



Proposed Selection Criteria of Contractors in the Egyptian Construction Projects Biddings

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ملخص البحث

يتأثر فشل ونجاح أي مشروع بالعديد من القرارات التي يأخذها متخذي القرار. واحد من هذه القرارات يتعلق بتأهيل المقاولين وتقييم العطاءات المقدمة من المقاولين المؤهلين مسبقاً. ويؤدي هذا في نهاية المطاف إلى اختيار المقاولين لمشاريع التشييد. عملية تأهيل وتقييم العطاءات تتطلب تطوير المعايير اللازمة والكافية للاختيار. إن اختيار المقاولين في مشاريع التشييد المصرية تسبب مشكلة لمتخذي القرار (المالك)، وتحدث هذه المشاكل نتيجة لتغير معايير الاختيار وتغير أوزانها من مشروع لآخر، ولذلك دائماً ما نحتاج إلى تحديد وتحديث معايير اختيار المقاولين في مشاريع التشييد في مصر. كانت هذه القضية موضع اهتمام لعقود عديدة ولا تزال موضوعاً معاصراً بسبب التحديث السريع لإدارة مشروعات البناء.

يستخدم هذا البحث منهجاً لتحقيق أهداف البحث وتصميم وإجراء استبيان من أجل جمع معلومات واقعية تغطي الأطراف المعنية (الممارسين والوزارات والوكالات ذات الصلة بصناعة الإنشاءات). وأظهرت النتائج أنه تم فحص ما مجموعه (15) معياراً رئيسياً، و 67 معياراً فرعياً باعتبارها أهم المعايير. على الرغم من الدراسة التي أجريت حول مصر، إلا أنه من المفيد جداً للممارسين الذين ينوون المشاركة في مشاريع البناء في المنطقة النامية في الشرق الأوسط بسبب الاتجاهات والممارسات الحالية المماثلة. تهتم هذه الدراسة بتزويد مديري البناء والمهنيين بالتوصيات لتحقيق تقييم أفضل للمقاولين في مصر والدول النامية.

ABSTRACT

The difficulty of selection of contractors in Egypt as a result of multiple and different criteria to select contractors and the different relative weights from one project to another has always been the main factors of the problem. There is a need to determine selection criteria of contractors for construction projects, as well as determine relative weights of the selection criteria. This issue has been of interest for many decades and remains a contemporary subject because of the rapid modernization of construction project management. This research utilizes an investigation approach to achieve the research goals and design and perform a questionnaire to collect real-life information covering relevant parties. Results showed that, a total of (15) main criteria, (67) sub-criteria were investigated as the most important criteria. The most important criteria are “experience, working schedule, bid specific, general information & registration details and management & organization of the contractor”. It is very useful to practitioners intending to engage in construction projects in the Middle East due to the similar trends and current practices. The paper concerns with providing construction managers and professionals with recommendations in pursuit of better evaluation of constructors in Egypt and Middle East.

Keywords: selection criteria, Egyptian, Construction, Projects management, tenders, biddings, quotations, evaluation.

1. INTRODUCTION

The selection of contractors in Egyptian construction projects always cause problems for decision makers (owners), there are no permanent criteria of this selection. Criteria for this selection vary depending on construction projects and several conditions. Determining these criteria lead to positive results on both sides (the decision makers and

the contractors). These criteria make it easier for decision-makers in Egypt to choose between contractor's applicants for construction projects. Also, it is helpful for contractors to know the important selection criteria for construction in Egypt to comply with. The Egyptian construction industry needs a robust database system capable of providing the decision maker with the accurate information necessary for contractors' selection process. This information should reflect upon technical experience, managerial experience, past owner/contractor relationship, past performance and quality, past failures and the contractor's history of claims and arbitration. The Egyptian construction industry should have a decision support software package that helps owners and professionals in evaluating the pre-qualification and bidding data. The software should have a database for the different evaluation criteria and the recommended relative weights as function of project aforementioned variables. It should be simple, flexible, and user-friendly yet considers the different and specific characteristics of the construction industry in Egypt.

2. LITERATURE REVIEW

The literature indicates a wide range of evaluation criteria that are being used to evaluate contractors' overall suitability. A thorough review of the literature reveals the existence of various criteria, different information types, and different assessment methods. In order to conduct the research investigation, it is necessary to study the global practices for the bid-prequalification process that are frequently being used by the industry, researchers, and practitioners. There are a lot of criteria which must be determined before this selection; these depend on the clients of the project if it is public or private. This also depends on the type of the project. The followings are some of previous studies that aim at determining the most important criteria for implementing a contractor selection process.

