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Analysing Financial Risks Inherent in the Iraqi Construction Sector Using Probability–Impact Matrix

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ABSTRACT

One of the biggest problems facing the construction sector throughout the globe is financial risks. This is especially true for building projects in Iraq. These hazards often result in project delays and budgetary constraints. The goal of this research is to find the reasons behind financial hazards. A questionnaire was used to discover and extract sub-factors. A probability and effect matrix was also used to provide a quantitative study of these parameters. We also utilized the relative relevance index to rank the hazards. The study's findings revealed that eight factors significantly influenced the project, categorized as high risk: inaccurate cost estimates, delayed client payment processes, clients' financial instability, material price fluctuations, change orders, corruption, strong political opposition, and operations in hazardous areas. This research will help those who work on building projects, such as owners, contractors, engineers, and decision-makers, figure out what causes financial hazards. It will also help them build a useful risk management strategy to lessen the impact of these risks on future construction projects. It also cuts down on time and money lost on projects and makes them better and more long-lasting.

Keywords: Construction sector, Financial risks, Impact, Iraq, Relative importance index.

1. INTRODUCTION

Construction work, which is done by the building industry across the globe, has grown riskier than other sorts of labor because cities are growing and become more complicated. Construction projects are complicated because they include many people and groups, such as owners, contractors, subcontractors, suppliers, workers, designers, and more. Infrastructure projects, roads, bridges, and homes are all part of these projects. Because of the long period of the project, the complexity of the operations, the high cost of funding, the bad business conditions, and the changing organizational structures, projects of this size are seldom devoid of inherent hazards **(Taylan et al., 2014)**. It normally takes a long time to finish a building job. So, things like changes in laws, rules, and the country's political and economic situation must be taken into account **(Bajwa and Syed, 2020)**. In construction

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projects, an effective risk management system may be difficult, but it is not impossible. It requires a realistic assessment of risks after identifying and monitoring them, and developing a plan for them before they become an uncontrollable reality, delaying or even disrupting the project **(Altaie and Onyelowe, 2024; Mishra and Mallik, 2017)**. Although it is impossible to avoid risks that threaten government infrastructure projects, dealing with each risk individually leads to losses in costs and time. Identifying risks helps control risk factors and reduce their future impact **(Kraidi et al., 2019)**. Latent risks affect performance measures, cost and time, and these risks change during the stages of the project itself **(Abd El Mohamed et al., 2017)**. According to **(Amca et al., 2025)**, projects are often delayed or even halted due to political conflicts and unstable governments. According to **(Kassam et al., 2019)**, construction costs can be significantly impacted by financial and political concerns. In order to prevent possible difficulties from escalating into major issues, it is essential to manage financial risks in construction projects. This foresight boosts project stability, which in turn increases the odds of success and profitability. As a subfield of risk management that focuses on financial hazards, financial risk management applies modern best practices in order to monitor and reduce the effects of financial risks **(Valaskova et al., 2018)**. The term "financial risk management" refers to an approach to reducing potential negative outcomes in the event of a financial crisis by identifying and mitigating the kinds of risks that might occur. There is little variation among nations with respect to the recognized and categorized risk factors. Consequently, it is essential to catalog all potential financial risks according to their effect and probability of occurrence. The purpose of this study is to catalog the financial risk factors that Iraqi civil engineering project participants encounter, discuss ways to lessen their effect, and ultimately eradicate them. There are a lot of anticipated and unforeseen dangers in construction projects. These dangers stem from a myriad of unknowns. Involvement of third parties, contractual agreements, environmental factors, resource availability, and the performance of construction parties are all potential sources **(Idris et al., 2022)**. Financial risks are defined as uncertain situations that affect a project and cause many secondary risks, including actual cost increases and contractual disputes between project parties **(Shibani et al.,2024).** Financial risks have a clear impact on projects, including extending project delivery times and increasing direct and indirect costs, which can create crises in projects **(Ildarabadi and Alamatian,2021)**. The effects of financial risks are evident in the successful execution of a long-term project **(Line and Shang,2025)**. A study **(Rahmati et al.,2022)** showed project delays or stopping are closely linked to the failure to identify financial risks in advance. Increased administrative costs, including claims for compensation and legal disputes, arise due to the lack of studies and diagnoses of the financial crises that projects are experiencing **(Mohammed, 2021)**.

Iraqi construction projects encounter various financial risks as a result of political and economic interference, inadequate legal procedures to safeguard investors' rights, inadequate financial planning, absence of work quality oversight, owners' delayed financing, and other factors that increase exposure to this type of risk. In recent years, the Iraqi economy has encountered several obstacles. The building business has been hit hard by the effects of Iraq's unstable economy, which in turn has created a number of dangers. Financial and economic uncertainties pose the greatest threat to Iraqi building projects **(Qllam and Mizikovsky, 2023)**. Certain financial hazards include insufficient backup plans, a systemic gap between revenue and spending promises, and sloppy methods of managing financial risk. Budgets are vulnerable to both external factors and management-related internal worries. Projects in Nigeria were found to have been suspended due to inflation being one

of the most significant financial concerns, according to a study that used questionnaires **(Obodo et al., 2021)**. The majority of the potentially significant risks include monetary matters, such as forgetting to make advance arrangements for finance or paying contractors on time **(Hasan and Burhan, 2025)**. Managing and analyzing risks are crucial parts of making decisions in the construction industry **(Mahamid, 2013)**. High degrees of risk are inherent to the construction sector and its clients. Delays in owner payments, a lack of coordination amongst stakeholders, and an uncertain political climate are only a few of the many sources of financial risk **(Taylan et al., 2014),** Critical elements that can contribute to difficult-to-manage financial risks include taxes, inflation, and the type and approach of the project **(Ammar et al., 2022; Burcar Dunovic et al., 2016; Kamaruddeen et al., 2020)**. Among the many discrepancies found in an Iraqi study, the most notable ones were financial insurance, corruption, the most efficient use of funds as per the contract, and the project's inability to secure funding **(Khaleel and Flayeh, 2020)**. The long-term viability of funding is susceptible to a wide variety of project hazards. According to **(Bahamid et al., 2019)**, the project budget is significantly affected by inflation and the dependence on limited finance sources. **Table 1** represents the most important causes of financial risks, which were collected from previous studies.

