# Evaluation of construction companies performance by using stepwise weight assessment ratio analysis

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#### ABSTRACT

The extent to which the facility and the construction process meet and/or surpass a client's expectations is critical for client satisfaction. As a result, company evaluation is a well-established procedure in project management in the construction industry to ensure projects are performed in compliance with the contract documents and applicable laws and regulations. The purpose of this study is to present and debate certain criteria for evaluating the Iraqi construction sector companies' performance based on Stepwise Weight Assessment Ratio Analysis (SWARA) to assess company responsibility and performance in support of future projects. The evaluation criteria of construction companies are studied in this paper. The criteria have been categorized into main groups: (a) organization and management; (b) time; (c) quality; (d) cost; (e) resource; (f) safety practices. The main criteria have been divided into forty-four sub criteria. The findings of this paper demonstrate that the most important criteria in evaluating the construction companies' performance is cost, followed by time, quality, organization and management, resources, and lastly safety practices which ranked based on the weight of criteria (35.7%, 24.2%, 16.3%, 11.2%, 7.4%, 5.2% respectively) with the SWARA technique.

Keywords: Construction, Companies, SWARA, Performance Evaluation, Management

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#### 1. Introduction

The construction industry is a vital sector that has a significant impact on a country's economic development and national society. It has the potential to help the country create a large number of job opportunities. The construction industry's growth is inversely linked to the country's economic growth. [1]. In the management of construction firms, performance measurement is critical. It gives the required data for process control and allows for the setting of difficult yet achievable goals. It is also essential to support the business strategies implementation [2]. As a result, the most important evaluation criteria for the company's performance in the Iraqi field of construction is studied in this paper. Weight assessment is a significant subject in several MCDM problems. One of the new techniques is the SWARA approach. An expert's perspective on estimates and weight computations is important in this technique. Reference [3] state that, every expert selects the significance of every criterion. All the factors are ranked by each expert in descending order from the first to the last one. The expert makes use of his or her own implicit knowledge, information, and abilities. The most important criterion is ranked first, and the least important criterion is ranked last, according to this procedure. The key advantage of this decision-making process is that important problems are defined in some cases, based on company or country policies, and there is no need for a ranking factor assessment. As a result, SWARA may be effective for some topics where priorities have been established based on previous events. Researchers have investigated and employed SWARA in a variety of domains in the past such as for machine tool selection [4], facility location



problem [5], architect selection [6], evaluating sustainability indicators of the energy system [7], personnel selection problem [8], evaluating the prominent criteria in high tech industry investment prioritization [9], evaluating the criteria for solar projects [10], project selection [11], [12].

Since there is no systematic study on the criteria for evaluating construction companies in Iraq, therefore this paper aims to fill a research gap by evaluating the performance of Iraqi construction sector enterprises using the SWARA method. The importance of research will be highlighted in this study by analyzing crucial performance evaluation criteria for construction companies. The following is a breakdown of the paper's structure. The data and methods used, as well as the procedural stages, are detailed in the following section. Section 3 demonstrates the results and discussion. Lastly, conclusions are drawn in the last section of this paper.

# 2. Data and methods

# 2.1 Identify the main criteria and sub-criteria

To identify the main criteria and sub-criteria for construction companies' evaluation, for construction companies' evaluation, the researcher studies the literature review related to the research and extract a number of criteria, and interviews with project managers, group of experts, academics, professionals and engineers in government institutions to find out the criteria from their perspective about evaluation of construction companies.

# 2.2 Use the focus group discussion (FGD) technique

Used the Focus Group Discussion (FGD) technique with experts and specialists and decision-makers to select the criteria and sub-criteria to be suitable with Iraqi environmental and requirements.

In the table 1, the six Main Criteria (MC) and forty-four Sub-Criteria (SC) for performance evaluation of construction companies captured and selected by theoretical study and field work [13], [14], [15], [16], [17].

Code	Main Criteria	Sub-criteria	Code	Justifications for selection the criteria
OMMC	Organization and Management	Cooperation/Responsiveness with project staff, client, and representatives Follow chain of authority and comply with directions Actively and cooperatively participate in the settlement of project issues. Promptly resolve any issues after notification Meet expectations on project coordination Carry out activities in a timely manner that does not disrupt other people's work or cause harm to their property. Any issues that arise are quickly resolved. Work with subcontractors to exercise authority, coordinate, and supervise work operations to ensure the timeline and requirements are met.	OMSC1 OMSC2 OMSC3 OMSC4 OMSC5 OMSC6	The purpose of this criteria is to evaluate to what extent are the company executes the directions.
TMC	Time	Schedule the work and follow it Initial project schedule suitability Observance of the agreed-upon schedule Timeliness and accuracy of schedule updates Adherence to recovery schedule and timely submittal Notification of changes to the schedule in a timely manner	TSC1 TSC2 TSC3 TSC4 TSC5 TSC6	The purpose of this criteria is to evaluate to what extent are the company is experienced and active at scheduling work and arranging construction activities, including starting and finishing the project on time and meeting important

