprehensive research study, Chow and Ng (2005) proposed a consultant performance evaluation framework, identified quantitative indicators of consultants' selection, highlighted the problem of using expert judgement in evaluating consultants, and proposed methods to overcome this problem, using fuzzy logic. Subsequently, Chow and Ng (2006) proposed a fuzzy gap analysis to facilitate assessors to compare the client's expectation and the actual service quality of an Engineering Consultant. Nguyen (1985), however, addressed the difficulties associated with formulation of the membership functions due to their complexity in addition that the user should acquire extensive mathematical background to understand and run the fuzzy model, which may not be available for Real Estate Project Teams.

Manohran (2005) identified the criteria used for selection process and proposed a simpler knowledge acquisition approach to capture experts' knowledge using interviews and literature review. He, however, highlighted the problem of the selection of sub-contractors, based on multi criteria decision making, which could be applied to consultants' selection. His study recommended using a more user friendly decision support system (DSS) than fuzzy-based models, such as the Analytical Hierarchy Process (AHP) (Saaty 1980), which can replace the approach of collecting experts' opinions using a traditional questionnaire-based survey. According to Manohran (2005), the reason behind using AHP is its ability to incorporate tangible and intangible factors in a systematic way, its capability of breaking the problem down in a logical fashion from large elements to smaller ones, and its excellence in examining the consistency of experts' decisions. El-Shawalhi et al. (2006) attempted to find the state-of-the art model that meets most characteristics of the pre-qualification process, yet he used the model for contractors' selection, and emphasized the advantages and disadvantages of the AHP-based selection models (Munai 1995, Al-Harbi 2001, Mahdi 2002, and Topcu 2004). Some of the advantages listed by El-Shawalhi et al. (2006) were that the AHP allows group decision-making by transforming subjective judgments into meaningful weights upon which the decisions could be based, and it synthesizes judgement into representative outcomes and pinpoints its inconsistencies. As such, AHP is adopted in this paper to develop Real Estate consultants' selection model.

4   General Methodology and Detailed Steps of the Framework

The methodology of this research is comprised of 5 main steps as illustrated in Figure 1. The first step is to conduct literature review to determine the client's needs, sub goals, and main criteria of consultant selection. The second step is to hold interviews with experts and unstructured interviews to update the main criteria of consultant selection and develop sub criteria and determine the selection attributes of each criterion that can be applied to Real Estate Mega projects. Also, in this step, the scale of each attribute is designed. The third step is to verify the scale of each attribute using expert judgment and a questionnaire that utilizes a 5 point Likert scale to determine the applicability and consistency of the elements of each scale with respect to its relevant attribute. The scale of each attribute is updated accordingly. After adjusting the description of the selection criteria and verifying the attributes scales, the information is entered into Expert Choice ^{TM} (AHP-based evaluation software) that enables experts to provide consistent weighing scheme to each criteria, sub-criteria, and attributes. In this step, interviews were conducted with experts, based on the developed hierarchy to provide relative weights to each of the selection criteria, sub-criteria and attributes in the hierarchy. Finally, a strategy to validate this model is proposed in this paper, which proposes utilizing a case study approach. The next subsection includes the detailed explanation of each of the previous steps.
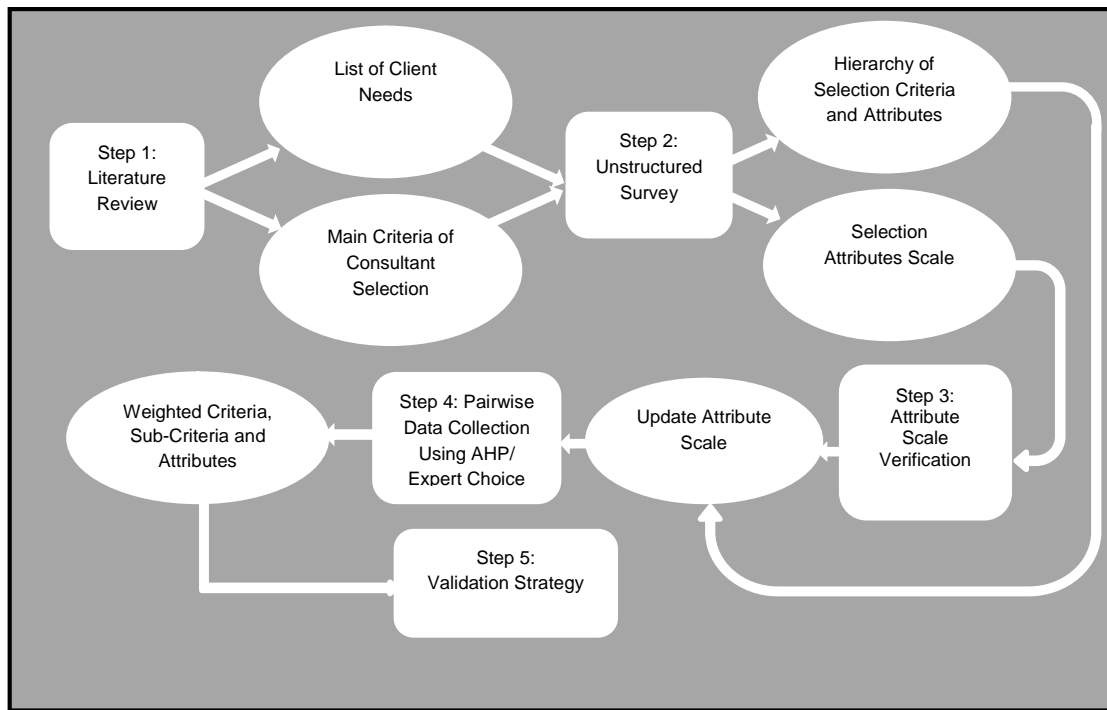
.