Tarawneh (2004) used about thirty-one prequalification criteria including: work quality, executing projects, handling safety requirements, managerial capability, financial stability, previous track record, past experience, current workload and obligations, reputation ... etc.

Anagnostopoulos & Vavatsikos (2006) determined criteria and sub-criteria in their hierarchy level that include financial performance (credit ratio, current ratio, asset turnover ratio, etc.), technical performance (resources and experience), safety and health policy (compensation paid to labor accidents, safety and health investment), and public work past performance (cost overruns, schedule overruns, and claims). Waara and Brochner (2006) benefitted from the criteria which were used at Swedish municipalities. These criteria and sub-criteria are presented in Table (1).

Table 1: Swedish Municipalities Criteria (Waara and Brochner 2006)

Swedish public procurement Act.	Criteria and sub-criteria
Quality	quality assurance system - Quality plan
Price and Cost	Bid price - Unit price
Performance technical	Technical solution
Technical features	Technical design
Environmental impact	Environmental characteristics - Environmental management system - Corporate environmental policy
Running costs	Operation costs – Maintenance Costs - Life-cycle costs
Service Technical support	Service – Responsiveness - availability
Others	Project duration - Contractor capabilities Skills, training, references, past experience, and past performance Construction methods - Financial capacity Solidity Health and safety Conformity with bidding documents

Al-dughaiter (2006) investigated several criteria such as; financial stability, capacity, operation and equipment, technical experience, performance record, managerial capabilities, and safety records. Banaitiene and Banatis (2006) showed that the most important criteria to be used are: financial strength, work capacity, experience, quality, and type of contract, as listed in Table 2.

Manideepak et al. (2009) proposed criteria such as bid amount, financial soundness, technical ability, management capability, safety and health records and reputation. Watt et al. (2010) determined the criteria involve: quality, track record, expertise, relevant experience, safety record, capability, and cost. Moreover, he determined the relative importance of each criterion compared with others Figure (1).

Table 2: Contractor evaluation criteria (Banaitiene and Banatis 2006)

Bid Price	Insurance
Legal Activity	Competitiveness
Adequacy of contractor	Clients' appreciation
Claims & contractual disputes	Quality assurance
Failed contracts	Experience
Bankruptcy possibilities	Environmental protection
Qualification of technical personnel	Safety and health at work
Type and size of past projects	

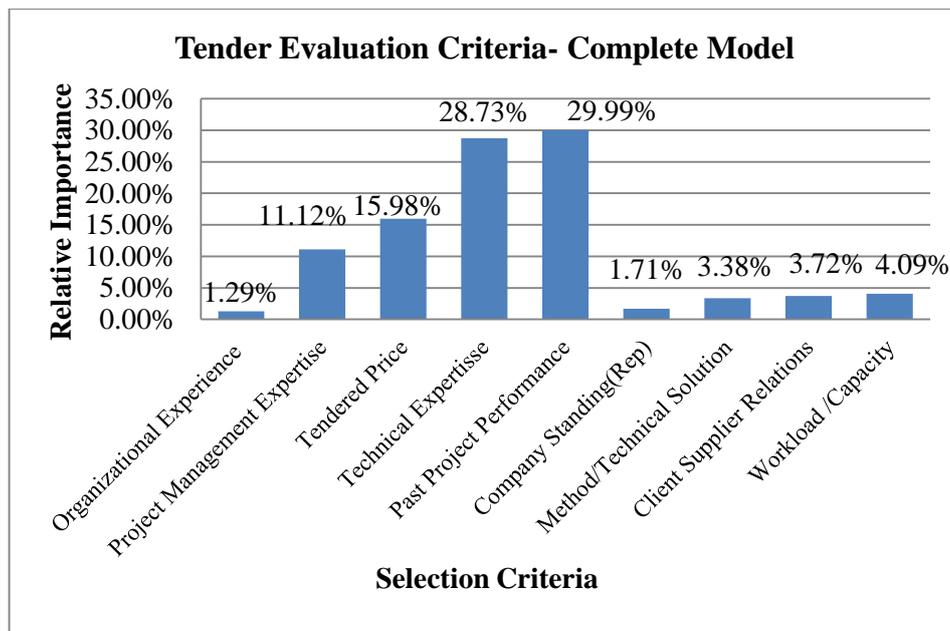


Figure 1: Relative importance of contractor evaluation criteria (Watt et al. 2010)

