Investigating the Causes of Poor Cost Control in Iraqi Construction Projects

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Abstract-Controlling cost in construction projects is an essential issue. This study investigates the most critical problems that cause weakness in cost control in Iraqi construction projects. The quantitative technique was used by conducting a survey directed to professionals who work on construction projects. One hundred and sixty-four questionnaire forms were distributed to private sector companies, government companies, and government institutions, and the responses were subjected to the required statistical analysis. The results indicate that the most influential factors are the weakness in keeping up with the use of modern concepts, methods, and technologies, the delay in receiving the amounts due for work done from the owner, fluctuations in market prices, the lack of knowledge and the inefficient use of currently available tools and technology, and the security situation in the country. The results indicate that the Iraqi construction projects suffer from weakness in cost control, which causes them to stop or delay their delivery, and this needs serious and quick solutions. One of the most important solutions is the adoption of modern technologies and their inclusion in the construction sector and the development of special systems for managing costs that are appropriate to the Iraqi construction environment.

Keywords-cost control; construction project; statistical analysis; causes; investigation

I. INTRODUCTION

A construction project will be successful if its technical goals are aligned with its budget and the budget is not exceeded. It is difficult to envisage a construction project being completed without cost variances and schedule delays, which may occur at any time during the procedure due to various factors such as poor management, supervision, and control [1]. Most construction projects require the completion of a specific set of operations to deliver a specific product. Construction projects include new buildings and structures, additions, changes, conversions, expansions, reconstruction, renovations, large replacements, and mechanical and electrical installations. Cost and time control is essential in the construction industry [2].

In general, a construction project's success is determined by its ability to fulfill the client's cost, time, safety, resource allocation, and quality objectives. A successful project meets technical goals, stays on schedule, and stays within cost limitations [3]. The construction industry as a whole has been deemed to be underperforming, resulting in an inability to attain effective cost performance. As a result, most building projects have a wide range of costs [4]. One of the most important concerns confronting the construction sector is cost overrun [5]. Time and cost overrun are common issues for the majority of construction projects [6, 7].

Cost overrun is a common theme in Iraq's construction industry. Despite the development of many cost control approaches and technologies, the Iraqi construction industry has yet to implement them [8]. This research contributes to the identification of the current reality of the Iraqi construction sector.

II. DESIGN OF THE QUESTIONNAIRE

Initially, previous studies were reviewed to collect, organize, and analyze relevant information in a manner appropriate to the intended purpose. After that, this information was subjected to a series of discussions, analyses, and modifications that helped develop a questionnaire. The first page of the questionnaire is a cover containing information related to the research topic. The questionnaire included two parts. The first part includes general information about the concerned entity (such as its type and name) and information about the people who fill out the questionnaire from the target community in the study (specialization, educational qualification, workgroup, and the amount of experience). The second part includes a list of factors that are probable to have a negative impact on the control of the cost of a construction project. This part includes 22 closed questions designed with a five-point Likert scale (1: Always, 2: Frequently, 3: Sometimes, 4: Scarcely, 5: Never). Each respondent was asked to assign a degree of measure to each factor based on his/her perceptions about the Iraqi construction sector's environment.

The most prominent and important problems the process of construction project cost control faces, according to the review of the previous literature and interviews with experts specialized in the field of construction projects, are shown in Table I.

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TABLE I. A REVIEW OF THE ISSUES THE CONSTRUCION PROJECT COST CONTROL