# Table 1. The criteria for evaluating a company's performance

Code	Main Sub-criteria		Code	Justifications for selection the criteria
				intermediate phases according to the contract.
QMC	Quality	Meet the contract requirements Provide an effective inspection and quality control procedures Workmanship quality Work Quality of Subcontractors Plan and specification adherence QA/QC Plan Adequacy Implementation of the QA/QC Plan QA/QC Documentation Adequacy of Materials Timely correction of deficient work	QSC1 QSC2 QSC3 QSC4 QSC5 QSC6 QSC7 QSC8 QSC9 QSC10	The purpose of this criterion is to see how well the organization meets deadlines for delivering required documentation and reports. This incorporates, but is not limited to, delivery tickets, certification of supplies, invoices, progress schedules, shop drawings, contractor staking, material samples, requests for extensions of time, and contractor QA/QC plans and documentation
СМС	Cost	Follow the contract's labor standards/wage- rate requirements. Laws and regulations compliance and early payment. Accuracy of payrolls and other required documentation. Identify changes as were needed, not at the end of the task or project Avoiding and minimizing change orders Documentation of the change order Pricing of the change order Timely performs change order work	CSC1 CSC2 CSC3 CSC4 CSC5 CSC6 CSC7 CSC8	The object of this criterion is to see how well the company adheres to all applicable rates of wage, employment laws, and regulations, as well as submit correct certified payrolls and pay all subcontractors on time.
RMC	Resources	Enough equipment to finish the job on time Personnel who are both competent and sufficient to accomplish the assignment on time. All of the equipment complies with or exceeds the specifications. Adjust resources in response to demands of the project delivery schedule Trained and Skilled Workforce	RSC1 RSC2 RSC3 RSC4 RSC5	This criterion is used to determine whether the company has appropriate and appropriate equipment to maintain the project on track. Is the equipment capable of meeting the parameters and producing a high-quality product?
SMC	Safety Practices	<ul> <li>Take the initiative to ensure the safety and health of the employees</li> <li>The safety equipment is in perfect working order.</li> <li>Follow good safety practices</li> <li>Take adequate precautions with any hazardous materials</li> <li>Properly report all injuries or damage associated with project</li> <li>Conduct the Periodic audits of compliance</li> <li>Minimizes job-site accidents</li> </ul>	SSC1 SSC2 SSC3 SSC4 SSC5 SSC6 SSC7	This criterion is used to determine whether the company has good safety practices. Is the company following its safety program and complying with regulatory requirements?

#### 2.3 Extract main and sub-criteria weights by used the (SWARA).

It is one of the techniques for determining weight values that play an important role in a decision-making process. The following steps will explain the essential principles of SWARA as well as the technique for determining the relative weights of criteria. [18]:

### 2.3.1 Ranking the criteria

The importance of each criterion should be prioritized. The experts rank the defined criteria in order of relevance throughout this phase. The final list of criteria is listed from the most important to the least important.

### 2.3.2 Determine value of (Sj)

Calculate the value of the average value's (Sj) comparative significance. Determine the relative importance Sj of criterion (j) in respect to criterion (j-1) starting with the second criterion, then repeat for each criterion. The criterion (Cj) is less important than (Cj-1)

$$Sj \leftrightarrow j + 1 = \sum_{k=1}^{r} Cj \leftrightarrow j + 1 / r$$
 (1)

Sj = Significance of the average value J= 2,3,... Cj= Current criteria more important than criteria h= No. of experts

### **2.3.3.** Determine value of (Kj)

The value of (Kj) find by calculate the coefficient (Kj) as follows:

$$Kj = \begin{cases} 1 & j=1 \\ Sj + 1 & j>1 \end{cases}$$
(2)

 $\begin{array}{l} Kj = Coefficient \ of \ criteria \\ J = 2,3, \ldots \\ Sj + 1 = Significance \ of \ the \ average \ value \end{array}$ 

# **2.3.4.** Determine value of (qj)

Re-calculated weight q j as follows:

$$qj = \begin{cases} 1 & j=1 \\ qj - 1/Kj & j>1 \end{cases}$$
(3)

qj= Re-calculated weight Kj= Coefficient of criteria qj-1= The previous re-calculated weight

# 2.3.5. Calculate the weight of criteria

$$Wj = qj / \sum_{k=1}^{m} qj$$
 (4)

Wj: denotes the relative weight of criteria.

#### 3. Results and discussions

The main criteria include Organization and Management, as well as time, cost, quality, resource, and safety. are deemed the essential criteria that are utilized in evaluating the company's performance in Iraq. Everyone main

criteria were broken down into sub-criteria. To evaluate the weights of criteria, the SWARA technique was applied to determine the main and sub criteria weights.

### 3.1. Ranking the main and sub criteria

The first stage is the one that all the eight experts rank criteria on their opinion, then a new (final) ranking is obtained by averaging the criteria rankings, which is shown in Figure 1, 2,3,4,5,6, and 7. The main criteria are listed in descending order by experts in Table 1. Through using the interval rating (1-5) Likert scale, where 5 denoted Very High, 4 High, 3 Medium, 2 Low, and 1 Very Low, each expert determines their preferred level of ratings for each single specified criterion.



Figure 1. Main criteria ranking

Experts have ranked the main criteria. Obtained rank of criteria indicate that the cost criteria are the first rank, while second criteria rank is time. quality has third rank, organization and management criteria was fourth rank, while the safety and resource have a fifth and sixth rank respectively. Figure 2, 3,4,5,6 and 7 illustrate how experts ranked the sub-criteria.







Figure 3. Time sub-criteria ranking



Figure 4. Quality sub-criteria ranking



Figure 5. Cost sub-criteria ranking



Figure 6. Resource sub-criteria ranking



Figure 7. Safety sub-criteria ranking

The results of sub-criteria ranking showed that, in the organization and management criteria, promptly resolve any issues after notification (OMSC4) is most important. In time criteria, the adequacy of initial project schedule (TSC2) is most important. In quality criteria, the compliance with plans and specifications (QSC5) is most important. In cost criteria, the practices change order avoidance and minimization (CSC5) is most important. In resource criteria, the Adjust resources in response to demands of the project delivery schedule (RSC4) is most important. In safety criteria, the Minimizes job-site accidents (SSC7) is most important.

#### 3.2. Determine comparative significance (Sj) and weights (Wj) for main criteria

The second stage is similar to the first stage. Again, the criteria importance order was obtained as in the first stage form, decision makers made their own pair wise comparisons, but instead of taking the average of the weight values at the end of the SWARA Method, the process was continued by taking the average of the pairwise comparisons (sj) by application equation 1. The process and results are presented in Table 2.