Trivedi et al. (2011) suggested six criteria, namely financial turnover, manpower resources, equipment resources, past experience, and past performance. Huang (2011) listed significant factors including: financial standing such as: financial stability, profit, turnover, technical ability, management capability, safety, current projects involving size, project location, and past owner cooperation with contractors. Puri et al. (2014) the following list includes most of the components that should be examined when conducting a contractor qualification. (1) Financial standing, such as financial stability, turnover, profit, obligations, amounts due, and owned financial funds. (2) Technical ability, such as experience, plant and equipment, and personnel. (3) Management capability, such as past performance and quality, quality control policy, quality management system, project management system, experience of technical personnel,

and management knowledge. (4) Quality, safety, senior management, including experience, tenure with firm, and division of responsibilities. (5) Current projects/backlog, including number, size, and location of projects, percent of capacity being utilized, and status and expected completion, past failures in completed projects, number of years in construction, past client relationships and cooperation with contactors.

Molla et al. (2015) from 1985 to 2012, a total of 18 main criteria, containing a total of 163 sub-criteria, were used during the contractors' bid prequalification process. . The main criteria are 1) general information and registration detail, 2) experience, 3) project specific, 4) references, 5) management and organization, 6) resources, 7) finances, 8) methodology, 9) working schedule, 10) quality, 11) safety, 12) communication, 13) claim history, 14) capability, 15) subcontracting, 16) estimation, 17) strategic business, and 18) bid specific.

Chiang et al. (2017) the most important criterion in evaluating the contractor-prequalification process Technical ability and management capability . Financial soundness is the third most important criterion for contractor prequalification. The last two criteria weights for contractor prequalification are reputation and health and safety. This indicates that construction-project owners are either not very concerned about or unlikely to reference contractors' reputation and health and safety, as listed in Table (3).

Table 3: Weight of criterion (Chiang et al. 2017)

Criterion	Technical ability	Management capability	Financial soundness	Reputation	Health and safety
weight	0.243	0.239	0.219	0.168	0.131

Salama et al. (2006) In Egypt, the process of contractor selection for the public projects is regulated by Act 89/1998. This act was introduced to replace Act 9. Despite introducing a point system to evaluate both the technical and financial offers, the Act still has some disadvantages. First, it did not mandate the use of the point system for contractors' evaluation. Second, it did not provide project managers and professionals with any criteria that could be taken into consideration for evaluating contractors' bids both technically and financially. Third, it only focuses on the bid price in evaluating financial offers.

3. AIMS OF RESEARCH

The primary objectives of this investigating study are to:

1. Giving decision makers (owners, consultants, sponsors, and governmental agencies) the main selection criteria for contractors, to facilitate and professionalize the selection process among contractors in construction projects.
2. Giving contractors important criteria that they should focus on, and work on developing their capabilities to match with them, within their organizations.
3. Recovering and investigating wide-range of selection criteria including those ignored in previous similar studies in different world countries and particularly in Egypt.

4. Selection Criteria

According to the literature review and to develop a reliable and valid research steps, the initial survey resulted with criteria were assessed and revised to satisfy validity to ensure its readability, clarity, completeness, relevance, and applicability. Investigation was done based on the feedbacks obtained from some academics and experts. As a

result of this questionnaire, Table (4) summarizes the fifteen main criteria and (67) sub-criteria that may be used in the contractor selection.

5. DATA ANALYSIS

This phase involves the analysis of the data received from the responses to the questionnaire survey. A total of 105 completed questionnaires were received back from the director's general projects in companies at construction engineer. Data was analyzed using SPSS and Microsoft Excel. Analysis of the data received was conducted through employing a straightforward descriptive statistical process such as percentages, graphics, tables and summary of the results.

