Factors Affecting Construction Projects' Cost Estimating.

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Abstract

A construction project's success depends on its planning, accurate cost estimating is critical in both public and private enterprises. Public building projects in Saudi Arabia have been plagued by enormous overruns and delays over the previous three decades due to poor construction performance. The purpose of the research is determining the most critical factors affecting the accuracy of Saudi Arabian public project construction cost estimates. A questionnaire survey was given to 100 participants at random,95 of whom were males and 5 of whom were women, in order to acquire data. Cost estimates for Saudi public building projects are affected by financial concerns, the bidding situation and project features, as well as the estimation technique. The results found that the main factor related to financial issues. And the most significant factors of financial issues, which affecting cost estimates are financial status of client market, the unstable economic situation, cost estimation accuracy, financial resource availability, punctuality of cost flow as well as the availability of high-quality financial plans and accurate estimation. Besides, the most significant factors of bidding situation, which affecting cost estimates are designer and design quality, company's strength and reputation in the construction industry, and amount of experience on such projects. Furthermore, the most significant factors of project characteristics, which affecting cost estimates are project manager competence, owners' requirement, Project specification and requirement, as well as project duration. Finally, the most significant factors of estimating process, which affecting cost estimates are project team's experience, time allowed for preparing estimates and availability of cost indices.

Keywords

cost estimation, public construction projects, financial issues, bidding situation, and estimating process

1. Introduction:

The project's cost performance is a critical consideration for project's parties involved in construction of the project. Early on in the planning and development phase, it is critical to have a precise costs estimation of construction projects. Project's parties involved in construction projects need accurate and early cost estimations prior to the acquisition of a site and the commitment of a building so that they may make informed judgments about the project's viability. (Mahamid, Al-Ghonamy & Aichouni, 2014). The Saudi government's development plans for public construction projects have resulted in major cost overruns and delays, as well as substandard construction performance, throughout the previous three decades. Studies have argued that the low-bid delivery strategy followed by the Saudi government in the execution of public construction projects are the essential factor in causing such cost estimating errors, as long as low bids for contracts didn't necessarily estimate the real project cost accurately (Al-Kharashi & Skitmore, 2009). Inaccurately estimating the costs of Saudi public works has resulted in the country losing billions of dollars in building projects, and a major drop in quality standards and requirements for public construction projects (Alzara et al., 2018). To minimize these losses and delays in execution . The KSA has to build a procedure for estimating cost of public projects. In order to accurately estimate a project's cost, a thorough review of the bid papers and the environmental circumstances is necessary, as well as an accurate cost analysis that ensures that the project is finished within the estimated budget.

2. Problem Statement:

Saudi Arabia has shown a growth in the number of construction projects over the past three decades, going to attract construction experts from all over the world as part of the government's national improvement plans; nevertheless, Saudi construction time and cost performance should be seen as a standout among the common and serious issues - (Faridi and Al-Sayegh, 2006). Assaf and Al-Hejji (2006) - found that just (30%) of public Saudi construction projects were achieved inside predetermined budget and timetable. Along these lines, it is important to recognize the principle factors contributing to the cost overrun or underestimate in construction projects in Saudi Arabia so as to overcome that critical issue.

Accordingly, this study represents an endeavor to extract the major factors affecting on cost estimate's accuracy for public building construction in Saudi Arabia. These factors that must be taken by estimator consideration when preparing a cost estimate and feasibility studies for public construction projects. Then, develop a model that evaluates the impact of relevant inaccurate cost estimate, so that it leads to:

1. Avoid submitting the contractor for an exaggerated offer.

2. Cost variation (cost overruns or underestimations) is a factor of needed accuracy of estimating cost.

3. Improving cost control process' efficiency and construction projects' performance.

3. Scope and Objectives:

The study's primary objective is to "determine key elements influencing accuracy of cost estimate for public construction development in Saudi Arabia."

4. Research Methodology:

The research method would be as follows:

1. Defining the research's problem through the literature review of related literature and previous studies conducted in this study field.

2. Identifying and Study of existing literature and consultation with Saudi construction professionals to identify all essential factors which effect on the accuracy of cost estimates of public construction projects. Carrying out an email distributed questionnaire survey to determine the critical factors that severely impact the cost estimation process in Saudi public construction projects.

3. Analyzing the collected relevant data from the selected sample of construction projects. Such analysis would help into determining how pre-determined The accuracy of the costing process may be affected by issues associated with the cost estimation process. The precision of the cost estimating procedure is shown by the determination of cost variance. Providing suggestions and recommendations based on the analysis, which could help in improving the accuracy of the cost estimating process for public building projects in Saudi Arabia.