Evenanta	Main criteria relative importance								
Experts	TMC↔CMC	QMC↔TMC	OMMC↔QMC	RMC↔OMMC	SMC↔RMC				
1	0.5	0.5	0.3	0.6	0.2				
2	0.4	0.4	0.5	0.5	0.5				
3	0.5	0.4	0.6	0.4	0.4				
4	0.4	0.6	0.5	0.6	0.3				

Table 2. Relative importance assessment for main criteria

Exporte	Main criteria relative importance								
Experts	TMC↔CMC	QMC↔TMC	OMMC↔QMC	RMC↔OMMC	SMC↔RMC				
5	0.6	0.4	0.4	0.6	0.5				
6	0.5	0.5	0.4	0.5	0.5				
7	0.5	0.5	0.5	0.3	0.6				
8	0.4	0.6	0.5	0.5	0.4				
Av.value	0.475	0.488	0.463	0.500	0.425				

After completing the (Sj) comparison between the primary criteria using equation 1, The next step is to use the equations 2, 3, and 4 to calculate the primary criteria weights. Table (3) show the main criteria weighting by using the SWARA.

M. C	$Sj \leftrightarrow j+1$	Kj = Sj + 1	qj=qj-1/ kj	Wj=qj/∑ qj
CMC		1.0	1.0	35.7
TMC	0.475	1.475	0.678	24.2
QMC	0.488	1.488	0.456	16.3
OMMC	0.463	1.463	0.312	11.2
RMC	0.500	1.500	0.208	7.4
SMC	0.425	1.425	0.146	5.2
			$\sum = 2.800$	$\sum = 100$

Table	3.	Main	criterion	weights
	-			0

# 3.3. Calculate sub criteria significance (S j) and weights (W j)

This stage is similar to the stage in section 3.2. Again, the sub-criteria importance order was obtained form, decision makers made their own pair wise comparisons. Table 4 show relative importance assessment for organization and management sub-criteria.

Table 4. Relative importance assessment for organization and management sub-criteria

Exports							
Experts	OMSC3↔ OMSC4	OMSC1↔ OMSC3	OMMC6↔ OMMC1	OMSC2↔ OMSC6	OMSC5↔ OMSC2	OMSC7↔ OMSC5	OMSC8↔ OMSC7
1	0.4	0.4	0.7	0.4	0.3	0.7	0.3
2	0.4	0.5	0.7	0.5	0.4	0.4	0.6
3	0.4	0.6	0.7	0.5	0.6	0.4	0.5
4	0.5	0.4	0.5	0.5	0.5	0.5	0.4
5	0.5	0.4	0.6	0.5	0.3	0.6	0.4
6	0.5	0.5	0.7	0.5	0.7	0.4	0.5
7	0.6	0.5	0.5	0.5	0.4	0.5	0.6
8	0.5	0.6	0.3	0.5	0.7	0.3	0.5
Av.value	0.475	0.488	0.588	0.488	0.488	0.475	0.475

O&M Sub criteria relative importance

The calculation of the organization and management sub-criteria weights shown in table 5.

M. C	Sj⇔ j+1	Kj = Sj + 1	qj= qj-1/ kj	Wj= qj/ $\sum$ qj
OMSC4		1.0	1.0	34.6
OMSC3	0.475	1.475	0.678	23.4
OMSC1	0.488	1.488	0.456	15.8
OMSC6	0.588	1.588	0.287	9.9
OMSC2	0.488	1.488	0.193	6.7
OMSC5	0.488	1.488	0.130	4.5
OMSC7	0.475	1.475	0.088	3.0
OMSC8	0.475	1.475	0.060	2.1
			$\sum = 2.892$	∑= 100

Table 5. Weights of organization and management sub-criteria

Table 6 show relative importance assessment for time sub-criteria.

Table 6. Relative importance assessment for time sub-criteria

	Time Sub criteria relative importance								
Experts									
	TSC1↔TSC2	TSC3↔TSC1	TSC4↔TSC3	TSC5↔TSC4	TSC6↔TSC5				
1	0.4	0.5	0.4	0.5	0.6				
2	0.5	0.5	0.4	0.3	0.6				
3	0.6	0.4	0.5	0.5	0.6				
4	0.5	0.6	0.5	0.3	0.4				
5	0.4	0.3	0.6	0.5	0.5				
6	0.5	0.4	0.7	0.5	0.4				
7	0.5	0.5	0.3	0.6	0.6				
8	0.4	0.6	0.4	0.7	0.3				
Av.value	0.475	0.475	0.475	0.488	0.5				

The calculation of the time sub-criteria weights shown in table 7.

Table 7. Weights of time sub-criteria

M. C	Sj⇔ j+1	Kj = Sj + 1	qj=qj-1/ kj	Wj=qj/∑qj
TSC2		1.0	1.0	35.7
TSC1	0.475	1.475	0.678	24.2
TSC3	0.475	1.475	0.460	16.4
TSC4	0.475	1.475	0.312	11.2
TSC5	0.488	1.488	0.210	7.5
TSC6	0.500	1.500	0.140	5.0
			$\sum = 2.8$	$\sum = 100$

			Qı	uality Sub ci	riteria relati	ve importar	nce			
Exp.	QSC2↔	QSC1↔	QSC10	QSC3↔	QSC4↔	QSC7↔	QSC6↔	QSC8↔	QSC9↔	
	QSC5	QSC2	↔QSC1	QSC10	QSC3	QSC4	QSC7	QSC6	QSC8	
1	0.4	0.6	0.5	0.3	0.5	0.6	0.4	0.6	0.6	
2	0.5	0.6	0.5	0.5	0.4	0.6	0.5	0.6	0.5	
3	0.5	0.4	0.5	0.5	0.6	0.5	0.7	0.5	0.5	
4	0.6	0.5	0.5	0.4	0.4	0.7	0.5	0.5	0.4	
5	0.4	0.6	0.4	0.6	0.4	0.4	0.5	0.6	0.4	
6	0.5	0.5	0.3	0.6	0.5	0.5	0.6	0.3	0.5	
7	0.5	0.3	0.7	0.4	0.6	0.3	0.5	0.5	0.6	
8	0.5	0.4	0.5	0.6	0.5	0.3	0.6	0.4	0.4	
Av.v alue	0.488	0.488	0.488	0.488	0.488	0.488	0.538	0.500	0.488	

Table 8 show relative importance assessment for quality sub-criteria.