S	Issue	References
1	Weakness in keeping up with the use of modern concepts, methods, and technologies	[9-12]
2	Lack of knowledge and inefficient use of currently available tools and technology	[13, 14]
3	Failure in the decision-making process due to various reasons	[12]
4	Poor communication and transfer of information and data between the concerned parties	[15]
5	Lack of progress in measuring work properly	[16]
6	Poor planning and scheduling and not dividing work items in a way that helps tracking costs easily	[14, 17]
7	Unclear contract documents (contracting details, technical specifications, general and special requirements)	[17]
8	Failure to prepare an appropriate purchase plan	[14, 18]
9	Fluctuations in market prices	[14, 18]
10	Involving inexperienced executive staff in terms of cost and low labor productivity	[17, 18]
11	Low labor productivity	[16]
12	Changes made by the owner	[14, 18, 19]
13	Changes resulting from design errors	[19]
14	Poor management of site data and not accurate documentation	[14, 18, 19]
15	Delay in receiving the amounts due for work done from the owner	[18]
16	Excessive waste of materials on the site	[19]
17	Inaccurate estimation of quantities	[14, 20]
18	Insufficient information needed to achieve cost control	[20]
19	Lack of a fixed and specific method in the process of making measurements for real work	Added during the open survey
20	Not clearly specifying the type of data and information required	Added during the open survey
21	Inadequate analysis of cost data to ensure a better benefit in the control process	Added during the open survey
22	Security situation in the country	Added during the open survey

III. FACE VALIDITY

Face validity, or content validity is a sort of validity in which diverse aspects, skills, and behaviors are measured appropriately and successfully. The research tools and data may be reviewed by professionals in the field of study to this goal. Vague and cryptic questions can be updated, and the difficult items can be reworded based on the reviewers' remarks [21]. Since the construction of the scale of measurement items was primarily based on an exhaustive analysis of the literature and detailed reviews by numerous industry experts, professionals, and academics, the content validity of the proposed questionnaire was satisfied in this study. Five specialists with more than 10 years of experience in construction projects and with an academic background in questionnaire evaluation were consulted to analyze the questionnaire and make revisions that best match the Iraq conditions.

IV. PILOT STUDY

A pilot study is a small experimental attempt or study that applies to a part of the study population whose characteristics are usually similar to those of the study population [22, 23]. According to [24] the pilot research is a test run for the questionnaire, which includes detecting any vague questions, testing the phrasing of questions, testing the data collection technique, etc. The most important challenge that the study faced is the difficulty of communicating with experts directly due to the covid-19 related quarantine, so finishing this stage took a long time. The sample size for the pilot study is preferably between 30 and 50 [25]. In this research, 35 respondents were selected, the questionnaire was distributed to them, and the answers were collected, organized, and prepared for conducting the required statistical tests. The pilot study was applied to respondents with characteristics similar to the total sample, and after ensuring the validity of the research tool, the questionnaire was distributed to the total sample without including the pilot sample.

V. PILOT STUDY TESTS (VALIDITY AND RELIABILITY)

Using a good research tool is one of the most critical factors to reach acceptable and valuable results. According to [26], one of the researcher's key goals is to develop his research tool which should be characterized by three traits, i.e. it should be meaningful, accurate, and efficient. The data collected from the pilot study were subjected to the required tests using the statistical analysis software Statistical Package for the Social Sciences (SPSS) Version 26 to verify the extent of validity and reliability.

A. Statistical Validity

The validity of an instrument refers to how well it measures what it is supposed to measure [27]. This test is used to find the correlation coefficients between each item in a specific portion and the part as a whole [28]. Each of the 22 items of the questionnaire was assigned a different symbol from F1 to F22. Table II shows the results of the internal validity test for the second part of the questionnaire titled Possible Reasons for Poor Cost Control in Construction Projects.

B. Statistical Reliability (Cronbach's Alpha)

The value of the Cronbach's alpha constant, which ranges from 0 to 1, is an essential technique of calculating reliability. The closer it is to 1, the higher the degree of reliability [29]. Table III shows the classification of reliability according to the value of the Cronbach's alpha coefficient.

After implementing the Cronbach's alpha test, the results were compared with the standard values mentioned in Table II and they were found to be within excellent limits with a value of 0.902 which confirms the reliability of the used questionnaire.