Figure 1: General Methodology and Detailed Steps of the Framework

4.1 Step 1: Literature Review to Identify Real Estate Consultant Selection Criteria

Based on the conducted literature review, clients' general needs and main criteria of consultants' selection are defined. This resulted in a list of 52 client's needs (Table 1) that are proposed to be categorized in groups of main criteria for consultant selection as recommended by Lewis (2004), such as compliance, price, work plan, competence and experience, and performance and management. The next step is to adapt the clients' needs and consultant selection criteria to Real Estate projects, as the selection process of qualified consultants for those types of projects is much more difficult than that of ordinary consultants who are only capable of handling ordinary buildings.

Table 1: Real Estate clients' needs

Maintain efficiency with intended purpose	Design building to reflect clients' image	Be flexible to change designs	Keep variations to the minimum	Maximize taxation benefits.
Ensure timely construction	Design beautiful exteriors	Keep the Value for money	Safeguard timely planning approvals	Adopt a team work approach
Identify Risks and uncertainties	Ensure early start of construction	Avoid bureaucracy in securing permits	Track capital and life cycle costs	Ensure quality and matching standards.
Minimize Risks	Ensure durability	Avoid claims	Avoid disputes	Meet budget
Submit acceptable planning of briefs, in terms of scheduling.	Provide environmental and health service	Probity (internal and public accountability)	Handle phased design and construction	Consider energy efficiency in design options
Involve Client in project schemes	Be familiar with contractors	Conduct Traffic studies	Design beautiful interiors	Reduce tendering costs
Keep legal aspects up to standards	Avoid confrontations with contractors	Design attractive finishes and decorations	Maintain clear procedures to conform to regulations	Design buildings to satisfy occupiers' use
Keep the client informed of project developments	Help contractor to better control subcontractors	Comply with the governmental regulations	Ensure adequate reaction by contractors to identified risks	Prepare detailed design prior to construction
Ensure that contractors provide reference from previous clients.	Ensure good housekeeping and safety records in the prequalification docs.	Partially keep the project operational (where necessary) during construction	Ensure high quality of workmanship to be provided by contractors	Carry out the environmental studies during the design stage
Assess the effect of the project on surroundings during construction.	Communicate at all levels with all concerned parties.	Provide innovative designs (Incorporating high/latest technologies)	Allocate responsibilities efficiently	Minimal interference with the work
Maintain lowest price of product	Provide oversight of utilities			

4.2   Step 2: Unstructured Survey to define Real Estate Consultant Selection Hierarchy

In this step, unstructured interviews with experts were conducted. A group of Real Estate industry experts who have extensive experience with clients have been carefully selected. Some of them worked as consultants and project managers of Real Estate mega development projects in the Middle East. Table 2 illustrates the demographics and background information of these experts who had a minimum of 15 year experience in the field of Real Estate Development, with at least 5 years of experience in the consultant selection process.

Table 2: Demographic data of experts

Experts' Information							
Expert #	Title	Years of Experience	Organization Type	Academic Degree	Experience in Consultant Evaluation	Steps 2 and 3 Survey	Step 4 Pairwise / AHP
1	Director Design	25	Client	B.Sc.	9	×	
2	Senior Project , Projects	25	Client	B.Sc.	6		
3	Senior Projects Control	25	Client	MSc	15		
4	QA/QC Senior Manager	25	Client	MBA	3		
5	Planning Manager	15	Client	MSc.	3		
6	Projects Control Manager	15	Client	BMBA	5		
7	Sr. Facility Manager	23	Client	B.Sc.	10		
8	Sr. Project Manager	21	PM	B.Sc.	12	×	
9	Sr. Design Manager	25	PM	B.Sc.	5		
10	Sr. Construction Manager	26	PM	B.Sc.	10		×
11	Sr. Projects Control	25	PM	B.Sc.	8		
12	Director Commercial	25	Client	B.Sc.	8	×	
13	Sr. Manager- Contracts	20	Client	MSc	19		
14	Sr. QS Manager-	18	Client	B.Sc.	5		
15	Construction Coordinator	15	Client	B.Sc.	7		×
16	Sr. Design Manager	20	Client	B.Sc.	5	×	
17	Sr. Manager- Contracts	29	PM	B.Sc.	15		
18	Project Manager	25	Consultant	B.Sc.	7	×	
19	Commercial Manager	10	Client	MSc. CBIFM	3	×	
20	Sr. MEP Manager	35	Client	B.Sc.	15	×	