5. Data Analysis:

• Cost estimating:

Cost estimation was defining in various ways by researchers and experts .However, they all agreed on what they wanted to accomplish and main intentions. Larson and Gray (2011) defined it as the process by which project's cost and financial resources are predicted and forecasted to accomplish the project objective. Moreover, Akintoye (2000) concentrated on the technicality of cost estimation for predicting and allocating suitable financial resources and costs for implementing projects' activities that are required to achieve the objectives and intentions of such construction project within a specific period of time and without confronting any delays or postponements.

In the same manner, different construction institutes and agencies defined this process and obviously assumed it as a focal concern of any initiated construction projects. For example - Chartered Institute of Building (CIOB, 2009) - construction project cost estimation has been recognized as a major issue through which predicted costs and resources are allocated. Moreover, the Association for Advancement of Cost Engineering (AACE, 2013) considers it as a basic process for project planning and management, scheduling and costing control as well as financial budget planning. Similarly, the Project Management Institute (PMBOK, 2013) the process of estimating how much money and resources will be expected to accomplish a project's operations within the allotted time frame.

At all, the researcher concluded from the previous wide variety of definitions that they are all agreed that cost estimation is a way of forecasting the future costs for construction projects and forecasting it before it implemented. Nonetheless, the final cost of project will not be recognized till the facility's construction and operation is completed.

• Cost Variance (CV):

Cost variance represents an evaluation instrument for the construction project's financial performance. It mainly compares the project's budget that has been allocated before the initiation of the project with its really cost after it is accomplished. ACWP (Actual Cost of Work Performed) is calculated by subtracting BCWP (Budgeted Cost of Work Performed) from following equation (Asal, 2014):

Cost Variance (CV) = budgeted cost of work performed (BCWP) – actual cost of work performed (ACWP)

The ideal situation would be achieved if the ACWP of the project matches its BCWP; but commonly, this is practically difficult to accomplish. The reason for realizing project's CV is to enable project managers and contractors to check up and evaluate their funds as construction project is progressing (AACE, 2013). In this study, CV is considered as: difference between estimated value project cost from actual value/ the same project's cost.

6. Cost Estimating Elements:

Projects' Cost estimating consisted of three vital components which are (Asal, 2014):

• Direct Costs:

This type of cost is the ones which are either wholly or in part, attributable to performance of the project and is mainly needed for project's completion (AACE, 2013). This cost in construction project consisted of staff and labor costs, contractual services, operating expenses, purchases, installed equipment, materials as well as supervision that are immediately involved in the facility physical construction.

• Indirect Costs:

Those costs are also known as Project Servicing Cost (PSC). It is the type of costs that are not immediately attributable to the completion of the project, however it may contribute the performance of it and facilitates its implementation and progress. This type mainly includes the costs allocated for services provision and other support administrative operations to a financed project (AACE, 2013). In construction field, these costs are not a permanent part for installation; rather they are needed for the completion of the installation in an organized way. They include direct supervision, startup costs, field administration, insurance, contractor fees, etc.

• Markup:

This is utilized variously in construction project estimating. It mainly includes percent applications such as profit, overhead and other indirect costs as stated by Asal (2014). For construction purposes and for this study, this type of cost is divided into the following two categories:

• Profit:

This type forms the minimum investments' return to be accepted, and it is risk function. Its amount which will be added to estimated work is conditional only to the contractor and is determined individually for each offer, since there is no specific amount to be added. Its amount is varied depending on competition, local conditions, and the extent of the desired job (Asal, 2014).

• Contingency:

It is the amount of cash to be added to cost estimation for the purpose of covering any possible unanticipated needs of the construction project, challenges, or estimation inaccuracy. Chief estimator usually adds contingency value to the estimated cost in order to cover unforeseen materials or labors' cost escalation, project complexity, unusual construction methods and startup requirements, etc. It is normally estimated through statistical analysis or depending on past project experiences (Mak & Picken, 2000).

7. Cost Estimation Types

For construction projects' cost estimation, estimating and cost evaluation efforts are needed to be applied at different stages of the project (Liu & Zhu, 2007). Project Management For Construction (2013) suggested that cost estimating of THE construction may be evaluated from different viewpoints owing to various institutional requirements and accordingly cost estimating passes through numerous stages during the project life. From the starting stage of any project till its completion, cost estimation types are varied and progressed along it. This can be observed as it is represented in the following Fig .1 which
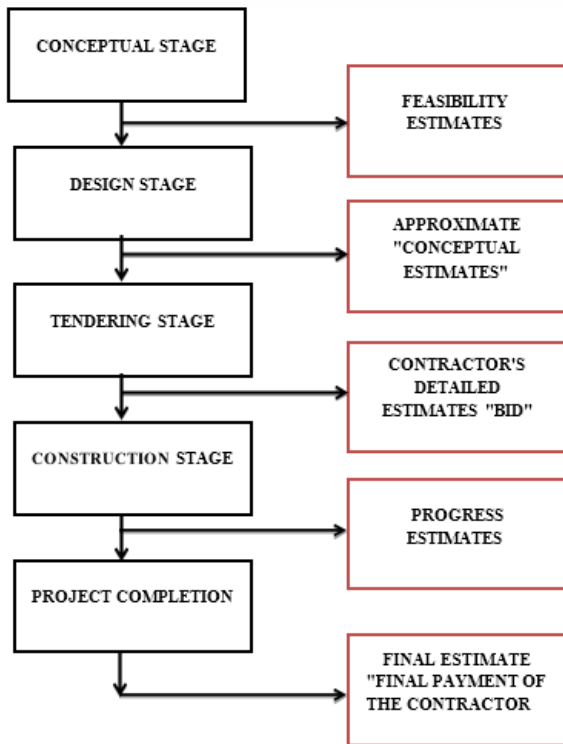