Table 4: Contractor selection criteria and sub-criteria

No.	Criterion (15)	Sub-Criterion (67)
1	General Information and Registration Details	[1]Qualification grade [2]Familiarity with regulating authorities [3]Age of shareholders [4]Organizational structure
2	Experience	[1]Length of time company controlled by current management [2]General work experience [3]Specialist work experience [4]Recent completed projects [5]Past performance in owner previous project [6]Classes of work performed in each project [7]Business coverage
3	References	[1]Largest similar project performed in past 5 years [2]Company image-historical non-performance [3]Good relationship with past project owners
4	Management and Organization	[1]Leader's personality and capability [2]Professional Contract management [3]Logistic and supply chain management [4]Design and consultant management [5]Purchasing experience, material handling and control
5	Resources	[1]Techno-ware Technology availability[2]Equipment operational experience [3]Availability of product and price information of labor, materials, plants, and all resources [4]Availability of testing equipment as quality assurance [5]Ownership of equipment versus ability to rent it [6]quantities and condition of the owned equipment
6	Quality	[1]Quality management system[2]Achievement of quality level[3]Awarding ISO certification
7	Methodology	[1]Environmental considerations[2]Specialization of particular construction method[3]Statement of methodology
8	Finance	[1]Quality of financial statement[2]Experience of accountants[3]Current commitments [4]Capital[5]Current and fixed assets[6]Projects completed on budget
9	Safety	[1]Health and safety performance and plan [2]Security [3]Health and safety records [4]Availability of liability and workers compensation insurance policies
10	Communication	[1]Communication [2] Documentation management [3] Customer service, Inadequately reception arrangements for telephone message at head-office.
11	Working Schedule	[1]Projects completed on time[2]Scheduling of resources[3]Scheduling of cost control[4]Applying monthly or periodic update to schedules
12	Claiming History	[1]Current claims in court or arbitration [2]Engaged in fraudulent activity [3]Claim and dispute resolving skills [4]Knowledge and expertise on law [5]Contract not renewed due to failure to perform
13	Subcontracting	[1]Percentage of subcontracted work [2]Subcontractor prequalification process [3]Management of subcontractors [4]Standard of subcontractors' works in past projects
14	Strategic Business	[1]Time and cost saving considerations (e.g. application of value engineering) [2]Strategic awareness and perspective [3]Strategy implementation [4]Motivation and job satisfaction [5]Technological innovation ability [6]Market research and planning [7]Existence of research and development dept.
15	Bid Specific	[1]Bidding strategy [2]Experience in bidding [3]Bidding resources

5.1. Reliability

This section aims to investigate the Reliability of the questionnaire survey through Cronbach's Alpha by used SPSS program version 22. Table (5) displays the Reliability Statistics of the questionnaire; it shows that about Cronbach's Alpha is 0.960 that is veer good for Reliability Statistics of the questionnaire.

Table 5: Reliability Statistics of the Questionnaire

Reliability Statistics	
Cronbach's Alpha	N of Items
.960	67

5.2. Respondents' Characteristics

This section aims to investigate the characteristics of the respondents who respond to the questionnaire survey through answering several questions such as; the contact information of respondents like: the name, the telephone number and the Email address. It was remarkable from the received questionnaire that most of the respondents fill this optional data. Other information required includes: the respondent's level of education, the respondent's job title, the respondent's role during the selection or the prequalification of the construction contractor.

5.2.1. Respondents level of education

The results as illustrated in Figure (2) indicate that about (74.3%) of the respondents have a bachelor degree, followed by the respondents have a master degree with (17.1%) percent, and the respondents having a Ph.D. are with (8.6%) percent.

5.2.2. Respondent job title

As displayed in Figure (3), it is found that the majority of the respondents about (56.2%) were site engineers, (24.8%) were construction managers, (17.1%) were Engineering Consultant whereas remaining (1.9%) of respondents were academic professor.

