

Analyzing Cost Deviation Factors in Iraqi Construction Projects: A Comprehensive Examination of Influencing Variables

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ABSTRACT

Construction projects suffer from many difficulties and complications, including cost deviations due to multiple factors. The research goal of this study is to explore the factors causing cost deviation in Iraqi construction projects. Twenty-five influencing factors were identified, based on previous studies and expert opinions. One hundred questionnaires were distributed to project participants, including contracting companies, consultants, and employers, with a 73% response rate. Relative Importance Index (RII) was used to analyze the findings. The results showed that the five most influential factors are poor planning approaches, contracting companies' financial difficulties, poor site management, poor project management/poor cost control, and inaccurate cost estimates. In order to reduce cost deviations, a set of improvements was recommended based on the results of the study.

Keywords-cost deviation; employers; consultants; contracting companies

I. INTRODUCTION

Construction projects succeed when they are finished within the specified time and budget. It is in the interest of the stakeholders involved to complete the project according to the required quality. However, due to poor management, supervision and control, success becomes difficult [1]. In Iraq, the construction industry suffers many obstacles and difficulties that lead to cost deviations and inability to achieve project objectives. Authors in [2] reported that the most common causes of exceeding the specific cost of projects in Iraq are inaccurate cost estimates, poor cost control, poor financial situation of employers, inflation and fluctuation of construction resources, and changing work scope. Authors in [3] found that common factors for cost deviations were design failures, material price differences, inadequate project planning, project scope changes, and design changes. Authors in [1] concluded that cost deviation is caused by insufficient information, poor planning, unclear employer requirements, and change in orders during the implementation phase. Authors in [4] mentioned that the use of modern technologies and tools, the use of modern design programs, the establishment of solid rules, and the use of work-study techniques are factors that contracting companies should focus on. Authors in [5] found that the factors that influence cost are delays in payments from the client, the maturity period of the down payment, payment

terms, down payment, project delay, poor planning, changes in orders, and inaccurate project duration. Authors in [6] found that poor site management and supervision, incompetence of subcontracting companies, schedule delays, insufficient planning and scheduling, incomplete design, and delayed payment to the supplier/subcontractor are the most common factors causing cost deviation. It is essential to explore the factors causing cost deviation to find appropriate ways to reduce or minimize their impact on construction projects. Authors in [7] concluded that time and cost deviations are persistent problems in construction projects. The risk of cost deviations can be reduced by proper planning before the implementation starts, accurate estimations, preventing changes in orders during implementation, enhancing contract management, and improving communication between project stakeholders. Results of a research regarding UAE construction industry indicate that design variations comprise the main reason for cost deviation. Another major reason the poor cost estimation [8].

Deep comprehension of the involved factors and their interplay within distinct sectors of Iraqi construction projects is lacking, impeding the formulation of targeted strategies for mitigating cost overruns. The current research aims to fill this void by conducting a thorough analysis tailored to the unique challenges prevalent in the Iraqi construction industry.

II. RESEARCH OBJECTIVES

The primary aim of this study is to investigate the multifaceted factors contributing to cost discrepancies in construction projects in Iraq. By conducting a thorough analysis, the study intends to unveil the intricate interplay of various elements influencing project costs. Moreover, the research seeks to identify potential risk factors, unforeseen challenges, and systemic inefficiencies that may lead to budgetary variations. In addition, the study aims to provide stakeholders with actionable insights to facilitate informed decision-making. By understanding the root causes of cost deviations, project managers and decision-makers can implement strategic measures to mitigate risks, enhance cost control mechanisms, and ensure the successful completion of projects within the predefined budget constraints. This research, therefore, aspires to offer a comprehensive framework that empowers stakeholders to proactively manage and address cost-related challenges in Iraqi construction projects.

III. METHODOLOGY

A questionnaire was conducted to collect the opinions of employers, consultants, and contracting companies on the factors causing cost deviation in Iraq. Questionnaires were sent to a randomly selected group of employers, consultants, and construction companies. A total of 100 questionnaires were distributed and 73 were returned, resulting in a response rate of 73%. The participants were instructed to indicate the degree of importance associated with each of the 25 previously identified cost deviation factors, using a 5-point Likert scale ranging from "no impact" to "major impact".