Using the list of client's needs and main criteria of consultant selection, the objective of the interviews was to develop a hierarchy of selection criteria and attributes that can be applied to the Real Estate Development Projects in the Middle East. The sessions comprised four main objectives:

1.   Determining the main criteria, sub criteria, and attributes that are most applicable to Real Estate projects.
2.   Categorizing the qualified main criteria in two sub goals (Technical and Financial) and detailing them to the level of selection attributes.
3.   Sorting out the criteria that are applicable to the Real Estate Projects in the Middle East from the generic ones (output of step 1) as well as removing or combining redundant or conflicting ones to reach no more than 30 measurable attributes.
4.   Creating the attributes' scales that incorporate measuring elements to rank the consultant based on the values of their selection attributes.

First, experts were asked to categorize the selection criteria/attributes and match them with the relevant clients' needs which are most applicable to Real Estate. It took around 10 individual and group sessions with the experts to achieve this objective, which resulted in a list of 82 sub criteria and measurable attributes, in which all relevant selection aspects were covered. Second, another 12 sessions were conducted with the experts in order to reduce/combine the sub-criteria / attributes to be able to employ them in the pairwise comparison of the AHP method. The selection sub criteria and attributes were distilled, refined, and then classified in the 5 main criteria of Real Estate Consultants' selection: compliance, work plan, experience, contractual, and fees, based on their individual relevance to each main category and the recommendations of experts. Then, the 5 main criteria were categorized in two sub goals: technical and financial. Several sessions were held with the experts to eliminate the redundancy between the levels of the hierarchy to provide a consistent input for the selection model. The final result of this extensive exercise is shown in Figure 2 and Table 3, which illustrate the final hierarchy that includes 2 sub goals, 5 main selection criteria, 6 sub criteria, and 26 attributes. Finally, the experts proposed a preliminary scale to measure each attribute as illustrated in Table 4d.

4.3 Step 3: Verification of the Attribute Scale

In this step, the preliminary attributes' scales created in step 2 were rechecked and further verified by experts in terms of their applicability to measure each attribute, using a survey questionnaire. The questionnaire helped in ranking the final attributes' scales, using a 5-point Likert scale: [(5) fully agree, (4) strongly agree, (3) moderate, (2) disagree and (1) fully disagree]. The survey was followed by in-depth interviews with the experts who showed disagreements on some of the preliminary scales, those experts also provided alternative attributes' scales. The intent of this step was to redefine the preliminary scales based on their applicability and enhance the quality of the scales to be more effectively used in ranking the consultants. For example, for the attribute "International Experience" Hierarchy ID: 1.3.1.1, a consultant would receive a score of 100 on the relevant scale if its experience equals or exceeds 5 Years, a score of 50 if its experience falls between 2 and 4 years, and a score of 0 if its experience is 2 years or less. Columns d and e of Table 4 illustrate the attributes' scales before and after this step, respectively. Figure 3 Illustrates the average results of the experts' ratings in a descending order that shows that 80% of the attributes' scales exceeded [(4) strongly agree], which signifies that an adequate general consensus has been reached on 80% of the proposed scales.