Figure 1. Cost Estimation Types (Akeel, 1989)

Table 1. Factors Affecting on Construction Projects obtained from literature review and previous studies.

No.	Author.	Year.	Factor.	No.	Author.	Year.	Factor.
1	Akintoye	2000	• Project's complexity • Technology requirements • Project's information • Contract's requirements • Labor requirement • Project duration • Environmental and climate issues	5	Toor and Ogunlana	2008	• Labor and equipment availability • Contract period • Competence of construction manager • Owners requirement • Labors, designers and contractors' nationalities • Social and cultural impact • Unforeseen and unexpected changes in local laws and specifications • Social and political situation.
2	Oberlender and Trost	2001	• Cost information and team experience • Allowed time for preparing estimates • Methods utilized in estimation • Availability of cost indices • Procurement standards	6	Odusami	2008	• The consultants or estimators' expertise • financial information and cash flow requirement, • Team's experiences • Methods utilized in estimating
3	Oberlender and Trost	2001	• cost information and team experience • Allowed time for preparing estimates • Methods utilized in estimation • Availability of cost indices • Procurement standards	7	Liu and Wang	2010	cash flow
4	Enshassi, Mohamed and Madi	2007	• Financial status of client • Market condition • Unstable economic situation • The availability of high quality financial plans and • Accurate estimation.	8	Oladokun et al.	2011	• Project size • Project sector
9	Liu and Zhu	2007	• Cost estimation accuracy • Fluctuation average • Financial resource availability T • The type of procurement system • The stability of economic conditions.	12	Oyeyipo et al.	2016	• Financial capability of clients • Availability of material • availability of capital

No.	Author.	Year.	Factor.	No.	Author.	Year.	Factor.
10	Azman et al.	2013	• Types of project • Design scopes • Location • Project size, • Type and size of contract • Labor and equipment required	13	Alsaedi et al.	2019	• Job size • Strength and reputation of the Company in the construction industry • Type of the project • Designer and quality of designs . • Project's cash flow and rate of interest and return
11	Mahamid	2015	• Contract • management • Fluctuation in currency exchange rate • Level of competitor • Project financing • Cost of materials				

8. Conceptual design Checklist of Cost Estimating factors that may affect Saudi Public construction projects

Through the examination and reviewing of the past studies and research conducted in this field, the researcher considered the following list of factors to be a predetermined list for factors that he would include in preparing his study's questionnaire.

Table 2. Project's financial issues

Financial Issues	
Financial status of client	Fluctuation average
market condition	Financial resource availability
The unstable economic situation	Type of procurement system
The availability of high-quality financial plans and accurate estimation	Punctuality of cash flow
Cost estimation accuracy	

Table 3. Project's bidding Situation

Bidding Situation	
Company's strength and reputation in the construction sector	Number of competitors in tendering
Designer and design quality	Previous experience on similar projects
project cash flow and rate of interest and return	Contractors' need for work
Availability of capital	Profitability

Table 4. Project characteristics

Project Characteristics	
Project size	Climate and environmental issues
Project location	Type and size of contract
Cultural and social situation	Project manager competence
Labor nationalities	Owners' requirement
Project specification and requirement	Political situation
Unexpected change in local laws and conditions	Project duration

Table 5. Project characteristics

Estimating Process	
Project team's experience	Procurement standard
Time allowed for preparing estimates	Estimating method
Availability of cost indices	Method utilized in determining contingency

According to the reviewed previous works and research, factors affecting the construction cost estimating accuracy are determined and summarized into a list of 35 factors It will serve as a basis for the research's questionnaire.

• Questionnaire Design:

In accordance with study aim, the main purpose of this questionnaire was to study of the analysis the design of the essential factors affecting on cost estimate accuracy of public building construction in Kingdom of Saudi Arabia, and the questionnaire no. 1 consisted of (35) items distributed on four dimensions, namely "project financial issues, project bidding situation, project characteristics, and estimating process ". The researcher has used the fifth Liker project scale to gauge the views of the participants, (V. major effect) has been provided (5), and (Major effect) given (4) while (Minor impact) was given (3), and (V. minor effect) is given

(2), and lastly (No effect) was given (1). (1). The categorization used to determine averages is shown in the following table.