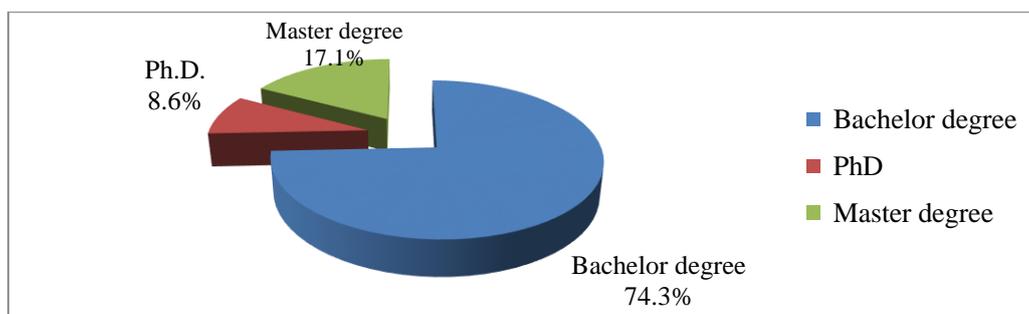


Figure 2: Respondents' level of education

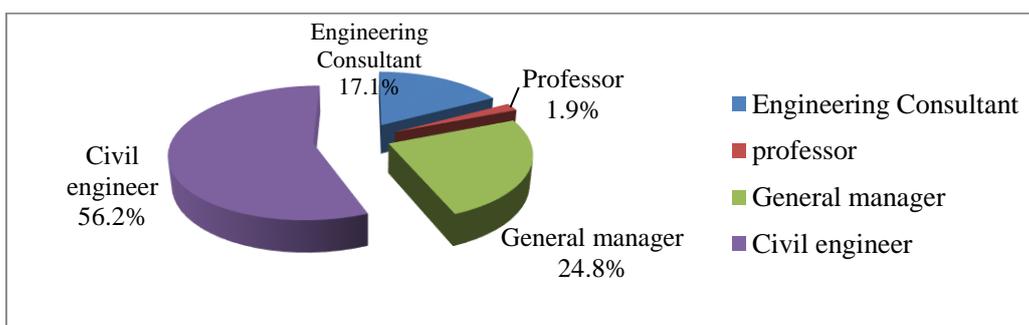


Figure 3: Job title of respondents

5.2.3. Respondents Specialization

It is found that the majority of the respondents about (65.7%) were Design/Consulting, whereas remaining (34.3%) are Execution/Contracting.

5.2.4. Experience of respondents

About (30.5%) of the respondents have less than 5 years of experience, (23.8%) between (5-10) years, (8.6%) between (10-15) years, and about (37.1%) have work experience more than 15 years.

5.2.5. Type of organization

About (37.1%) of the respondents are working for Sector/Private, (23.8%) for Enterprise/Public, and about (39%) have working for Government.

5.3. Statistical Results for Criteria

Table (6) shows the Relative importance Index for Main Criteria. Determined the range of criteria from (3.3918) to (2.8571) and the range of Std. Deviation ratio from (0.36852) to (0.72055), the maximum mean for main criteria is Experience and the minimum mean for main criteria is Safety.

Table 6: Relative importance Index for Main-Criteria

Main Criteria	Mean	Std. Deviation
General Information and Registration	3.2754	.45777
Experience	3.3918	.36852
References	3.1714	.49163
Management and Organization	3.2171	.54640
Resources	2.9937	.58284
Quality	3.1048	.57422
Methodology	2.9905	.58371
Finance	3.1356	.53939
Safety	2.8571	.63251
Communication	2.9270	.72055
Working Schedule	3.3833	.48296
Claiming History	3.2095	.64174
Subcontracting	3.1762	.59739
Strategic Business	3.0249	.63243
Bid specific	3.3079	.71267

Table (7) shows a sort of the main criteria and sub criteria by the mean.

Table 7: Sorting the main criteria and sub criteria

No.	Main criteria	Mean	Sub-Criteria	Mean
1	Experience	3.3918	Specialist work experience	3.6857
			Past performance in owner's previous project	3.6442
			Business coverage	3.5905
			General work experience	3.5714
			Recent completed projects	3.4571
			Classes of work performed in each project	3.1048
			Length of time company controlled by current	2.6923
2	Working Schedule	3.3833	Projects completed on time	3.5048
			Scheduling of cost control	3.3714
			Scheduling of resources	3.3333
			Applying monthly or periodic update to schedules	3.3238
3	Bid Specific	3.3079	Experience in bidding	3.3786
			Bidding strategy	3.3143
			Bidding resources	3.2381
4	General Information	3.2754	organizational structure	3.5524
			Qualification grade	3.4762

	and Registration Details		Familiarity with regulating authorities	3.1442
			Age of shareholders	2.9238
5	Management and Organization	3.2171	Professional Contract management	3.3238
			Logistic and supply chain management	3.3048
			Design and consultant management	3.1905
			Leader's personality and capability	3.181
			Purchasing experience, material handling and control	3.0865
6	Claiming History	3.2095	Engaged in fraudulent activity	3.4476
			Contract not renewed due to failure to perform	3.3143
			Claim and dispute resolving skills	3.1143
			Knowledge and expertise on law	3.1048
			Current claims in court or arbitration	3.0667
7	Subcontracting	3.1762	Management of subcontractors	3.3143
			Standard of subcontractors' works in past projects	3.2952
			Subcontractor prequalification process	3.1333
			Percentage of subcontracted work	2.9619
8	References	3.1714	Largest similar project performed in past 5 years	3.4519
			Good relationship with past project owners	3.0762
			Company image-historical non-performance	2.9905
9	Finance	3.1356	Quality of financial statement	3.4667
			Capital	3.2571
			Projects completed on budget	3.1442
			Experience of accountants	3.0857
			Current commitments	3.000
			Current and fixed assets	2.8571
10	Quality	3.1048	Achievement of quality level	3.4095
			Quality management system	3.1619
			Awarding ISO certification	2.7429
11	Strategic Business	3.0249	Time and cost saving considerations (e.g. application)	3.4286
			Technological innovation ability	3.1238
			Market research and planning	3.0667
			Strategic awareness and perspective	2.9619
			Strategy implementation	2.9619
			Motivation and job satisfaction	2.9429
			Existence of research and development dept.	2.6827
12	Resources	2.9937	Techno-ware Technology availability	3.2095
			Equipment operational experience	3.1619
			Availability of product and price information of labor,	3.1333
			Availability of testing equipment as quality assurance	3.0476
			quantities and condition of the owned equipment	2.9238
			Ownership of equipment versus ability to rent it	2.4857
13	Methodology	2.9905	Statement of methodology	3.2095
			Specialization of particular construction method	3.1143
			Environmental considerations	2.6476
14	Communication	2.927	Communication	3.2857
			Documentation management	2.8447
			Customer service, Inadequately reception arrangements	2.625
15	Safety	2.8571	Health and safety performance and plan	2.9714
			Security	2.9524
			Availability of liability and workers' compensation	2.8095
			Health and safety records	2.6952