4.4 Step 4: Applying AHP and Expert Choice ^{TM}

In this step, the hierarchy was entered in Expert Choice ^{TM} within which a questionnaire was created to compare criteria, sub criteria and attributes, pair-wise. The pair-wise data were collected through interviews conducted with 18 experts (Table 2), where 38 pairwise comparisons were collected from each expert with a total number of (18*38) 684 pairwise comparisons. The finalized weights of the factors have been computed by Expert Choice ^{TM} that are illustrated in Figure 2, based on the input of the 18 experts' judgment matrices, an example of which is illustrated in Figure 4. The local priority weights of all main criteria and sub criteria were calculated, and then combined with all successive hierarchical levels in each matrix. The steps used to compute the weights were conducted as follows:
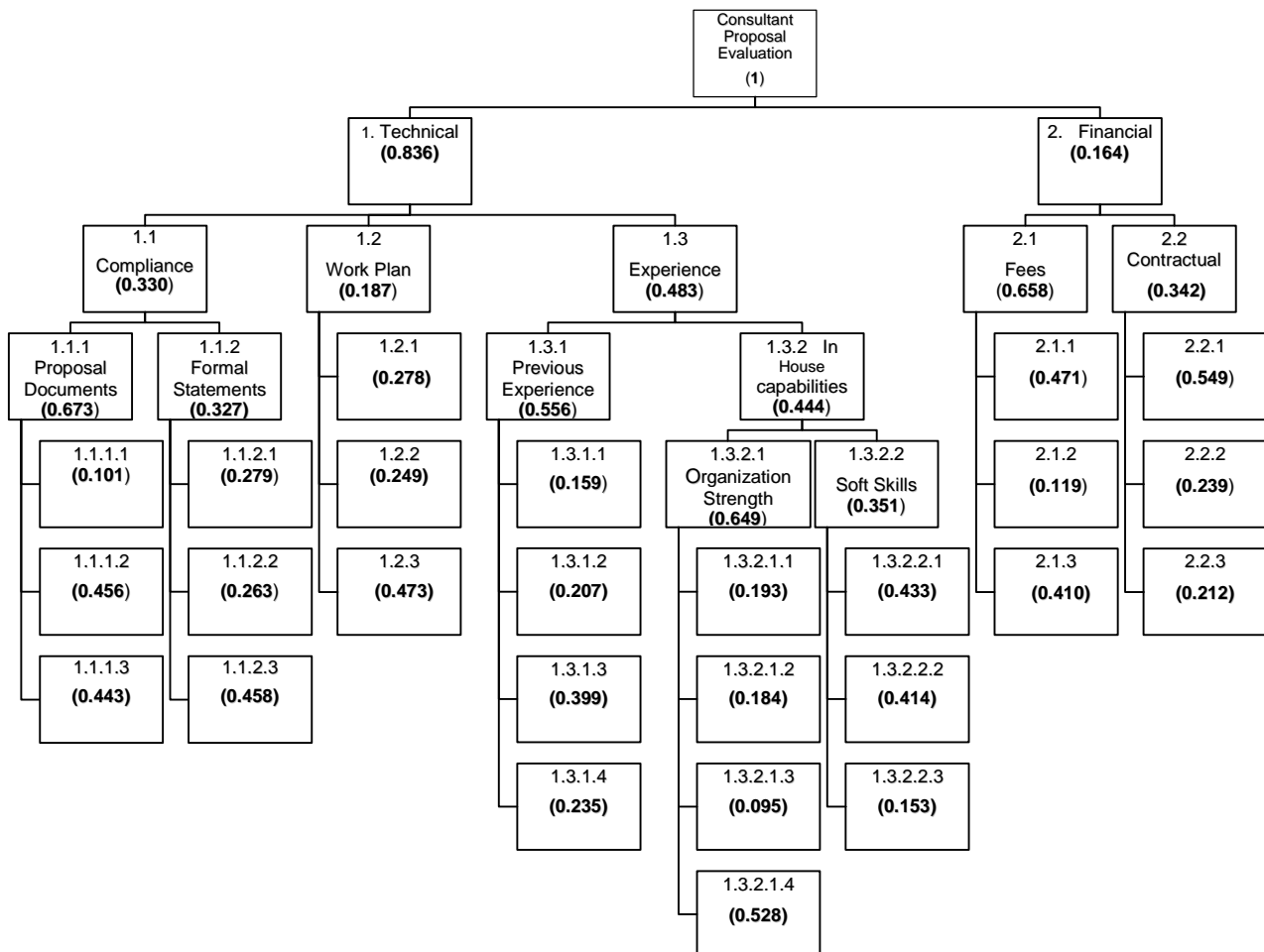
Figure 2: An illustrative decision hierarchy for consultants' selection with weights

Table 3: An illustrative decision hierarchy for consultants' selection with attribute name