Table 6. Mean values & their interpretation

Mean values	Response Standard (degree)
1 - 1.80	No effect
1.81 - 2.60	V. minor effects
2.61 - 3.40	Minor effects
3.41 - 4.20	Major effects
4.21- 5	V. major effects

The questioner's final script is included in Appendix (A). A sentence's rank is determined by its greatest mean value, with the first sentence displaying the Mean number one, followed by the Number two, and so on all the way down to the lowest Mean values.

• Statistical process:

The following statistical process and results through statistical software application (SPSS) were used:
- Reliability (Cronbach Alpha).
- Study participants' characteristics are shown as frequency and percentage.
- Means and standard deviation for research domains.

• Normality:

Normality test is one of the essential tests before moving through the data analysis, in which the normality assumption for each variable must be validated. The normality features of data dictate the adequate test applied for hypothesis testing.
There are several approaches to evaluate the normality of data; one of the most prominent is utilizing the Skewness and Kurtosis values that effectively deliberate the distribution shape of responses which acquired from two tests; Kolmogorov-Simirnov and Shapiro-Wilk tests. Table 7 shows negative skews and kurtosis negative value means that there is a flatter pattern in distribution of responses, while positive kurtosis shows a peaked distribution. As seen in the same table, all values were between +1 to -1, which implies that it is acceptable.

Table 7. Normality's test of factors affecting Saudi public building construction projects' cost estimating)

Component	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
Financial issues	.041	.241	-.781	**.478**
Bidding situation	-.134	.241	.027	**.478**
Project characteristics	-.370	.241	.414	**.478**
Estimating process	**-.094**	**.241**	**-.594**	**.478**

Regarding Table 8, Kolmogorov-Simirnov and Shapiro-Wilk statistics show that the significance of the factors affecting Saudi public building construction projects' cost estimating are equal to (.008), (.172), (.066), (.189) in accordance with the Kolmogorov-Simirnov theory. The Shapiro-Wilk test's significant value is also equal. (.046), (.309), (.025), (.096) respectively, that are less than (0.05) for financial issues thus significant values indicate that the data is deviated from the non-normal distribution significantly, As well as the bidding situation, project characteristics, and estimating process which are more than 0.05 This considerable number reflects the data is varied from the normal distribution considerably.

Q-Q plots are another approach to examine response normality. Figures 2, 3, 4 and 5 show the Q-Q plots Cost estimates for Saudi public building construction projects are affected by a variety of variables, including budgetary concerns, bidding circumstances, project features, and the estimation process itself.

Table 8. Kolmogorov-Smirnov and Shapiro-Wilk Tests

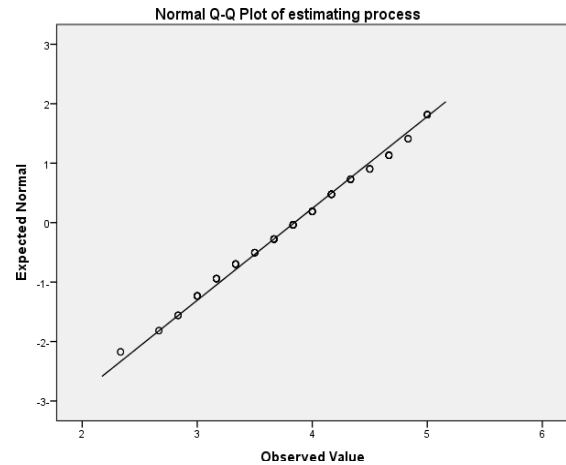|	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Financial issues	.106	100	.008	.9100	100	**.046**
Bidding situation	.076	100	.172	.985	100	**.309**
Project characteristics	.086	100	.066	.971	100	**.025**
Estimating process	**.075**	**100**	**.189**	**.978**	**100**	**.096**
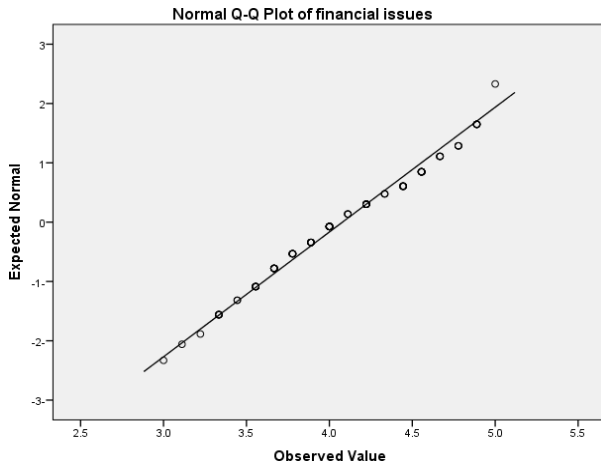
Figure 2. Normality of items of financial issues