Version 26 of the IBM SPSS was used, and the reliability test on the data returned a Cronbach's alpha value of $\alpha=0.902$, indicating excellent reliability. Participants included experienced construction project management, site engineering, office engineering, and organizational management professionals. This study considered 25 factors that are believed to be causative for cost deviation based on the reviewed literature [1-7, 9-16] and the recommendations of local experts. The Relative Importance Index (RII) method [17] was used to ascertain the perceived relative importance of the causative factors of cost deviation among employers, consultants and construction companies. RII is calculated as:

$$RII = \frac{\sum W}{A \times N} \tag{1}$$

where W is the weight as assigned on the Likert's scale by each respondent in a range from 1 to 5 (1 = no impact, 2 = negligible impact, 3 = marginal impact, 4 = moderate impact, and 5 = major impact), A is the highest weight, and N is the total number of the respondents.

The questionnaire (see Appendix) was prepared based on previous studies and expert opinions and 100 samples were distributed to the participants, which were consultants, contracting companies, and employers. Figures 2-5 show the characteristics of the participants, their academic level, their sector of experience, the years of experience, and their profession. Figure 1 shows the research plan and Table I shows the RII and ranking for each factor.

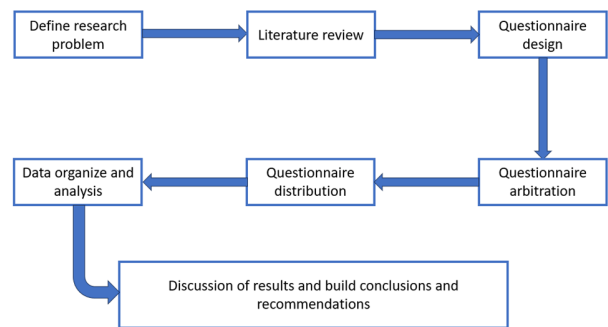


Fig. 1. The research strategy.

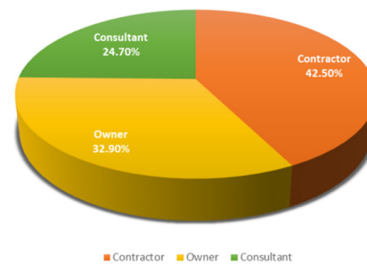


Fig. 2. Respondent affiliation.

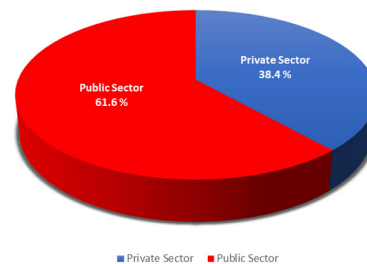


Fig. 3. Respondent sector.

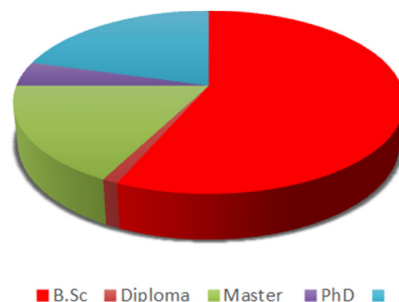


Fig. 4. Respondent level of education.

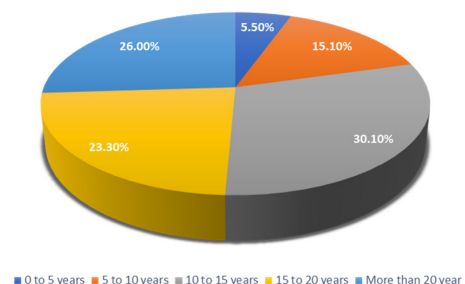


Fig. 5. Respondent years of experience.