| Goal		Consultant Proposal Evaluation							
Sub Goal		1. Technical						2. Financial	
Main Criteria		**1.1Compliance**		1.2 Work Plan	**1.3-Experience**			2.1 Fees	2.2 Contractual / Legal
Sub Criteria		*1.1.1 Proposal Documents*	*1.1.2 Formal Statements*	**1.2 Work Plan**	*1.3.1 Previous experience*	*1.3.2 In House capabilities*		**2.1 Fees**	**2.2 Contractual / Legal**
Attributes		1.1.1.1 Document organization	1.1.2.1 Environmental, industrial requirements	1.2.1 Resources	1.3.1.1 International Experience	*1.3.2.1 Organization Strength*	*1.3.2.2 Soft Skills*	2.1.1 Budget	2.2.1 PII Professional Indemnity Insurance
		1.1.1 2 Information	1.1.2.2 Health and safety policies	1.2.2 Time	1.3.1.2 Local Experience	1.3.2.1.1 Disciplines	1.3.2.2.1 Value Engineering	2.1.2 Breakdown	2.2.2 Statement of No conflict of Interest
		1.1.1 3 Adding value.	1.1.2.3 Statement of project Understanding	1.2.3 Outcomes / Deliverables	1.3.1.3 Previous Experience with the client	1.3.2.1.2 Quality Procedures	1.3.2.2. 2 Time management	2.1.3 Offer Price	2.2.3 Additional submitted qualifications
					1.3.1.4 Experience with International PM	1.3.2.1.3 Relevant Software	1.3.2.2.3 Awards		
						1.3.2.1.4 Key Personnel Experience			
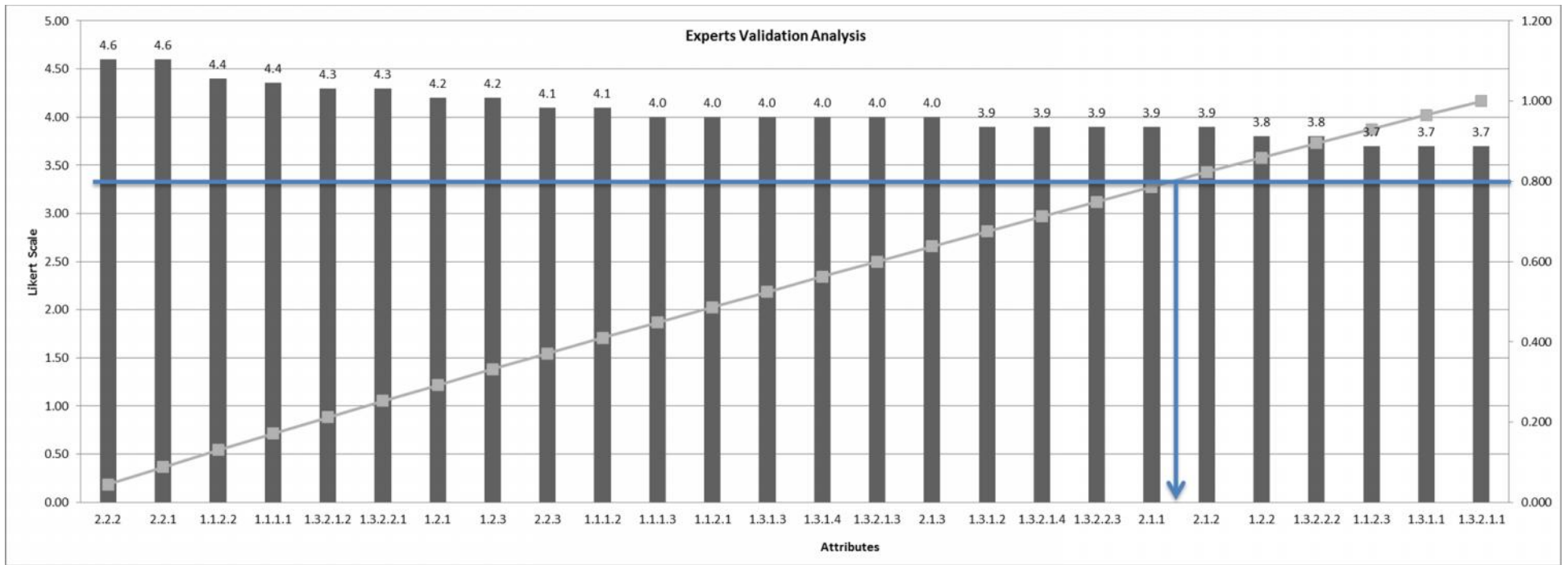
Figure 3: Experts' Feedback on Attributes' Scales