Figure 3. Normality of Items of bidding situation

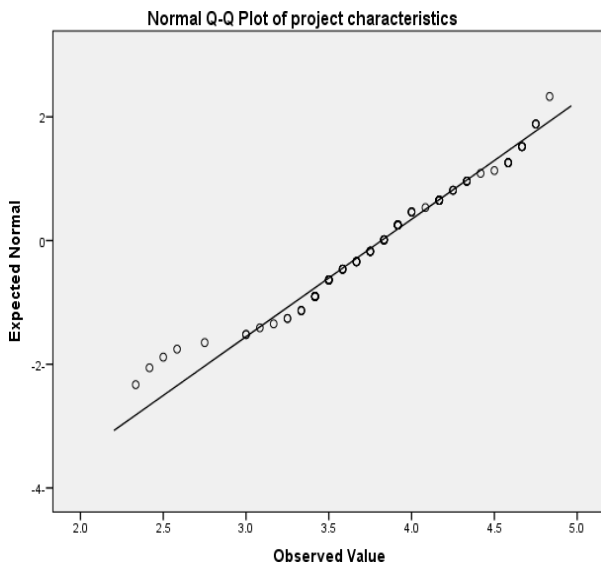
Figure 4. Normality of Items of project characteristics

Figure 5. Normality of estimating process & items

- **Reliability analysis:**

The survey was administered to 100 study participants as part of a pilot study, and the researcher evaluated (Cronbach's alpha) results to identify reliability of the questionnaire.

Table 9. Reliability's result

NO.	Variables	Cranach's Alpha	Item No.
1	Project financial issues	.736	9
2	Project bidding situation	.710	8
3	Characteristics of the project	.788	12
4	Estimating process	.836	6
	Factor affecting Saudi public building construction projects cost estimating	.904	35

Table 9 shows the reliability financial issues is equal to 0.736, the reliability of bidding situation is equal to 0.710, the reliability of the project characteristics is equal to 0.788, and the reliability of estimating process is equal to 0.836. The highest Cronbach' alpha value reached (0.836) for the total alpha values of factors affecting Saudi public building construction projects' cost estimating " reached (0.904). This suggests that one accepts the dependability of others.

9.   Descriptive records and its analysis:

i.   Respondents demographics' profile:
The demographic profile of respondents in this study is presented in following table
The summary of demographic information from participants is represented; It is in this section that we look at the distribution of the questionnaire in a non-discriminatory method

ii. Participants' demographic profile:

The study tool was distributed among all workers in the public building construction of Saudi Arabia. Percentage and frequency were computed for each demographic variable to explore the participant's profile. The total number of participants in this study was 100 employees, belonging to various gender, age, and Number of experience years, which gain the study responses about research objectives and questions.

Table 10. Demographic Characteristics of the Participants in the Study

Independent Variable	Category	Frequency	Percent %
Gender	Male	95	95
	Female	5	5
	Total	**100**	**100**
Age	23-28 years	6	6
	29-34 years	15	15
	35-40 years	32	32
	More than 40	47	47
	Total	**100**	**100**
Number of experiences	Less than 3	4	4
	3-5 years	3	3
	6-10 years	16	16
	More than 20	77	77
	Total	**100**	**100**

According to gender category, the high percentage of participant was male with total 95% of employees in the public building construction of Saudi Arabia participants, while the female participants represented only 5% of employees in the public building construction of Saudi Arabia participants.
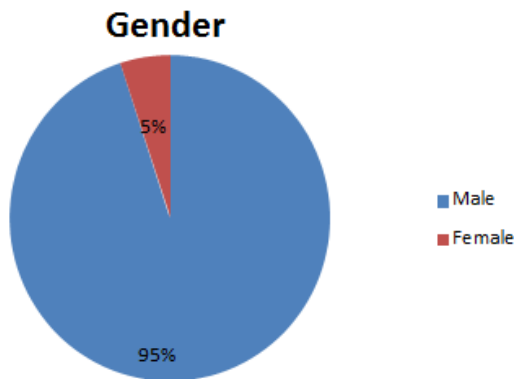

Figure 6. Demographic profile: gender

Furthermore, Table 10 shows the majority of employees for the public construction of Saudi Arabia participant age was within more than 40 years, and 35-40 years totaling of 47%, 32% respectively of the study participants. While the age participants less than 23-28 years represents only 6%. As shown in figure below.
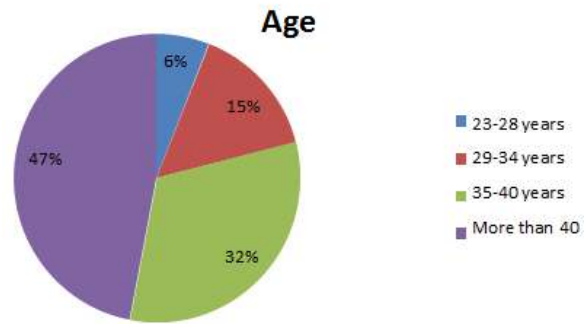

Figure 7. Demographic Profile: (Age)