TABLE II. ITEM CORRELATION COEFFICIENTS

Item	Correlation coefficient	Sig. (2-tailed)
F1	0.479**	0.000
F2	0.427**	0.000
F3	0.484**	0.000
F4	0.629**	0.000
F5	0.620**	0.000
F6	0.506**	0.000
F7	0.577**	0.000
F8	0.604**	0.000
F9	0.252**	0.002
F10	0.577**	0.000
F11	0.512**	0.000
F12	0.365**	0.000
F13	0.519**	0.000
F14	0.696**	0.000
F15	0.379**	0.000
F16	0.586**	0.000
F17	0.707**	0.000
F18	0.736**	0.000
F19	0.665**	0.000
F20	0.660**	0.000
F21	0.684**	0.000
F22	0.193*	0.017

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

TABLE III. RELIABILITY CUT-OFF VALUES [30]

Cronbach's alpha	Degree of reliability
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

VI. QUESTIONNAIRE DISTRIBUTION

Convenience sampling was adopted. Convenience sampling is a sort of nonprobability sampling in which respondents are chosen because they are "convenient" data sources for researchers [31]. The questionnaire form was distributed to the intended sample, consisting of 180 individuals, and 164 forms were answered (response rate 91%). After checking, 14 forms were found to be incomplete, resulting in a total of (150) forms which were processed. Professionals in Iraqi construction projects (architects, civil engineers, mechanical engineers, electrical engineers, and other professionals with associated specialty) were included in the research population. The questionnaire was distributed manually in paper form through group interviews with specialists from different workplaces and through an electronic link. Questionnaire completion took about 7 to 9 minutes. Table IV shows the statistical analysis of the characteristics of the target sample.

VII. QUESTIONNAIRE DATA ANALYSIS

The quantitative method was used. Quantitative data analysis methods can be beneficial to a researcher attempting to extract meaningful conclusions from a vast body of qualitative data. The key advantage is that a quantitative analytical technique allows the separation of many confounding elements that can obfuscate the core qualitative conclusions [32].

TABLE IV. CHARACTERISTICS OF THE TARGET SAMPLE

Question	Categories	Percentage
Concerned party percentage of respondents	Contracting companies	51%
	Owner	42%
	Consulting offices	7%
Respondents' educational level	Diploma	1%
	Bachelor's degree	56%
	Master's degree	38%
	Ph.D.	3%
	Other	2%
Respondents specialization	Architects	1%
	Civil engineers	85%
	Electrical engineers	5%
	Mechanical engineers	3%
	Others	6%
Current field of respondents	Designers	5%
	Consultants	8%
	Project managers	19%
	Contractors	4%
	Site engineers	53%
	others	11%
Respondents' experience	Less than 5 years	27%
	5-10 years	33%
	11-15 years	23%
	16-20 years	8%
	More than 20 years	9%

Statistical approaches play an essential part in most studies that rely on quantitative data analysis by converting ordinal to numeric data using a rating scale (i.e. the 5-point Likert scale). IBM SPSS was used to analyze the data. The Relative Importance Index (RII) method was employed to determine the respondents' rankings of items/variables. RII can be calculated by:

$$RII = \frac{\sum W}{(A*N)} \quad (1)$$

$$RII = \frac{5(n_5)+4(n_4)+3(n_3)+2(n_2)+n_1}{5(n_5+n_4+n_3+n_2+n_1)} \quad (2)$$

where W is the weight given to each component by the respondents (ranging from 1 to 5), A represents the most significant weight (which equals to 5), and N is the total number of people who took part in the survey. The RII value ranges from 0 to 1 (0 not inclusive). The higher the RII value, the more significant the attribute's impact. RII, on the other hand, does not take into account the relationships between the various elements. Table V shows the details of the statistical analysis of the second part of the questionnaire. The results indicated that "Weakness in keeping up with the use of modern concepts, methods, and technologies" is the highest cause of weakness to control costs in construction projects according to specialists' point of view with RII=80.00, mean=2.00, SD=0.82. The follow-up and use of the world's continuous development in administrative and technical tools related to project cost management has a significant role in solving most of the problems facing this process and shortening the time for the relevant parties. This study is in agreement with the findings in [9,11]. "Delay in receiving the amounts due for work done from the owner" came second with RII=78.81, mean=2.06, SD=0.96. This reason falls outside the control of the implementing party and hinders the good management of project costs, but sometimes this delay may be based on problems or weaknesses in the data provided by the contractor. This result is in agreement with [18].