Table 8. Relative importance assessment for quality sub-criteria

The calculation of the quality sub-criteria weights shown in table 9.

Table 9. Weights of quality sub-criteria

M.C	$Sj \leftrightarrow j+1$	Kj = Sj + 1	qj=qj-1/ kj	Wj= qj/ $\sum$ qj
QSC5		1.0	1.0	33.5
QSC2	0.488	1.488	0.672	22.5
QSC1	0.488	1.488	0.452	15.0
QSC10	0.488	1.488	0.304	10.3
QSC3	0.488	1.488	0.204	6.9
QSC4	0.488	1.488	0.137	4.5
QSC7	0.488	1.488	0.092	3.0
QSC6	0.538	1.538	0.060	2.0
QSC8	0.500	1.500	0.04	1.4
QSC9	0.488	1.488	0.027	0.09
			$\sum = 2.961$	$\sum = 100$

Table 10 show relative importance assessment for cost sub-criteria.

Table 10. Relative importance assessment for cost sub-criteria

	Cost Sub criteria relative importance						
Experts	CSC3↔ CSC5	$\begin{array}{c} \text{CSC2} \leftrightarrow \\ \text{CSC3} \end{array}$	$\begin{array}{c} \text{CSC1} \leftrightarrow \\ \text{CSC2} \end{array}$	$\begin{array}{c} \text{CSC6} \leftrightarrow \\ \text{CSC1} \end{array}$	CSC7 ↔ CSC6	CSC4 ↔ CSC7	CSC8 ↔ CSC4
1	0.5	0.4	0.4	0.3	0.5	0.3	0.6
2	0.5	0.5	0.7	0.4	0.6	0.5	0.3
3	0.5	0.4	0.3	0.7	0.4	0.7	0.4
4	0.5	0.5	0.4	0.5	0.7	0.5	0.3
5	0.5	0.4	0.6	0.3	0.5	0.4	0.6
6	0.4	0.6	0.3	0.5	0.4	0.6	0.5
7	0.5	0.5	0.4	0.4	0.4	0.4	0.7
8	0.5	0.5	0.6	0.5	0.6	0.4	0.5
Av.value	0.488	0.475	0.463	0.450	0.513	0.475	0.488

		e		
M. C	Sj⇔ j+1	Kj = Sj + 1	qj=qj-1/ kj	Wj= qj/ $\sum$ qj
CSC5		1.0	1.0	33.8
CSC3	0.488	1.488	0.672	22.7
CSC2	0.475	1.475	0.456	15.5
CSC1	0.463	1.463	0.312	10.5
CSC6	0.450	1.450	0.215	7.3
CSC7	0.513	1.513	0.142	4.8
CSC4	0.475	1.475	0.096	3.2
CSC8	0.488	1.488	0.065	2.2
			$\sum = 2.958$	$\sum = 100$

The calculation of the cost sub-criteria weights shown in table 11.

Table	11	Weights	of c	ost su	b-criteria
raute	11.	vv Cigino	UI U	υδι δα	0-0110110

Table 12 show relative importance assessment for resource sub-criteria.

Exports -		Resource Sub criteria relative importance					
Experts	RSC1↔ RSC4	$RSC2 \leftrightarrow RSC1$	$RSC3 \leftrightarrow RSC2$	$RSC5 \leftrightarrow RSC3$			
1	0.5	0.5	0.3	0.7			
2	0.4	0.5	0.5	0.5			
3	0.5	0.4	0.6	0.3			
4	0.4	0.6	0.4	0.5			
5	0.4	0.3	0.6	0.4			
6	0.4	0.5	0.7	0.5			
7	0.5	0.5	0.4	0.5			
8	0.7	0.4	0.5	0.3			
Av.value	0.475	0.463	0.500	0.463			

Table 12. Relative importance assessment for resource sub-criteria

The calculation of the resource sub-criteria weights shown in table 13.

Table 13. Weights of resource sub-criteria						
M.C	$Sj \leftrightarrow j+1$	Kj = Sj + 1	qj=qj-1/ kj	Wj= qj/ $\sum$ qj		
RSC4		1.0	1.0	37.6		
RSC1	0.475	1.475	0.678	25.5		
RSC2	0.463	1.463	0.463	17.4		
RSC3	0.500	1.500	0.309	11.6		
RSC5	0.463	1.463	0.211	7.9		
			$\sum = 2.661$	$\Sigma = 100$		

Table 14 show relative importance assessment for safety sub-criteria.

	Safety Sub criteria relative importance					
Experts	SSC1↔ SSC7	SSC4↔ SSC1	SSC2↔ SSC4	SSC6↔ SSC2	SSC3↔ SSC6	$\begin{array}{c} SSC5 \leftrightarrow SSC\\ 3\end{array}$
1	0.4	0.6	0.2	0.6	0.6	0.4
2	0.5	0.5	0.5	0.6	0.5	0.2
3	0.5	0.3	0.5	0.6	0.5	0.4
4	0.4	0.4	0.6	0.4	0.6	0.5
5	0.7	0.4	0.7	0.3	0.5	0.6
6	0.5	0.4	0.6	0.3	0.4	0.7
7	0.3	0.6	0.5	0.5	0.4	0.5
8	0.4	0.7	0.3	0.6	0.3	0.5
Av.value	0.463	0.488	0.488	0.488	0.475	0.475

Table 14. Relative importance assessment for safety sub-criteria

Table 15 shows how the weights of the safety sub-criteria were calculated.