In term of the experience variable, the frequencies of categories shows that the higher common to (more than 10 years) total 77% of the study, while the employees for the public construction of Saudi Arabia participants of (6-10 years) years with 16% of the employees in the public building construction participants. The fewer employees in the public building construction of Saudi Arabia participants have 3-5 years with 3%. As shown in figure below
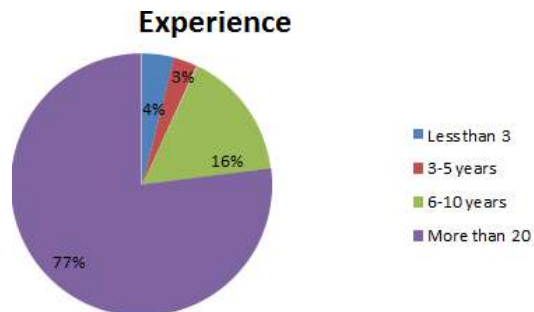
Figure 8. Demographic profile: experience

10. Conclusions:

The factors affecting Saudi public building construction projects' financial struggles, the bidding situation, the project characteristics, and other factors are all considered while cost estimates and estimating process. In this regard, financial issues include financial status of client, market condition, the unstable economic situation, the availability of high-quality financial plans and accurate estimation, fluctuation average, cost estimation accuracy, financial resource availability, type of procurement system, and punctuality of cash flow. The main factor related to financial issues. Additionally, the most significant factors of financial issues, which affecting cost estimates are financial status of client market, the unstable economic situation, cost estimation accuracy, financial resource availability, punctuality of cost flow as well as the availability of high-quality financial plans and accurate estimation.

On the other hand, the most significant factors of estimating process, which affecting cost estimates are project team's experience, time allowed for preparing estimates and availability of cost indices. These results have been supported by many former studies' outcomes. identified that these factors were: the consultants or estimators' expertise, project team experience and the techniques used to estimate direct, indirect, and contingency costs, as well as the quality of financial information and cash flow requirements,   Contract management, currency exchange rate variation, level of rivals, project financing, and material cost are the top five impacting factors.

11. Recommendations:

The following some recommendations to enhance the cost estimating:

1. To minimize erroneous and misleading cost estimates, it is proposed that an artificial neural network or other approach be used to establish a cost estimate model that can calculate the projected cost variation of public construction projects.

2. It is recommended to provide more communication and coordination among project participants such as owner, designer, supplier, and consultant during the early phases of project.

3. Nature of projects and their associated hazards must be considered at the time of cost estimating.

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Appendix (A)

Cost estimating factors affecting on Saudi Public Construction projects

Questionnaire

Construction projects are vital for economic development of all countries around the world; same is the case in Saudi Arabia. Unfortunately, many governmental Saudi public projects fail to perform according to the targets resulting in delays and cost overruns. Thus, current study focuses on identifying the main factors affecting the accuracy of cost estimate of public building construction in Saudi Arabia. These factors that must be taken by estimator consideration when preparing a cost estimate and feasibility studies for public construction projects.

This pioneering research will be conducted in the Public construction sector in Saudi Arabia through the adoption of survey (questionnaire) technique that is oriented towards the workers in the public building construction sector of Saudi Arabia in order to identify their perspective about the main factors that must be considered when estimating the cost of Saudi private building construction projects. Kindly, I would like to ask you to fill out the following questionnaire in order to achieve my study data collection goal.

All the information you provided in this survey will be treated confidentially, and the collected data will only be used purely for academic research purposes. This questionnaire will require you no longer than 5-10 minutes. Your participation in this study is totally voluntary and you have the right to withdraw for any reason and at any time, and your responses will be directly damaged.

Thank you in advance for your precious time and participation in this research. For further inquiries and explanations, please do not hesitate to contact me or the director of my study.

Best Regards,

Part (1): Demographic & General Information

The purpose of this section is to obtain general information related to you as a worker in the public building construction sector of Saudi Arabia. Initially, please choose the most appropriate option from the following questions by putting (√) sign beside the appropriate alternative:

1. *Gender :*
   □ Male   □Female

2. *Age :*
   □ 23-28   □ 29-34   □ 35-40   □ More than 40

3. *Years of Experience:*
   □ < 3 years   □ 3-5 years   □ 6-10 year   □ > 10 years

Part (2): Cost estimating factors affecting on Saudi Public Construction projects

This section has been designed to obtain information regarding various factors affecting the accuracy of cost estimate of public building construction in Saudi Arabia. In front of each factor in the following table, you will find 5 different responses with relation to its degree of affection. Kindly read the factors carefully and tick (√) the selected choice clearly.