Table (8) shows top five main-criteria based on the highest mean.

Table 8: Top five main criteria

No.	Main-criteria	Mean
1	Experience	3.3918
2	Working Schedule	3.3833
3	Bid Specific	3.3079
4	General Information and Registration Details	3.2754
5	Management and Organization	3.2171

Table (9) shows top twenty sub-criteria based on the highest mean.

Table 9: Top twenty sub-criteria

No	Sub-criteria	Mean	Main criteria
1	Specialist work experience	3.6857	Experience
2	Past performance in owner's previous	3.6442	Experience
3	Business coverage	3.5905	Experience
4	General work experience	3.5714	Experience
5	organizational structure	3.5524	General Information and
6	Projects completed on time	3.5048	Working Schedule
7	Qualification grade	3.4762	General Information and
8	Quality of financial statement	3.4667	Finance
9	Recent completed projects	3.4571	Experience
10	Largest similar project in past 5 years	3.4519	References
11	Engaged in fraudulent activity	3.4476	Claiming History
12	Time and cost saving considerations	3.4286	Strategic Business
13	Achievement of quality level	3.4095	Quality
14	Experience in bidding	3.3786	Bid Specific
15	Scheduling of cost control	3.3714	Working Schedule
16	Scheduling of resources	3.3333	Working Schedule
17	Applying monthly or periodic update	3.3238	Working Schedule
18	Professional Contract management	3.3238	Management and Organization
19	Bidding strategy	3.3143	Bid Specific
20	Contract not renewed due to failure	3.3143	Claiming History

Table (10) shows the relative importance index for main criteria by specialization execution and contracting, design and consulting.

It is found that the top five for main criteria it is "Experience, working schedule, Bid Specific, General Information & Registration Details and Management & Organization". The descriptive for Std. Deviation by specialization execution and contracting, design and consulting for the top five criteria it is between (0.35459) and (0.58655) is very close together. This indicates the convergence of views in this specialization, but the Std. Deviation by specialization design and consulting for Bid Specific is (0.78774) is different and this indicates different opinions in this specialization.

Table (11) shows the relative importance Index for main criteria by total years of experience (0-5, 5-10, 10-15, >15). It is found that the Top five for main criteria it is "Experience, Working Schedule, Bid Specific, General Information & Registration Details and Management & Organization. The descriptive for Std. Deviation by total years of experience (0-5, 5-10, 10-15, 15<), for the top five criteria it is between (0.33521) and (0.58958) is very close together. This indicates the convergence of views for all years of experience, but the Std. Deviation by years of experience (5-10) for Bid Specific is (1.0000) is very big different and This shows that the opinions are very large dispersion in this part of year experience. As well the Std. Deviation by years of experience (0-5) for Bid Specific is (0.68653) is different and this indicates different opinions in this part of year experience.

The Std. Deviation for main criteria “Experience, Working Schedule, General Information & Registration Details and Management & Organization” is very close together in specialization and total years of experience. This points to/shows the coming together of views as we show from Tables (10 and 11).

Although Bid Specific is one of the five most important criteria in the selection of contractors, there is a difference in the opinion of the respondents as shown in Tables (10 and 11).