	Table 15. Weights of safety sub-criteria							
M.C	Sj⇔ j+1	Kj = Sj + 1	qj=qj-1/ kj	Wj=qj/∑qj				
SSC7		1.0	1.0	34.5				
SSC1	0.463	1.463	0.684	23.6				
SSC4	0.488	1.488	0.460	15.8				
SSC2	0.488	1.488	0.309	10.7				
SSC6	0.488	1.488	0.208	7.2				
SSC3	0.475	1.475	0.141	4.9				
3303	0.475	1.475	$\nabla = 2.898$	$3.3 \Sigma = 100$				
			<u> </u>	<u> </u>				

# **3.4.** Final weights of main criteria and sub criteria

Final results of weights for main criteria and sub-criteria by using the SWARA technique illustrated by Table 16.

Main Criteria         Wight         Sub-criteria         Weight           Avoiding and minimizing change orders         33.8           Accuracy of payrolls and other required documentation         22.7           Laws and regulations compliance and early payment         15.5           Cost         35.7         Documentation of the change order         4.8           Heinburg order         4.8         4.4           Initial project         7.3         project           Timely performs change order work         2.2           Time         24.2         Observance of the agreed-upon schedule         16.4           Timely performs change order vork and follow it         24.2         Observance of the agreed-upon schedule in a timely manner         5.0           Quality         Plan and specification adherence         33.5         7.5         Notification of buccharteors         4.5           Implementation of the QA/QC Plan         3.0         7.5         Mork Quality of Subcontractors         4.5           Implementation         Of autory of materials         0.9         QA/QC Plan         3.0           QA/QC Plan Adequacy         0.0         QA/QC Plan         3.0         QA/QC Plan         3.0           QA/QC Plan Adequacy of Materials         0.9         9.9         9.9		Table 16	6. The final weight for companies' performance evaluation criteria	
Organization and Management         Avoiding and minimizing change orders         33.8 Accuracy of payrolls and other required documentation         22.7 Laws and regulations compliance and early payment         15.5           Cost         35.7 Documentation of the change order         7.3 pricing of the change order work         2.2 project           Timely performs change order work         2.2 project         35.7 Documentation of the change order work         2.2 project           Timely performs change order work         2.2 Observance of the agreed-upon schedule         16.4 Unitial project schedule suitability         35.7 Schedule the work and follow it         24.2 Observance of the agreed-upon schedule         16.4 Unitial project schedule and timely submittal         7.5 Notification of changes to the schedule in a timely manner         5.0           Quality         16.3 Work Quality of Subcontractors         4.5 Imiler corract requirements         15.0 Timely correction of deficient work         10.3 QuAQC Plan Adequacy         2.0 QA/QC Plan Adequacy         3.0           Promptly resolve any issues after notification         3.4 Promptly resolve any issues after notification         3.4 Cooperation/Responsiveness with project staff, client and representatives         5.7 Enclow chan of aboth complex taff, client and representatives         5.7 Coordination         5.7 Follow chan of aboth complex taff, client and representatives	Main Criteria	Wight	Sub-criteria	Weight
Cost         Accuracy of payrolls and other required documentation         22.7           Cost         35.7         Documentation of the change order         15.5           Documentation of the change order         4.8         Identify changes as were needed, not at the end of the task or project         32.7           Timely performs change order work         2.2         Initial project schedule suitability         35.7           Timely performs change order work         2.2         Initial project schedule suitability         35.7           Time         24.2         Observance of the agreed-upon schedule         16.4           Timely performs change order work         2.2         2.1           Atherence to recovery schedule and timely submittal         7.5           Notification of changes to the schedule in a timely manner         5.0           Provide an effective inspection and quality control procedures         22.5           Meet the contract requirements         15.0           Timely correction of deficient work         10.3           Quality         16.3         Work Quality of Subcontractors         4.5           Implementation of the QA/QC Plan         3.0         QA/QC Plan Adequacy         3.0           QA/QC Documentation         1.4         Adequacy of Materials         0.9           Promptly resolve			Avoiding and minimizing change orders	33.8
Cost         35.7         Documentation of the change order pricing of the change order (dentify changes as were needed, not at the end of the task or project.         7.3           Time         24.2         Timely performs change order intial project schedule suitability         35.7           Schedule the work and follow it         24.2           Observance of the agreed-upon schedule         16.4           Timely performs change order receives and a curvacy of schedule updates         11.2           Adherence to recovery schedule updates         11.2           Provide an effective inspection and quality control procedures         22.5           Meet the contract requirements         15.0           Updating and specification adherence         30.3           Plan and specification adherence         3.0           Vork canning quality         6.9           Work Quality of Subcontractors Timely correction of deficient work         10.3           Quality         16.3         Work quality of Subcontractors Timely correction of project issues.         23.4           Cooperation/Responsiveness with project staff, client and representatives         23.4         Cooperation/Responsiveness with project staff, client and representatives         3.0           QA/QC Documentation         14.4         Adjust resources in response to demands of the project delivery schedule         3.0           Man			Accuracy of payrolls and other required documentation	22.7
Cost         35.7         Follow the contract's Labor Standards/Wage-Rate requirements         10.5           Y         35.7         Documentation of the change order         4.8           Identify changes as were needed, not at the end of the task or project         7.3           Time         24.2         Initial project schedule suitability         35.7           Time         24.2         Observance of the agreed-upon schedule         16.4           Adherence to recovery schedule and timely submittal         7.5           Adherence to recovery schedule and timely submittal         7.5           Notification of changes to the schedule updates         11.2           Adherence to recovery schedule and timely submittal         7.5           Meet the contract requirements         10.3           Timely correction of deficient work         10.3           Quality         16.3         Work Quality of Subcontractors         4.5           Implementation of the QA/QC Plan         3.0         2.0           QA/QC Documentation         1.4         Adequacy of Materials         9.9           Promptly resolve any issues after notification         34.6         6           Participate in the settlement of project staff, client and requirements are met         3.0         2.4           Corganization and         11.2			Laws and regulations compliance and early payment	15.5