Table A1. Factors affecting projects

No.	Category	Factor	Degree of Effect				
			V. major effect (5)	Major effect (4)	Minor effect (3)	V. minor effect (2)	No effect (1)
1	Financial Issues	Financial status of client					
2		Market condition					
3		The unstable economic situation					
4		The availability of high quality financial plans and accurate estimation					
5		Fluctuation average					
6		Cost estimation accuracy					
7		Financial resource availability					
8		Type of procurement system					
9		Punctuality of cash flow					
10	Bidding Situation	Company's strength and reputation in the construction industry					
11		Designer and design quality					
12		Rate of return and project cash flow					
13		Availability of capital					
14		Number of competitors tendering					
15		Amount of experience on such projects					
16		The contractors' need for work					
17		Profitability					
18	Project Characteristics	Project size					
19		Project location					
20		Cultural and social situation					
21		Labor nationalities					
22		Climate and environmental issues					
23		Type and size of contract					
24		Project manager competence					
25		Owners' requirement					
26		Project specification and requirement					
27		Unexpected change in local laws and conditions					
28		Political situation					
29		Project duration					
30	Estimating Process	Project team's experience					
31		Time allowed for preparing estimates					
32		Availability of cost indices					
33		Procurement standard					
34		Estimating method					
35		Method utilized in determining contingency					

Please be honest in your responses as long as this data will be important and valuable for the study.

Answer to questions

Question mine: what are the main factors affecting the accuracy of cost estimate of public building construction in Saudi Arabia?

To answer this question and to detect the main factors affecting the accuracy of cost estimate of public building construction in Saudi Arabia, the arithmetic means, and standard deviations were used for all the factors affecting Saudi public building construction projects' cost estimating:

financial issues, bidding situation, project characteristics, and estimating process.

To assess the question the main factors affecting the accuracy of cost estimate of public building construction. The responses for each component were recoded into the numerical value of "1" for minimal response to "5" for a maximum value of responses.

The descriptive analysis was computed for each item. Tables A2 to A5 below reveals the components means and standard deviation.

Table A2. Means and standard deviation for "financial issues" items and total means of them (n= 100)

No.	Item	Percentage (%)					Mean	SD	Ranking question
		No effect	V. minor effect	Minor effect	Major effect	V. major effect			
1	Financial status of client	1.0	2.0	4.0	37.0	56.0	4.45	.757	1
2	Market condition	1.0	1.0	25.0	44.0	29.0	3.99	.823	7
3	The unstable economic situation	3.0	3.0	15.0	34.0	45.0	4.15	.989	6
4	The availability of high quality financial plans and accurate estimation	-	4.0	15.0	39.0	42.0	4.19	.837	3
5	Fluctuation average	2.0	4.0	41.0	48.0	5.0	3.50	.745	9
6	Cost estimation accuracy	-	3.0	13.0	44.0	40.0	4.21	.782	2
7	Financial resource availability	2.0	-	17.0	41.0	40.0	4.17	.853	4
8	Type of procurement system	4.0	1.0	23.0	47.0	25.0	3.88	.935	8
9	Punctuality of cash flow	-	1.0	21.0	38.0	40.0	4.17	.792	4
	Total Means						4.08	.475	

Table A2 shows that the arithmetic means of paragraphs "financial issues" ranging from (3.50-4.45), and most notably the highest means reached (4.45) out of (5) for the item (1) "Financial status of client", then for the item (6) "Cost estimation accuracy" (means 4.21). And the lowest means was (3.50) for the item (5) "Fluctuation average".

All respondents were often with the financial issues, and the total means reached (4.08) and standard deviation (0.475). This result agrees with the results of study Enshassi, Mohamed and Madi (2007) revealed that the most significant factors affecting cost estimates are the financial ones which namely were: financial status of client, market condition, the unstable economic situation as well as the

availability of high-quality financial plans and accurate estimation.

Liu and Zhu (2007) found that the following main factors related to financial issues: cost estimation accuracy, fluctuation average, financial resource availability as well as the type of procurement system and the stability of economic conditions, and study Liu and Wang (2010) indicated that more consideration must be given to the timing of cash flow and not only its amount as long as it is vital to effective budget estimation during construction.

Table A3. Means and standard deviation for" bidding situation" items and total means of them (n= 100)

No.	Item	Percentage (%)					Mean	SD	Ranking question
		No effect	V. minor effect	Minor effect	Major effect	V. major effect			
1	Company's strength and reputation in the construction industry	1.0	1.0	20.0	47.0	31.0	4.06	.802	2
2	Designer and design quality	-	2.0	15.0	33.0	50.0	4.31	.800	1
3	Rate of return and project cash flow	3.0	5.0	21.0	43.0	28.0	3.88	.977	5
4	Availability of capital	2.0	2.0	23.0	39.0	34.0	4.01	.916	4
5	Number of competitors tendering	7.0	3.0	34.0	40.0	16.0	3.55	1.029	8
6	Amount of experience on such projects	1.0	1.0	20.0	48.0	30.0	4.05	.796	3
7	The contractors' need for work	4.0	8.0	24.0	46.0	18.0	3.66	.997	7
8	Profitability	1.0	4.0	25.0	47.0	23.0	3.87	.849	6
	Total Means						3.92	.520	

Table A3 shows that the arithmetic means of paragraphs "bidding situation" ranging from (3.55-4.31), and most notably the highest means reached (4.31) out of (5) for the item (2) "Designer and design quality", then for the item (1) "Company's strength and reputation in the construction industry" (means 4.06). And the lowest means was (3.55) for the item (5) "Number of competitors tendering".