Table 4: Attribute scale verification results

(a) Hierarchy	(b) Attribute	(c) Definition	(d) Attribute Scale before	(e) Attribute Scale after	(f) Reasoning
1.1.1.1	Document organization	Is it a well-organized and competently produced document?	High = 100, Medium = 50 , No= 0	High = 100, Medium = 50, No= 0	No Change
1.1.1.2	Information	Does the proposal contain all the information requested?	Completed=100 No =0	Completed=100 Partially =50 Not=0	Add partially=50 for flexibility
1.1.1.3	Adding value.	Does it offer added value in a way that sets it apart from other proposals?	Good = 100 Fair = 50, Poor = 0	Good = 100 Fair = 50 Poor = 0	No Change
1.1.2.1	Environmental, industrial requirements	Does the consultant submit Environmental, industrial relations?	Yes=100, No=0	Yes=100 No=0	No Change
1.1.2.2	Health and safety policies	Does the consultant submit Health and safety policies?	Yes=100, No=0	Yes=100 No=0	No Change
1.1.2.3	Statement of project comprehension	What is the level of the consultant's understanding to his scope of work?	V good=100, Good =50, Poor=25	V good=100 Good =75 Poor=50	Understanding instead of comprehension
1.2.1	Resources	Does it show a realistic and sufficient input of resources?	High = 100, Med = 50, Low = 0	High = 100, Med = 50, Low = 0	No Change
1.2.2	Time	Will it achieve your deadlines?	Yes=100 Acceptable=50, Unacceptable=0	Yes=100 Acceptable=50 Unacceptable=0	No Change
1.2.3	Outcomes/Deliverables	Are the deliverables clearly stated and as required?	Clear= 100 Medium= 50 Poor = 0	Clear= 100 Medium= 50 Poor = 0	No Change
1.3.1.1	International Experience	State the extent of International Experience in the last 5 years for similar projects	(5 or more Years)=100, (2-4 Years)=50, (Less than 2 years)=0	5 or more Y=100 (2-4) Years=50 Less than 2 y=0	No Change
1.3.1.2	Local Experience	State the extent of Local Experience in the last 5 years for similar projects	>=5 Years =100 (2-4) Years=50 Less than 2 y=0	>=5 Years =100 ,(2-4) Years=50 Less than 2 y=0	No Change
1.3.1.3	Previous Experience with the project's client	Does the consultant have previous experience with your Client?	2 or more Y=100 one project =50 No projects =0	>2 projects=100 one project =50 No projects =0	No Change
1.3.1.4	Experience with International PM	Does the consultant have previous experience working with international PM?	> 3 projects=100 (1-3)projects=50 No projects =0	> 3 projects=100% , (1-3)projects=50 No projects =0	No Change
1.3.2.1.1	Disciplines	Does the firm have all required disciplines?	cover all =100 Covers 50% =50 <50%=25	> 75-100 =100%, 50-75=50% <50=25%	More realistic scale
1.3.2.1.2	Quality Procedures	Does the firm have QA/QC procedures/Quality system Department	Yes=100, No=0	Yes=100, No=0	No Change
1.3.2.1.3	Relevant Software	Availability of relevant computer systems Net meeting and conference calls...etc...	Good = 100, Fair = 50 ,Poor = 0	Good = 100, Fair = 50 , Poor = 0	No Change
1.3.2.2.1	Value Engineering	Does it meet the experience requested in the RFP?	Yes=100, No=0	Yes=100 ,No=0	No Change
1.3.2.2.2	Time management	Does the consultant have VE procedures mentioned in the proposal?	Yes=100 , No=0	Yes=100 ,partially=50 , Not=0	Add partially=50 for flexibility
1.3.2.2.3	Awards	Does the consultant have time management system?	Yes=100 , No=0	Yes=100 ,No=0	No Change
1.3.2.2.4	Key Personnel Experience	Have the consultant been awarded for pervious projects?	Yes=100 , No=0	Yes=100 ,No=0	No Change
2.1.1	Budget	Are the fees within your allocated budget?	Yes=100 , No=0	Budget =100% , >(10-15)%=75% >(15-20)% =50% >25 % =0	More realistic & flexible
2.1.2	Breakdown	Does it follow the breakdown stated in the remuneration?	Yes=100 , No=0	Yes=100 partially=50 Not=0	Add partially=50 for flexibility
2.1.3	Values	Financial fees in relation with other submitted fees	Minimum=100 Relative =%	Minimum=100 Relative =%	Offer Price instead of Value
2.2.1	PII Professional Indemnity Insurance	Is it submitted as per the required limits?	Yes=100 , No=0	Yes=100 ,No=0	No Change
2.2.2	Statement of no conflict of Interest	Did the consultant submit that no conflict of interest?	Yes=100 , No=0	Yes=100 ,No=0	No Change
2.2.3	Additional submitted qualifications	Are there any conditions submitted?	Non=100 Acceptable=50 Unacceptable=0	Non=100 Acceptable=50 Unacceptable=0	No Change

- Enter the hierarchy from the top level (the Goal) through the intermediate levels (main and sub-criteria) to the lowest level (attributes) in Expert Choice [TM].
- Employ a simple pair-wise comparison matrix for the factors in each level.
- Compute a consistency ratio (CR), using Expert Choice [TM].
- Estimate relative weights of the components of each level.