TABLE V. STATISTICAL ANALYSIS OF THE SECOND PART OF THE QUESTIONNAIRE

Item	Mean	Std. deviation	RII	Rank
Weakness in keeping up with the use of modern concepts, methods, and technologies	2	0.82	80	1
Delay in receiving the amounts due for work done from the owner	2.06	0.96	78.81	2
Fluctuations in market prices	2.11	0.9	77.88	3
Lack of knowledge and inefficient use of currently available tools and technology	2.23	0.85	75.5	4
Security situation in the country	2.24	0.91	75.23	5
Poor planning and scheduling and not dividing work items in a way that helps tracking costs easily	2.4	1.09	72.05	6
Failure in the decision-making process due to various reasons	2.46	0.85	70.86	7
Involving inexperienced executive staff in terms of cost and low labor productivity	2.46	0.91	70.73	8
Changes made by the owner	2.5	0.91	69.93	9
Poor management of site data and not accurate documentation	2.56	1.08	68.74	10
Inadequate analysis of cost data to ensure a better benefit in the control process	2.62	0.98	67.68	11
Lack of progress in measuring work properly	2.62	1.03	67.68	12
Failure to prepare an appropriate purchase plan	2.62	1.06	67.68	13
Insufficient information needed to achieve cost control	2.65	0.95	67.02	14
Low labor productivity	2.68	0.96	66.49	15
Poor communication and transfer of information and data between the concerned parties	2.7	0.99	66.09	16
Inaccurate estimation of quantities	2.72	1.04	65.56	17
Changes resulting from design errors	2.81	0.93	63.71	18
Not clearly specifying the type of data and information required	2.85	0.98	63.05	19
Excessive waste of materials on the site	2.89	1.06	62.12	20
Unclear contract documents (contracting details, technical specifications, general and special requirements)	3.01	1.1	59.74	21
Lack of a fixed and specific method in the process of making measurements for real work	3.05	1.08	59.07	22

The ranked third reason for the poor cost control is "Fluctuations in market prices" with RII=77.88, mean=2.11, SD=0.90. It is a problem that frequently occurs in the construction sector in Iraq due to the country's fluctuating economic conditions and negatively affects the performance of construction projects. Also, this result is in agreement with what was stated in [14, 18]. The fourth reason is "Lack of knowledge and inefficient use of currently available tools and technology" (RII=75.50, mean=2.23, SD=0.85). This result is somewhat consistent with the first result, which indicated the weakness of keeping pace with modern technologies, as the current technologies are insufficient and need to be developed. This result is in agreement with [13, 14]. The fifth reason for poor cost control is the "Security situation in the country" with RII=75.23, mean=2.24, SD=0.91. This is actually and negatively reflected on the performance of construction projects in general and not only on the cost performance. The top 5 reasons for the poor cost control appear to be reasonable and commensurate with the problems that Iraqi building projects face. The two lowest-ranking reasons are "Unclear contract documents (contracting details, technical specifications, general and special requirements)" and "Lack of a fixed and specific method in the process of making measurements for real work".

VIII. CONCLUSION

According to the opinions of specialists in the field of the Iraqi construction sector, construction projects mainly need to develop in the field of knowledge by adopting the most modern, at a global level, techniques in this field to solve multiple problems, including cost overruns. Also, there is a need for real solutions related to financing. Specifically concerned with addressing the problem of late payments allocated to projects, which impede the progress of projects. On the other hand, there is an urgent need to address the issue of market prices and reduce price fluctuations that occur at various times in the Iraqi market and negatively affect the cost of construction projects. Cadres of the public and private sectors need continuous education and updating in order to keep pace with the most prominent developments in the field of construction. Finally, the general security situation of any country is directly reflected in the performance of its construction projects. The data indicate that cost overruns can be minimized. It is evident from the fact that most of the factors mentioned in each of the problems is caused by human incompetence and therefore can be removed to a large extent. Good management strategies may influence this situation more favourably than any other treatment and can have both short and long term effects. Also, most indicators require the presence of specialized systems and trained cadres to use them for the purpose of reducing the problem of cost overruns. Therefore, striving towards automating cost control operations will be very beneficial.

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