All respondents were often with the bidding situation, and the total means reached (3.92) and standard deviation (0.520). This result agrees with the results of study Alsaedi et al. (2019) noted that the top six factors related to bidding situation and significantly alter the accuracy of cost estimating are: size of the job, company's strength and reputation in the construction industry, type of the project, designer and design quality, rate of return and project cash flow. In the same manner, but in Nigeria, Oyeyipo et al. (2016) observed that the main factors were namely: financial capability of clients, availability of material and availability of capital.

Table A4. Means and standard deviation for "project characteristics" items and total means of them (n= 100)

No.	Item	Percentage (%)					Mean	SD	Ranking question
		No effect	V. minor effect	Minor effect	Major effect	V. major effect			
1	Project size	4.0	1.0	27.0	39.0	29.0	3.88	.977	6
2	Project location	6.0	3.0	28.0	38.0	25.0	3.73	1.062	8
3	Cultural and social situation	4.0	13.0	41.0	32.0	10.0	3.31	.961	11
4	Labor nationalities	8.0	14.0	39.0	28.0	11.0	3.20	1.073	12
5	Climate and environmental issues	3.0	10.0	33.0	40.0	14.0	3.52	.959	10
6	Type and size of contract	3.0	3.0	16.0	56.0	22.0	3.91	.877	5
7	Project manager competence	-	2.0	14.0	44.0	40.0	4.22	.760	3
8	Owners' requirement	2.0	-	9.0	37.0	52.0	4.37	.812	1
9	Project specification and requirement	-	2.0	10.0	38.0	50.0	4.36	.746	2
10	Unexpected change in local laws and conditions	3.0	7.0	25.0	34.0	31.0	3.83	1.045	7
11	Political situation	9.0	9.0	25.0	33.0	24.0	3.54	1.210	9
12	Project duration	3.0	2.0	22.0	43.0	30.0	3.95	.936	4
	Total Means						3.82	.526	

Table A4 shows that the arithmetic means of paragraphs "project characteristics" ranging from (3.20-4.37), and most notably the highest means reached (4.37) out of (5) for the item (8) "Owners' requirement", then for the item (9) "Project specification and requirement" (means 3.36). And the lowest means was (3.20) for the item (4) "Labor nationalities".

All respondents were often with the project characteristics, and the total means reached (3.82) and standard deviation (.526). This result does not agree with the results found

Oladokun et al. (2011) shown that project size as well as project sector formulate the most significant factors impacting the accuracy of pretender cost estimating of construction project. However, study Azman et al. (2013) has shown that number of factors; however, the ones who are related to project characteristics were types of project, design scopes, location, project size, type and size of contract as well as labor and equipment required. They finally concluded that the availability of data and its accuracy are the most significant factors that are needed in preparing any accurate estimates.

Table A5. Means and standard deviation for "estimating process" items and total means of them (n= 100)

No.	Item	Percentage (%)					Mean	SD	Ranking question
		No effect	V. minor effect	Minor effect	Major effect	V. major effect			
1	Project team's experience	-	-	8.0	53.0	39.0	4.31	.615	1
2	Time allowed for preparing estimates	2.0	3.0	30.0	37.0	28.0	3.86	.932	2
3	Availability of cost indices	-	2.0	32.0	49.0	17.0	3.81	.734	3
4	Procurement standard	5.0	4.0	22.0	46.0	23.0	3.78	1.011	4
5	Estimating method	2.0	8.0	33.0	38.0	19.0	3.64	.948	6
6	Method utilized in determining contingency	3.0	4.0	35.0	39.0	19.0	3.67	.933	5
Total Means							3.85	.647	

Table A5 shows that the arithmetic means of paragraphs "estimating process" ranging from (3.64-4.31), and most notably the highest means reached (4.31) out of (5) for the item (1) "Project team's experience", then for the item (2) "Time allowed for preparing estimates" (means 3.86). And the lowest means was (3.64) for the item(5) "Estimating method".

All respondents were often with the estimating process, and the total means reached (3.85) and standard deviation (0.647). These results have been supported by many former studies' outcomes. As Odusami and Onukwube (2008) identified that these factors were: the consultants or estimators' expertise, quality of financial information and cash flow requirement, project team's experience as well as methods utilized in determining direct cost, indirect cost and contingency, and Mahamid (2015) summed up that the top five affecting factors are: contract management, fluctuation in

currency exchange rate, level of competitors, project financing, and cost of materials.