TABLE I. RII RANKING FOR FACTORS CAUSING COST DEVIATION IN IRAQI CONSTRUCTION PROJECTS

Factors	Employer		Consultant		Contracting Companies		All	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Material shortage	0.717	24	0.778	23	0.787	21	0.762	25
Plant and equipment shortage	0.742	23	0.822	9	0.794	19	0.784	20
Acceleration required by the client	0.7	25	0.789	19	0.871	10	0.795	18
Mistakes during construction	0.825	8	0.889	7	0.852	12	0.852	8
Fluctuation in prices of raw materials	0.775	16	0.789	19	0.897	7	0.830	13
Shortage of workforce	0.75	22	0.811	11	0.832	14	0.800	17
Lack of skilled labor	0.858	6	0.922	5	0.826	16	0.860	7
Delays in work approval	0.767	18	0.8	15	0.916	6	0.838	11
Poor project management / poor cost control	0.883	4	0.933	4	0.845	13	0.880	4
Contract awarded to the lowest bidder	0.75	22	0.778	23	0.774	23	0.767	24
Incompetent subcontractor	0.758	20	0.789	19	0.768	24	0.770	23
Additional work	0.758	20	0.778	23	0.787	21	0.775	22
Unstable cost of manufactured product	0.783	13	0.8	15	0.929	4	0.849	9
Poor planning approaches	0.933	1	0.944	3	0.981	1	0.956	1
Inaccurate cost estimates	0.858	6	0.889	7	0.877	9	0.874	5
Increase in labor cost	0.775	16	0.811	11	0.884	8	0.830	13
Inappropriate procurement	0.8	10	0.8	15	0.761	25	0.784	20
Poor site management	0.925	3	0.944	3	0.826	16	0.888	3
Breakdowns of construction plant equipment	0.783	13	0.811	11	0.852	12	0.819	15
Gap between design and tendering	0.775	16	0.789	19	0.826	16	0.800	17
Project complexity	0.825	8	0.833	8	0.813	18	0.822	14
Delay of drawings and site instructions	0.775	16	0.778	23	0.929	4	0.841	10
Inappropriate government policies	0.792	11	0.778	23	0.774	23	0.781	21
Contractor's financial difficulties	0.925	3	0.978	1	0.923	5	0.937	2
Delays in inspection and testing of work	0.808	9	0.8	15	0.955	2	0.869	6

IV. RESULTS AND DISCUSSIONS

The elements causing cost deviation are grouped by the respondent affiliation, i.e. employer, contracting companies, and consultants in Table I. Poor planning approaches take the first place, with RII=0.956. This result is in agreement with [18], whereas it was the seventh factor in UAE [8]. Contractor's financial difficulties take the second place with RII=0.937, whereas it was the first factor in Pakistan [13]. Poor site management takes the third place with RII=0.888. Poor project management/ poor cost control ranks fourth with RII=0.880, while it was the first factor in [11]. Inaccurate cost estimates take the fifth place with RII=0.874. This result did not correspond with the findings in [11]. Delays in inspection and testing of work take the sixth place with RII=0.869. Lack of skilled labor takes the seventh place with RII=0.860. Mistakes during construction take the eighth place with RII=0.852. Unstable cost of manufactured product takes the ninth place with RII=0.849. Delay of drawings and site instructions take the tenth place with RII=0.841, whereas it was the sixth factor in UAE [8].

The respondents from contracting companies or employers have ranked poor planning approaches in the first position. However, this factor has been ranked third by the consultant respondents. In the realm of construction project management, the discrepancy in the ranking of poor planning approaches among employers and contracting companies, as opposed to consultants, can be attributed to the diverse perspectives and roles inherent in the construction industry. Employers and contracting companies, being intimately involved in the day-to-day execution and operational aspects of projects, may prioritize poor planning approaches due to their direct impact

on project timelines, resource utilization, and overall project efficiency. On the other hand, consultants, who often provide advisory services and possess a broader outlook on projects, may consider other factors such as design intricacies, regulatory compliance, or external market forces as equally or more influential on project costs. This discrepancy in ranking underscores the importance of recognizing the varied vantage points within the construction ecosystem, highlighting the need for a comprehensive understanding of the nuanced challenges associated with poor planning approaches in construction projects to develop effective and tailored mitigation strategies.

The employer respondents have ranked contractor's financial difficulties in the third position. The consultant respondents have ranked it in the first position and the contracting company respondents in the fifth. The disparate ranking of contractor's financial difficulties reflects the multifaceted nature of cost overruns, emphasizing divergent perceptions on the pivotal role of contractors' financial stability in project success. This underscores the importance of recognizing and reconciling these varied viewpoints for the development of comprehensive strategies to address and mitigate cost overruns in construction projects.

Employers and consultants ranked poor site management in the third position and respondents from contracting companies in the 16th. Employers and consultants, likely emphasizing project efficiency and risk mitigation, recognize the pivotal role of effective site management in averting cost overruns. In contrast, the lower ranking by contracting companies may suggest a potential underestimation of the impact of poor site management. Employers and consultants ranked poor project management/poor cost control in the fourth position and

respondents from contracting companies in the 13th. Employers and consultants, emphasizing effective project oversight and financial control, are more likely to recognize the substantial impact of poor project management on cost overruns. Conversely, the lower ranking by contracting companies may indicate a potential underestimation of the significance of inadequate project management.