Cost       35.7       Documentation of the change order       7.3         pricing of the change order       4.8         Identify changes as were needed, not at the end of the task or project       32.2         Timely performs change order work       2.2         Initial project schedule suitability       35.7         Schedule the work and follow it       24.2         Observance of the agreed-upon schedule       16.4         Timely performs change order work       21.2         Adherence to recovery schedule and timely submittal       7.5         Provide an effective inspection and quality control procedures       20.5         Work Quality of Subcontractors       4.5         Implementation of the QA/QC Plan       30.0         QA/QC Documentation       14.4         Adequacy of Materials       0.9         Promptly resolve any issues after notification       34.6         Participate in the settlement of project issues.       23.4         Organization and       Cooperation/Responsiveness with project staff, client and representatives       5.0         Organization and       Fersonnel who are both competivity meet expectations on project       4.5         Management       Follow chain of authority and comply with directions       6.7         Adjustr resources in response to demands of the pro	~		Follow the contract's Labor Standards/Wage-Rate requirements	10.5
Organization and Management         11.2 Follow is used harmonic to its	Cost	35.7	Documentation of the change order	7.3
Organization and Management       1.2       1.2         Organization and Management       1.1.2       Follow chain of authority and comply with directions Adjust resources in response to demands of the project delivery schedule       3.2         Promptly resources in response to demands of the project delivery schedule       1.2.         Promptly resources in response to demands of the project delivery schedule       3.2         Promptly resources in response to demands of the project delivery schedule       3.2         Promptly resources in response to demands of the project delivery schedule       3.2         Promptly resources in response to demands of the project delivery schedule       3.2         Promptly resources in response to demands of the project delivery schedule       3.2         Promptly resolve any issues after notification Adjust resources in response to demands of the project staff. Client and representatives       1.2         Promptly resolve any issues after notification Adjust resources in response to demands of the project delivery schedule       3.0         Promptly resolve any issues after notification Adjust resources in response to demands of the project delivery schedule       3.0         Promptly resolve any issues after notification Adjust resources in response to demands of the project delivery schedule       3.0         Promptly resolve any issues after notification Adjust resources in response to demands of the project delivery schedule       3.0         Presonnel who are both			pricing of the change order	48
Organization and Management         Progect Timely performs change order work         2.2           Time         24.2         Initial project schedule suitability Schedule the work and follow it         24.2           Time         24.2         Observance of the agreed-upon schedule updates         11.2           Adherence to recovery schedule and timely submittal         7.5           Notification of changes to the schedule in a timely manner         5.0           Plan and specification and puality control procedures         22.5           Meet the contract requirements         15.0           Timely correction of deficient work         10.3           Quality         16.3         Work Ruality         6.9           Vork Quality of Subcontractors         4.5         1           Implementation of the QA/QC Plan         3.0         QA/QC Plan Adequacy         2.0           QA/QC Plan Adequacy         2.0         2.4         2.4           Organization and         1.4         Adequacy of Materials         0.9           Promptly resolve any issues after notification         34.6         7           Participate in the settlement of project issues.         2.3.4         Cooperation/Responsiveness with project staff, client and representatives         5.8           Carry out activititis in a timely manner that does not disrupt other p			Identify changes as were needed not at the end of the task or	3.2
Organization and Management         Project Timely performs change order work         2.2           Timely performs change order work         2.2           Timely performs change order work         35.7           Schedule the work and follow it         24.2           Observance of the agreed-upon schedule         16.4           Timely performs change to the schedule updates         11.2           Adherence to recovery schedule in a timely manner         5.0           Plan and specification adherence         33.5           Provide an effective inspection and quality control procedures         22.5           Meet the contract requirements         15.0           Timely correction of deficient work         10.3           Quality         16.3         Work Quality of Subcontractors         4.5           Implementation of the QA/QC Plan         3.0         0.4/QC Plan Adequacy         2.0           QA/QC Documentation         1.4         2.4         2.3 4           Cooperation/Responsiveness with project starf, client and         15.8         2.3 4           Cooperatives         Carry out activities in a timely manner that does not disrupt other         9.9           people's work or cause harm to their property.         6.7         Actively and cooperatively meet expectations on project         4.5           Aujus			project	5.2
Organization and Management         Promptly resolution to finish the job on time.         21.2 (Adjust resource or large of using birder)         35.7 (Adjust resource)           Organization and Management         24.2         Observance of the agreed-upon schedule updates Timeliness and accuracy of schedule updates         11.2 (Adherence to recovery schedule and timely submittal 7.5 (Notification of changes to the schedule in a timely manner         5.0 (Plan and specification adherence Provide an effective inspection and quality control procedures Meet the contract requirements Timely correction of deficient work         10.3 (Plan add pacification)           Quality         16.3         Work Quality of Subcontractors Work Quality of Subcontractors         4.5 (Promptly resolve any issues after notification Promptly resolve any issues after notification         34.6 (Participate in the settlement of project issues.           Organization and Management         11.2 (Follow chain of authority and comply with directions Actively and cooperations to ensure that does not disrupt other people's work or cause harm to their property.         9.9 (Porganization (Adjust resources in response to exercise authority, coordinate, and supervise work operations to ensure the timeline and requirements are met         3.0 (Nork with subcontractors to exercise authority, coordinate, and supervise work operations to ensure the timeline and requirements are met         3.0 (Promptly resolved in the job on time.         2.5 (Proversite requipment to finish the job on time.         2.5 (Proversite requipment to finish the job on time.         2.5 (Proversite requipment to finish the job on time.         3.0 (Proversite accidents)         3.0 (			Timely performs change order work	2.2