Table 10: Relative importance Index for Main Criteria by Specialization

Main Criteria	Mean	Mean for Specialization			
		Execution and contracting		Design and Consulting	
		Mean	Std. Deviation	Mean	Std. Deviation
General Information and Registration	3.2754	3.3542	.42835	3.2343	.47016
Experience	3.3918	3.4722	.35459	3.3499	.37118
References	3.1714	3.1667	.54917	3.1739	.46304
Management and Organization	3.2171	3.2667	.46353	3.1913	.58655
Resources	2.9937	3.1111	.54482	2.9324	.59637
Quality	3.1048	3.1574	.61456	3.0773	.55467
Methodology	2.9905	3.0370	.62629	2.9662	.56344
Finance	3.1356	3.2593	.56265	3.0710	.51933
Safety	2.8571	2.8542	.58668	2.8587	.65932
Communication	2.9270	3.0093	.64972	2.8841	.75586
Working Schedule	3.3833	3.5000	.44320	3.3225	.49464
Claiming History	3.2095	3.2167	.65792	3.2058	.63798
Subcontracting	3.1762	3.4583	.42046	3.0290	.62505
Strategic Business	3.0249	3.1667	.58802	2.9510	.64619
Bid Specific	3.3079	3.4352	.52746	3.2415	.78774

Table 11: Relative importance Index for Main Criteria by Total years of experience

Main Criteria	Mean	Mean for Total years of experience							
		15<		10-15		5-10		0-5	
		Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
General Information&	3.2754	3.2500	.41359	3.3333	.43301	3.2367	.43213	3.3203	.54342
Experience	3.3918	3.3736	.33521	3.4921	.35074	3.4057	.34670	3.3750	.43505
References	3.1714	3.1880	.51750	3.2593	.54716	3.1333	.53576	3.1563	.42320
Management and	3.2171	3.1795	.54056	3.3333	.46904	3.1520	.58958	3.2812	.55150
Resources	2.9937	2.9231	.52960	3.0000	.49301	3.0133	.59884	3.0625	.66633
Quality	3.1048	3.1624	.53460	3.1481	.44444	3.0533	.55008	3.0625	.67965
Methodology	2.9905	3.0256	.57423	3.1111	.50000	3.0000	.48113	2.9063	.69424
Finance	3.1356	3.0812	.46338	3.0741	.74587	3.1893	.49942	3.1771	.60603
Safety	2.8571	2.8654	.68067	2.8056	.80795	2.8200	.53288	2.8906	.61872
Communication	2.9270	2.8974	.71800	3.2222	.40825	3.0000	.79349	2.8229	.73316
Working Schedule	3.3833	3.3397	.38682	3.6389	.43501	3.4600	.47148	3.3047	.58797
Claiming History	3.2095	3.1897	.61721	3.4000	.48990	3.3440	.54320	3.0750	.76158
Subcontracting	3.1762	3.1026	.46140	3.3611	.94465	3.2900	.72053	3.1250	.52363
Strategic Business	3.0249	2.8987	.62089	3.1429	.51508	3.2457	.59408	2.9732	.67927
Bid Specific	3.3079	3.3675	.56088	3.4444	.40825	3.1867	1.0000	3.2917	.68653

As displayed in Figure (4), determined the ratio of each criteria that an Owner can choose contractors and determine their performance that involved: “General Information & Registration Details, Experience, References, Management & Organization, Resources, Quality, Methodology, Finance, Safety, Communication, Working Schedule, Claiming History, Subcontracting, Strategic Business and Bid Specific”. Moreover, he determined the relative importance of each criterion compared with others.