Employers ranked inaccurate cost estimates in the sixth position. The consultants ranked it in the 7th position, and the respondents from contracting companies in the 9th position. Employers and consultants, likely emphasizing project financial precision, recognize the significance of accurate cost estimates in mitigating cost overruns. The lower ranking by contracting companies suggests potential differences in priorities, highlighting the need for a nuanced understanding of stakeholder viewpoints to develop effective strategies addressing inaccurate cost estimates and minimizing cost deviations in construction projects. The variation of the results with earlier Iraq-based studies and other countries affirms the assertion that cost overrun causes were country-specific and time-related.

V. CONCLUSION

The current study has determined the five main factors causing cost deviations as: poor planning approaches, contractor financial difficulties, poor site management, poor project management/ poor cost control, and inaccurate cost estimates. The limitations of this research include the reliance on survey data, which may be subject to respondent bias. The study focused on specific key project participants and may not encompass the perspectives of all relevant stakeholders in the Iraqi construction industry. Overcoming these limitations in future research could involve employing diverse data collection methods and expanding the participant pool to ensure a comprehensive understanding of the factors causing cost overrun.

In order to minimize cost deviations, the stakeholders involved in the project should use the best methods and tools in planning the project and making plans based on cash flows. They should also rely on qualified cadres who have sufficient experience in project management and cost management. The use of appropriate methods and tools to calculate the cost and address deviations (alternative analysis, value engineering, what-if scenarios, lean management, or other effective methods) is also advised.