Time     24.2     Observance of the agreed-upon schedule     16.4       Time     24.2     Observance of the agreed-upon schedule     16.4       Timeliness and accuracy of schedule updates     11.2       Adherence to recovery schedule and timely submittal     7.5       Notification of changes to the schedule in a timely manner     5.0       Plan and specification adherence     33.5       Provide an effective inspection and quality control procedures     22.5       Meet the contract requirements     15.0       Timely correction of deficient work     10.3       Work Quality of Subcontractors     4.5       Implementation of the QA/QC Plan     3.0       QA/QC Plan Adequacy     2.0       QA/QC Plan Adequacy     2.0       QA/QC Plan Adequacy     2.0       QA/QC Plan Adequacy     2.4       Corganization and     1.4       Adequacy of Materials     0.9       Promptly resolve any issues after notification     4.6       Participate in the settlement of project staff, client and representatives     5.7       Organization and     11.2     Follow chain of authority and comply with directions     6.7       Actively and cooperatively meet expectations on project     4.5     2.1       Management     11.2     Follow chain of authority and comply with directions     6.7 <t< td=""><td></td><td></td><td>Initial project schedule suitability</td><td>25.7</td></t<>			Initial project schedule suitability	25.7
Time       24.2       Observance of the agreed-upon schedule       16.4         Time       24.2       Observance of the agreed-upon schedule updates       11.2         Adherence to recovery schedule and timely submittal       7.5         Notification of changes to the schedule in a timely manner       50         Plan and specification adherence       33.5         Provide an effective inspection and quality control procedures       22.5         Meet the contract requirements       10.3         Work Quality of Subcontractors       4.5         Timely correction of deficient work       10.3         WorkQuality of Subcontractors       4.5         Implementation of the QA/QC Plan       3.0         QA/QC Plan Adequacy       2.0         Quality       11.2         Follow chain of authority and comply with directions       6.7         Adequacy of Materials       0.9         Promptly resolve any issues after notification       9.9         people's work or cause harm to their property.       3.0         Management </td <td></td> <td></td> <td>Schedule the work and follow it</td> <td>24.2</td>			Schedule the work and follow it	24.2
Address     24.2     Observance of the agreed-upon schedule     10.4       Year     Timeliness and accuracy of schedule updates     11.2       Adherence to recovery schedule and timely submittal     7.5       Notification of changes to the schedule in a timely manner     5.0       Plan and specification adherence     33.5       Provide an effective inspection and quality control procedures     22.5       Meet the contract requirements     15.0       Timely correction of deficient work     10.3       Work Quality of Subcontractors     4.5       Implementation of the QA/QC Plan     3.0       QA/QC Documentation     1.4       Adequacy of Materials     0.9       Promptly resolve any issues after notification     34.6       Participate in the settlement of project states.     23.4       Cooperation/Responsiveness with project staff, client and representatives     15.8       Carry out activities in a timely manner that does not disrupt other people's work or cause harm to their property.     9.9       Prostively and cooperatively meet expectations on project     4.5       Management     11.2     Follow chain of authority and comply with directions     6.7       Actively and cooperatively meet expectations on project     2.1     5.5       Resources     7.4     Personnel who are both completent and sufficient to accomplish the assignment on time.	Time		Observance of the served upon schedule	24.2 16.4
Organization and Management       11.2 Adherence to recovery schedule and timely submittal       7.5 Notification of changes to the schedule in a timely manner       5.0         Quality       Plan and specification adherence       33.5         Provide an effective inspection and quality control procedures       22.5 Meet the contract requirements       15.0         Timely correction of deficient work       10.3       0.0         Work Quality of Subcontractors       4.5         Implementation of the QA/QC Plan       3.0         QA/QC Documentation       1.4         Adequacy of Materials       0.9         QA/QC Documentation       1.4         Adequacy of subcontractors       2.3         Promptly resolve any issues after notification       34.6         Participate in the settlement of project issues.       23.4         Cooperation/Responsiveness with project staff, client and representatives       5.0         Carry out activities in a timely manner that does not disrupt other people's work or cause harm to their property.       9.9         People's work or cause harm to their project staff, client and representatives       3.0         Work with subcontractors to exercise authority, coordinate, and supervise work operations to ensure the timeline and requirements are met       3.0         Adjust resources in response to demands of the project delivery schedule       3.0 <td>Time</td> <td>24.2</td> <td>Timeliness and accuracy of achedule undeter</td> <td>10.4</td>	Time	24.2	Timeliness and accuracy of achedule undeter	10.4
Adherence to recovery schedule and timely submittal         7.5           Notification of changes to the schedule in a timely manner         5.0           Plan and specification adherence         33.5           Provide an effective inspection and quality control procedures         22.5           Meet the contract requirements         15.0           Timely correction of deficient work         10.3           Quality         16.3         Workmanship quality         6.9           Work Quality of Subcontractors         4.5         1.1           Implementation of the QA/QC Plan         3.0         0           QA/QC Plan Adequacy         2.0         0           QA/QC Documentation         1.4         4           Adequacy of Materials         0.9           Promptly resolve any issues after notification         34.6           Participate in the settlement of project issues.         23.4           Cooperation/Responsiveness with project staff, client and representatives         Carry out activities in a timely manner that does not disrupt other people's work or cause harm to their property.         9.9           and         11.2         Follow chain of authority and comply with directions         6.7           Actively and cooperatively meet expectations on project         4.5         5.0           Work with subcontractors to			Timenness and accuracy of schedule updates	11.2
Organization and Management         11.2         For exercise authority control procedures provide an effective inspection and quality control procedures meter the contract requirements         33.5           Quality         16.3         Work manship quality         6.9           Work Quality of Subcontractors         4.5           Implementation of the QA/QC Plan         3.0           QA/QC Plan Adequacy         2.0           QA/QC Plan Adequacy         2.0           QA/QC Pocumentation         1.4           Adequacy of Materials         0.9           Promptly resolve any issues after notification         34.6           Participate in the settlement of project issues.         23.4           Cooperation/Responsiveness with project staff, client and representatives         15.8           Carry out activities in a timely manner that does not disrupt other people's work or cause harm to their property.         9.9           Interpretentatives         6.7           Actively and cooperatively meet expectations on project         4.5           cordination         Autively and cooperatively meet expectations on project         4.5           Adjust resources in response to demands of the project delivery schedule         3.0         3.0           Enough equipment to finish the job on time.         25.5         7.4         Personnel who are both comptent and sufficient			Adherence to recovery schedule and timely submittal	7.5