Note that the relative importance of the criteria and sub-criteria was rated using the five-point scale proposed by Saaty 1980, which indicated that the level of relative importance ranges between equal, moderate, strong, very strong, to extreme level using the scores 1, 2, 3, 4, and 5, respectively. The consistency ratio (CR) is one of the essential features of the AHP method which aims at eliminating the possible inconsistency revealed in the criteria weights through the computation of consistency level of each matrix this is calculated by the Expert Choice [TM] software. As illustrated in Figure 2. The AHP method resulted in computing numerical weights representing the relative importance of each criterion with respect to the goal (to select the most competitive consultant). This step resulted in building the AHP hierarchy model as well as the calculation of the weights of each level of the consultant selection model. The Consultant Selection problem is illustrated in the AHP model as shown in Figure 2 within which the first level identifies the goal of the model: Consultant Proposal Evaluation. This is followed by the second level which details the sub goals consisting of: Technical and Financial, which are further broken down into Main Criteria (third level). The Technical Main Criteria included: Compliance, Work Plan and Experience; while the Financial Main Criteria includes: Fees and Contractual/Legal. The fourth level then determines the Sub-Criteria within which each Main Criteria is broken down into: Compliance (includes Proposal Documents and Formal Statements); and Experience (includes Previous Experience and In-house Capabilities that branches out into Organizational Strength and Soft Skills). The fifth and final level of the model deals with the selection attributes that include 26 attributes. Finally, it has to be mentioned that AHP was used in this step because it incorporates both qualitative and quantitative approaches to solve complex decision problems. On the qualitative level, AHP structured the problem through decomposing the criteria into a hierarchy of elements in levels: goal, sub goal, main criteria, sub-criteria, and attributes. On the quantitative level, AHP prioritize ('pair-wise' compare) a set of the attributes and distinguish in general the more important criteria from the less important criteria. AHP is also able to solicit consistent subjective expert judgment via the consistency test (CR).

4.5   Step 5: Proposed Strategy for Model Validation

A case study approach is proposed to validate the output of this research. It has been found that performing the validation process for older Real Estate construction projects is difficult due to the challenges in retrieving comprehensive information about them. Thus, more recent projects with easily accessible information will be sought out. Since the consultants' selection process is typically carried out through traditional methods that often rely on qualitative rather than quantitative criteria, it was necessary to find a validation strategy to more practically interpret the criteria, scale and weighing system to ones that will fit the model's attributes. The following are the steps proposed to conduct the validation process, using recent cases from the Egyptian Real Estate Projects:

- Select three actual projects recently tendered among design consultants in Egypt.
- Collect data about each consultant's proposal, based on the methods used for evaluation in the project.
- Analyze the actual consultants' proposals information and adapt them to fit the criteria, attributes, and scales of the model.
- Run the model with the adapted information from step 3, which will generate a score for each individual consultant in each project.
- Compare the outcomes of the model (consultant scores) in each project with the actual selection results previously performed using the selection methods of those projects. This will produce two potential scenarios: actual selection results either agree or disagree with the model's results.
- Perform gap analysis for each of these scenarios in order to seek the root causes of the agreement or difference between the results of the model and actual selection.
- Conduct further investigations of the selection results using traditional methods from a cost and time impact viewpoint on the project in order to measure the success rate and deficiencies of the model.
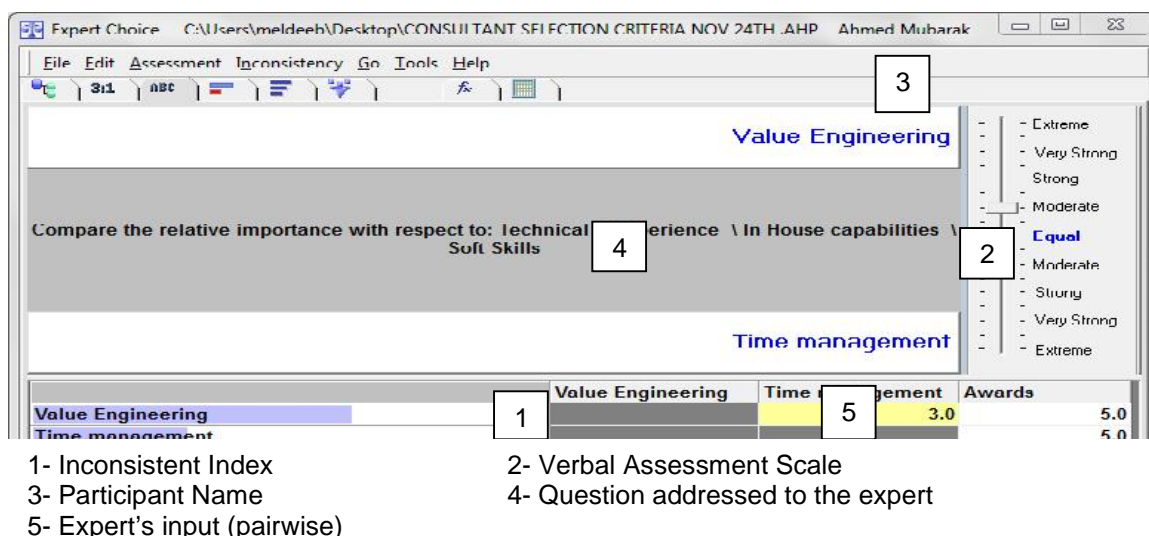
1- Inconsistent Index   2- Verbal Assessment Scale
3- Participant Name   4- Question addressed to the expert
5- Expert's input (pairwise)