REFERENCES

- [1] E. Mahde and N. A. Jasim, "Diagnoses the causes of cost deviation in Iraqi construction projects," *Diyala Journal of Engineering Sciences*, vol. 14, no. 3, pp. 36–50, 2021, <https://doi.org/10.24237/djes.2021.14304>.
- [2] M. Abdel-Monem, A.-R. El-Mohr, and K. El-Dash, "Cost Overrun Gap Analysis in Construction Projects: State -of-the-Art," *Engineering Research Journal - Faculty of Engineering (Shoubra)*, vol. 51, no. 3, pp. 76–97, 2022, <https://doi.org/10.21608/erjsh.2022.249998>.
- [3] R. F. Herrera, O. Sánchez, K. Castañeda, and H. Porras, "Cost overrun causative factors in road infrastructure projects: A frequency and importance analysis," *Applied Sciences (Switzerland)*, vol. 10, no. 16, 2020, <https://doi.org/10.3390/app10165506>.
- [4] L. T. Ali, R. S. A. Ali, and Z. S. M. Khaled, "Investigation of Cost Control Measures for Main Contractors in Construction Projects," *Journal of University of Babylon for Engineering Sciences*, pp. 222–241, 2019.
- [5] M. F. Hasan and S. R. Mohammed, "Factors affecting time and cost trade-off in multiple construction projects," *Archives of Civil Engineering*, vol. 68, no. 2, pp. 549–561, 2022, <https://doi.org/10.24425/ace.2022.140658>.
- [6] M. H. Kotb, A. S. Aly, and K. M. A. Muhammad, "Risk Assessment of Time and Cost Overrun Factors throughout Construction Project Lifecycle," *Life of Science Journal*, vol. 16, no. 9, pp. 78–91, 2019.
- [7] Y. S. Saeed, "Cost and Time Risk Management in Construction Projects," *Tikrit Journal of Engineering Sciences*, vol. 25, no. 1, pp. 42–48, 2018, <https://doi.org/10.25130/tjes.25.1.07>.
- [8] R. M. Johnson and R. I. I. Babu, "Time and cost overruns in the UAE construction industry: a critical analysis," *International Journal of Construction Management*, vol. 20, no. 5, pp. 402–411, 2020, <https://doi.org/10.1080/15623599.2018.1484864>.
- [9] A. Rezaei and S. Jalal, "Investigating the causes of delay and cost-overrun in construction industry," *International Advanced Researches and Engineering Journal*, vol. 2, no. 2, pp. 75–079, 2018.
- [10] B. P. Khanal and S. K. Ojha, "Cause of time and cost overruns in the construction project in Nepal," *Advances in Science, Technology and Engineering Systems*, vol. 5, no. 4, pp. 192–195, 2020, <https://doi.org/10.25046/aj050423>.
- [11] S. H. N. Alani and A. H. Mahmoud, "Factors Affecting the Cost Management of Iraqi Construction Firms," *Engineering, Technology and Applied Science Research*, vol. 13, no. 6, pp. 12001–12005, 2023, <https://doi.org/10.48084/etasr.5212>.
- [12] N. N. Abbas and A. M. Burhan, "Investigating the Causes of Poor Cost Control in Iraqi Construction Projects," *Engineering, Technology and Applied Science Research*, vol. 12, no. 1, pp. 8075–8079, 2022, <https://doi.org/10.48084/etasr.4661>.
- [13] S. Ahmed, A. H. Memon, N. A. Memon, A. N. Laghari, M. A. Akhund, and H. U. Imad, "Common Factors of Cost Escalation in Construction Industry of Pakistan," *Engineering, Technology & Applied Science Research*, vol. 8, no. 6, pp. 3508–3511, 2018, <https://doi.org/10.48084/etasr.2278>.
- [14] S. Sohu, A. H. Abdullah, S. Nagapan, A. A. Jhatial, K. Ullah, and I. A. Bhatti, "Significant Mitigation Measures for Critical Factors of Cost Overrun in Highway Projects of Pakistan," *Engineering, Technology & Applied Science Research*, vol. 8, no. 2, pp. 2770–2774, 2018, <https://doi.org/10.48084/etasr.1916>.
- [15] Y. Alfraidi, M. H. H. Abdelhafez, S. M. Alzahrani, and H. Boussabaine, "Impact of Endogenous Risk Factors on Risk Cost in PPP Projects in Saudi Arabia," *Engineering, Technology and Applied Science Research*, vol. 10, no. 4, pp. 6087–6091, 2020, <https://doi.org/10.48084/etasr.3462>.
- [16] F. A. Shaikh, "Financial Mismanagement: A Leading Cause of Time and Cost Overrun in Mega Construction Projects in Pakistan," *Engineering, Technology and Applied Science Research*, vol. 10, no. 1, pp. 5247–5250, 2020, <https://doi.org/10.48084/etasr.3271>.
- [17] S. O. Cheung, H. C. H. Suen, and K. K. W. Cheung, "PPMS: a Web-based construction Project Performance Monitoring System," *Automation in Construction*, vol. 13, no. 3, pp. 361–376, 2004, <https://doi.org/10.1016/j.autcon.2003.12.001>.
- [18] Y. Saeed, "Cost and Time Risk Management in Construction Projects," *Tikrit Journal of Engineering Sciences*, vol. 25, no. 1, pp. 42–48, 2018, <https://doi.org/10.25130/tjes.25.1.07>.

APPENDIX

The Questionnaire

The goal of this questionnaire is to determine the most important causes of cost deviation in Iraqi construction projects. The information provided by you will be treated confidentially. Thank you in advance for your efforts

Part One: Personal Information

1. Affiliation

- a. Client
 - b. Consultant
 - c. Contractor
2. Degree of education
- a. B.Sc.degree
 - b. Diploma degree
 - c. Master degree
 - d. PhD degree
3. Years of experience
- a. From 0 to 5 years
 - b. From 5 to 10 years
 - c. From 10 to 15 years
 - d. From 15 to 20 years
 - e. More than 20 years

Part Two: Questionnaire

Based on your experience in construction projects, please choose the level of importance (from 1 to 5 where 1- no impact, 2- little impact, 3-moderate impact, 4- impact, 5- high impact) of each of the following factors that you believe causes cost deviation in Iraqi construction projects.

Factors	1	2	3	4	5
Material shortage					
Plant and equipment shortage					
Acceleration required by the client					
Mistakes during construction					
Fluctuation in prices of raw materials					
Shortage of workforce					
Lack of skilled labor					
Delays in work approval					
Poor project management/ poor cost control					
Contract awarded to the lowest bidder					
Incompetent subcontractor					
Additional work					
Unstable cost of manufactured product					
Poor planning approaches					
Inaccurate cost estimates					
Increase in labor cost.					
Inappropriate procurement					
Poor site management					
Breakdowns of construction plant equipment					
The gap between design and tendering					
Project complexity					
Delay of drawings and site instructions					
Inappropriate government policies					
Contractor's financial difficulties					
Delays in inspection and testing of work					