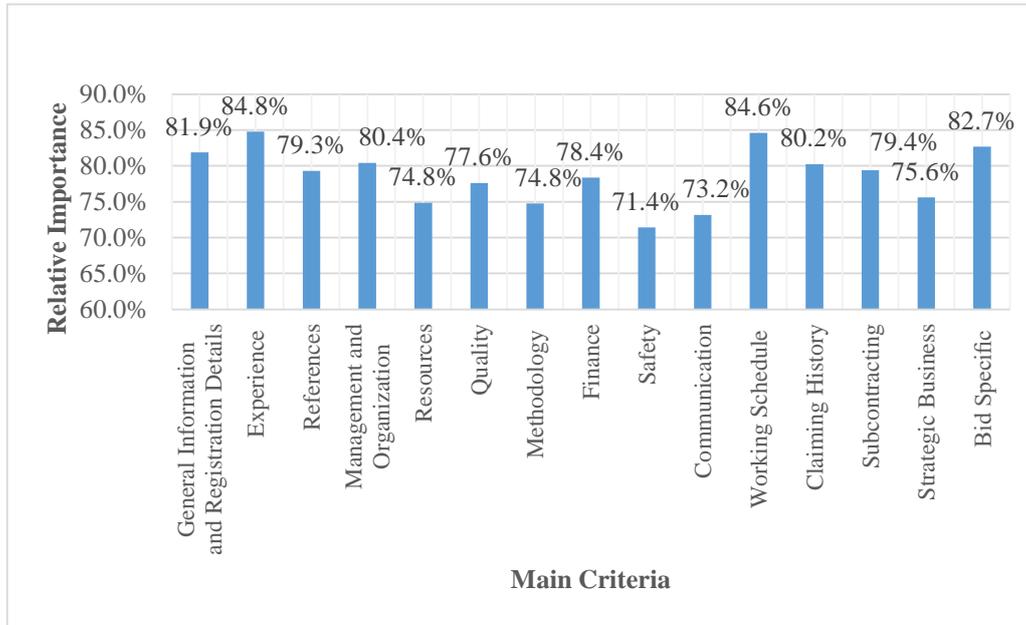


Figure 4: Histogram of Relative importance Index for Main-Criteria

6. SUMMARY AND CONCLUSION

The selection of contractors in construction projects always cause problems for decision makers. These problems result from changed criteria and their weights from one project to another. Therefore, there is always a need to determine and update the selection criteria of contractors in construction projects, as well as determine the weights of these criteria. The determination of these criteria and their relative weights gives the decision makers flexibility for selection of contractors. The importance of research is that it gives decision makers in Egypt important criteria in the selection of contractors.

The most important criteria are “experience, working schedule, bid specific, general information & registration details and management & organization of the contractor”, as we show in the figure (4). However, safety and communication at general acquired the lowest score from both consultants and contractors. Also, we can get the top five for main criteria and the top twenty for sub-criteria as we show in the tables (7 and 9). The result showed that, a total of (15) main criteria, (67) sub-criteria that is very important to select the contractors in Egypt. The limitations of the proposed selection criteria in popular project. Also, the study despite conducted in Egypt is useful to practitioners intending to engage in construction projects in the developing region of the Middle East due to the similar trends in current practices.

References

- Tarawneh, S. (2004). 'Evaluation of Pre-qualification Criteria: Client Perspective; Jordan Case Study', *Journal of Applied Sciences*, vol. 4, no. 3.
- Anagnostopoulos, K & Vavatsikos, A. (2006). "An AHP Model for Construction Contractor Prequalification", *Operational Research. An International Journal*, vol. 6, no. 3.
- Waara, F., and Brochner, J. (2006). "Price and Non-price Criteria for Contractor Selection", *Journal of Construction Engineering and Management*, vol. 132, no. 8.
- Al-dughaiter, K. (2006). "A Multi-Criteria Decision-Making Model for Contractors Prequalification", *Joint International Conference on Computing and Decision Making in Civil and Building Engineering*, Montreal, Canada.
- Banaitiene, N., and Banaitis, A. (2006). "Analysis of Criteria for Contractors' Qualification Evaluation", *Technological and Economic Development of Economy*, vol.12, no. 4.
- Manideepak, G., Bhatla, A., and Pradhan, B. (2009). "Methodologies for Contractor Selection in Construction Industry", *ACSGE, BITS Pilani, India*.
- Watt, D., Kayis, B., and Willey, K. (2010). "The Relative Importance of Tender Evaluation and Contractor Selection Criteria", *International Journal of Project Management*, vol. 28, no.1.
- Trivedi, M., Pandey, M., and Bhadoria, S (2011). "Prequalification of Construction Contractor Using a FAHP", *International Journal of Computer Applications*, vol. 28, no. 10.
- Dwarika Puri, S.Tiwari. (2014). "Evaluating the Criteria for Contractors' Selection and Bid Evaluation", *International Journal of Engineering Science Invention*, vol.3, No. 7, pp.44–48.
- Molla, M., and Eric, A. (2015). "Factors Influencing Contractor Prequalification Processes in Developing Countries", *International Journal of Architecture, Engineering and Construction* Vol.4, December 2015, pp. 232-245.
- Fu-Yuan Chiang, Vincent F. Yu, and Pin Luarn. (2017). "Construction Contractor Selection in Taiwan Using AHP", *International Journal of Engineering and Technology*, vol.9, No. 3, pp.211–215.
- Salama, M., Abd El Aziz, H., El Sawah, H., and Samadony, A. (2006). "Investigating the criteria for contractors' selection and bid evaluation in Egypt", *Proc. 22nd Annual ARCOM Conference, Birmingham, UK*, pp. 531–540.