Figure 4: Illustrative Expert Choice [TM] screen shot example

5   Conclusion and Future Research

This paper proposed a consultant selection model tailored to the Real Estate industry that combined clients' needs with consultant selection criteria to improve Real Estate construction projects .This model was established using the available intuitive information of selected Real Estate experts in the Middle East by applying structured and unstructured interviews, which resulted in: (1) Identifying Real Estate Consultants' selection Criteria, Sub-criteria and Attributes, (2) Creating and Verifying the required Attributes' scales, (3) Determining the weights of the consultant's selection criteria, sub criteria and attributes, using the pairwise comparison (AHP) Method and Expert Choice [TM], and (4) proposing a validation strategy for the model. The steps of the framework can be also utilized as bases to evaluate Real Estate Supervision Consultants. The data, methods, criteria and attributes from this paper can be modified to fit the nature of site supervision field and can serve as a data base to be revisited for future use.

6   Acknowledgments

7   References

Al-Harbi, K. 2001. Application of the AHP in Project Management. *Int. J. Project Management*, Elsevier, 19: 19-27.

Bennett, J. and Flanagan, R. 1983. For the Good of the Client. *Building*, 27: 26–27.

Bennett, J., Grice, A. 1990, *Procurement Systems for Building*. In Brandon, P.S. (Ed.), *Quantity Surveying Techniques: New Directions*, BSP Professional Books, Oxford, 243-262.

Chow, L-K, Ng, S T 2005. Establishing a Quantitative Performance Evaluation Framework through Fuzzy Membership Functions. in: Khosrowshahi, F (Ed.), *21st Annual ARCOM Conference, SOAS, University of London.* Association of Researchers in Construction Management, 2: 1015-1024.

El-Sawalhi, N., Eaton, D., Rustom, R. 2007. Contractor Pre-qualification Model: State-of-the-art, *International Journal of Project Management*, Elsevier, 25: 465-474.

Ezekiel A Chinyio, Paul O Olomolaiye and Pauline Corbett. 1998. An Evaluation of the Project Needs of UK Building Clients. *Int. J. Project Management,* 16: 385-391.

International Federation of Consulting Engineers (FIDIC). 2003. *Guidelines for the Selection of Consultants. 1st Edition*, International Federation of Consulting Engineers (FIDIC), Geneva, Switzerland.

International Federation of Consulting Engineers (FIDIC). 2011. *Quality Based Selection (QBS) Guidelines*. International Federation of Consulting Engineers (FIDIC), Geneva, Switzerland.

Lewise, H. 2004. *Choosing and using Consultants and Advisers.* Kogan Page Limited, London, UK.

Lai Kit Chow, S. Thomas Ng. 2006. A Fuzzy Gap Analysis Models for Evaluating the Performance *Automation in Construction*, Elsevier, 16: 425–435.

Hewitt, R. A. 1985. The *Procurement of Buildings: Proposals to Improve the Performance of the Industry*. Unpublished project report to the College of Estate Management for RICS Diploma in Project Management, College of Estate Management – Reading.

Mahdi, I. M., Riley M. J., Fereig S.M., and Alex, A.P. 2002. A Multi-Criteria Approach To Contractor Selection. *Engineering Construction and Architectural Management*, 9:29–37.

Munaif, M. 1995. Multiple Criteria Decision Making in Contractor Selection and Evaluation of Construction Bid in the Saudi Arabia. *PhD thesis, Department of Engineering Management*, University of Missouri-Rolla, U.S.

Manoharan, R. 2005. Subcontractor Selection Method Using Analytical Hierarchy Process. *Dissertation, MSc.Thesis, Faculty of Civil Engineering,* Universiti Teknologi Malaysia, Malaysia.

Ng, S T, Kumaraswamy, M and Chow, L K .2001. Selecting Consultants Through Combined Technical and Fee Assessment: a Hong Kong study. *In:* Akintoye, A (Ed.), *17th Annual ARCOM Conference*, 5-7 September 2001, University of Salford. Association of Researchers in Construction Management, 1: 639-47.

Nguyen, V. U. 1985. Tender Evaluation by Fuzzy Sets. *Journal of Construction Engineering and Management,* ASCE, 3, 111.

Saaty, T.L. 1980, the Analytic Hierarchy Process, New York: McGraw Hill. International, revised editions, (1996, 2000), Pittsburgh: RWS Publications.