Plan and specification adherence33.5 Provide an effective inspection and quality control procedures33.5 Provide an effective inspection of deficient work10.3Quality16.3Work Quality of Subcontractors4.5 Implementation of the QA/QC Plan3.0 QA/QC Plan Adequacy2.0 QA/QC Documentation1.4 Adequacy of MaterialsOrganization and ManagementPromptly resolve any issues after notification34.6 Participate in the settlement of project issues.23.4 Cooperation/Responsiveness with project staff, client and representatives15.8 Cooperation/Responsiveness with project staff, client and representativesOrganization and Management11.2Follow chain of authority and comply with directions Actively and cooperatively meet expectations on project coordination3.0 Work with subcontractors to exercise authority, coordinate, and supervise work operations to ensure the timeline and requirements are met3.0 Work with subcontractors to exercise authority, coordinate, and supervise work operations to ensure the timeline and requirements are met37.6 ScheduleResources7.4Personnel who are both competent and sufficient to accomplish the assignment on time. All of the equipment complies with or exceeds the specifications. Take adequate precautions with any hazardous materials11.6 Trained and Skilled WorkforcePractices5.2The safety equipment is in perfect working order. Conduct the Periodic audits o			Notification of changes to the schedule in a timely manner	5.0
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QualityMeet the contract requirements15.0Quality16.3Timely correction of deficient work10.3Work manship quality6.9Work Quality of Subcontractors4.5Implementation of the QA/QC Plan3.0QA/QC Documentation1.4Adequacy of Materials0.9Promptly resolve any issues after notification34.6Participate in the settlement of project issues.23.4Cooperation/Responsiveness with project staff, client and representatives15.8Corganization and Management11.2Follow chain of authority and comply with directions6.7Actively and cooperatively meet expectations on project3.0Work with subcontractors to exercise authority, coordinate, and supervise work operations to ensure the timeline and requirements are met3.0Resources7.4Personnel who are both competent and sufficient to accomplish the assignment on time. All of the equipment to finish the job on time.25.5Resources7.4Personnel who are both competent and sufficient to accomplish the assignment on time. All of the equipment to finish the job on time.34.5Take adequate precautions with or exceeds the specifications. Take adequate precautions with any hazardous materials34.5Safety Practices5.2The safety equipment is in perfect working order. Conduct the Periodic audits of compliance Take adequate precautions with any hazardous materials15.8Probley Proverve reverved5.2The safety equipment is in perfect working order. Conduct the Periodic audits of c			Provide an effective inspection and quality control procedures	22.5
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10.3     Work Quality of Subcontractors     4.5       Implementation of the QA/QC Plan     3.0       QA/QC Plan Adequacy     2.0       QA/QC Documentation     1.4       Adequacy of Materials     0.9       Promptly resolve any issues after notification     34.6       Participate in the settlement of project issues.     23.4       Cooperation/Responsiveness with project staff, client and representatives     20.9       Carry out activities in a timely manner that does not disrupt other people's work or cause harm to their property.     9.9       People's work or cause harm to their property.     6.7       Actively and cooperatively meet expectations on project     4.5       coordination     3.0       Management     11.2       Follow chain of authority and comply with directions     6.7       Actively and cooperatively meet expectations on project     4.5       coordination     3.0       Work with subcontractors to exercise authority, coordinate, and supervise work operations to ensure the timeline and requirements are met       Adjust resources in response to demands of the project delivery schedule     5.5       Resources     7.4     Personnel who are both completent and sufficient to accomplish the assignment on time.     34.5       Safety     5.2     The safety equipment to ensure the health and safety of the employces     3.6       Take the initiativ	Quality	163	Workmanship quality	6.9
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Organization and Management       QA/QC Plan Adequacy QA/QC Documentation       1.4         Adequacy of Materials       0.9         Promptly resolve any issues after notification       34.6         Participate in the settlement of project issues.       23.4         Cooperation/Responsiveness with project staff, client and representatives       15.8         Carry out activities in a timely manner that does not disrupt other people's work or cause harm to their property.       9.9         Follow chain of authority and comply with directions       6.7         Actively and cooperatively meet expectations on project       4.5         coordination       3.0         Work with subcontractors to exercise authority, coordinate, and supervise work operations to ensure the timeline and requirements are met       3.0         Resources       7.4       Personnel who are both competent and sufficient to accomplish the assignment on time.       25.5         Resources       7.4       Personnel who are both competent and sufficient to accomplish the assignment on time.       34.5         Take the initiative to ensure the health and safety of the employees       34.5       34.5         Take adequate precautions with any hazardous materials       15.8         Properly report all injuries of damage associated with project       4.9         Properly report all injuries or damage associated with project       4.9			Implementation of the QA/QC Plan	3.0
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### 4. Conclusions

This study presented the SWARA technique to prioritize performance evaluation criteria. The SWARA tool play a significant impact in the making of a decision and to compute the final weighted values of performance criteria. This study identified six main criteria and forty-four sub criteria that directly influence the success of construction firms, and they could be utilized by practitioners in the Iraqi construction business to better assess the company's performance. As the Iraqi construction market grows, the conclusions of this study will aid international corporations in understanding the success criteria by which Iraqi construction firms are measured. The findings of this study can help guide the process of evaluating the performance of construction companies' performance is cost, followed by time, quality, organization and management, resources, and lastly safety practices. The worth of this paper is to assist in determining the performance of companies in construction sector as well as the relative importance of decision criteria in measuring the performance of Iraqi construction sector companies using the SWARA technique.

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