Table 1. Risk factors from the reviewed literature.

No.	Risk Factor	Reference
1	Client's ability to meet financial requirements	**(Ammar et al., 2022; Bahamid et al., 2019; Yousri et al., 2023)**
2	Capability of subcontractors/suppliers	**(Ammar et al., 2022; Yousri et al., 2023)**
3	Complicated administration process	**(Ammar et al., 2022; Yousri et al., 2023;Chen et al.,2021)**
4	Material price fluctuations	**(Ammar et al., 2022; Jarkas and Haupt, 2015; Srinivasan et al., 2022)**
5	Inflation	**(Ammar et al., 2022; Bahamid et al., 2019; Jarkas and Haupt, 2015)**
6	Government Permits	**(Ammar et al., 2022; Bahamid et al., 2019; Saleh and Hilal, 2024)**
7	Interference between sponsors	**(Srinivasan et al., 2022; Viswanathan and Jha, 2020)**
8	Frequent currency fluctuation	**(Ammar et al., 2022; Viswanathan and Jha, 2020)**
9	Delay in performing the final inspection	**(Yousri et al., 2023;Genc, 2023)**
10	frequent changes in statutory regulations	**(Ammar et al., 2022; Jarkas and Haupt, 2015)**
11	Delay in paying staff salaries	**(Ammar et al., 2022; Jarkas and Haupt, 2015; Kamaruddeen et al., 2020)**
12	Change in regulations	**(Ammar et al., 2022; Bahamid et al., 2019; Viswanathan and Jha, 2020)**
13	Clients' financial stability	**(Saleh and Hilal, 2024; Srinivasan et al., 2022;Adafin et al.,2020)**
14	Strong political opposition	**(Ammar et al., 2022; Yousri et al., 2023)**
15	Unsuitable Construction Planning	**(Yousri et al., 2023;Gashaw and Jilcha, 2022)**
16	A delay in the payment process by the client	**(Ammar et al., 2022; Jarkas and Haupt, 2015; Srinivasan et al., 2022)**

17	Weakness in the decision–making process	**(Ammar et al., 2022; Bahamid et al., 2019; Saleh and Hilal, 2024)**
18	Corruption	**(Bahamid et al., 2019; Jarkas and Haupt, 2015; Saleh and Hilal, 2024)**
19	Cost of materials.	**(Bahamid et al., 2019; Jin et al., 2021; Valaskova et al., 2018)**
20	Change orders	**(Ammar et al., 2022; Bahamid et al., 2019; Jin et al., 2021; Viswanathan and Jha, 2020)**
21	Polices of contractors	**(Ammar et al., 2022; Jin et al., 2021)**
22	Poor communication between clients, consultants and contractors	**(Ammar et al., 2022; Yousri et al., 2023)**
23	Delay in approving design documents	**(Ammar et al., 2022; Marwa and Altaie, 2022)**
24	Inaccurate cost estimates	**(Ammar et al., 2022; Jarkas and Haupt, 2015; Khaleel and Flayeh, 2020)**
25	Changing of scope	**(Ammar et al., 2022; Yousri et al., 2023)**
26	Poor financial market	**(Ammar et al., 2022; Srinivasan et al., 2022; Valaskova et al., 2018)**
27	The sponsor made the short contract duration.	**(Amca et al., 2025; Ammar et al., 2022; Srinivasan et al., 2022)**
28	Funding problems from contractors	**(Yousri et al., 2023)**
29	Unavailability of competent staff.	**(Ammar et al., 2022; Burcar Dunovic et al., 2016; Srinivasan et al., 2022)**
30	Unclear and inadequate detail drawing	**(Amca et al., 2025; Srinivasan et al., 2022)**
31	Changing the material specification in the construction phase	**(Srinivasan et al., 2022; Yousri et al., 2023)**
32	Lack of design requirements	**(Ammar et al., 2022; Yousri et al., 2023)**
33	Misunderstanding of the authorities' requirements	**(Yousri et al., 2023)**
34	Mistakes/errors during construction.	**(Ammar et al., 2022; Srinivasan et al., 2022)**
35	Working in dangerous areas	**(Jarkas and Haupt, 2015; Yousri et al., 2023)**
36	Availability of equipment	**(Yousri et al., 2023)**
37	Awarding the design to unqualified designers	**(Ammar et al., 2022; Jarkas and Haupt, 2015)**
38	Delay in solving disputes	**(Jarkas and Haupt, 2015; Saleh and Hilal, 2024)**
39	Unstable government	**(Jarkas and Haupt, 2015; Rashid, 2023)**
40	Poor performance of subcontractors.	**(Ammar et al., 2022; Obodo et al., 2021; Srinivasan et al., 2022)**

2. METHODOLOGY

2.1 Research Methodology

In this study, qualitative and quantitative approaches were adopted to obtain somewhat comprehensive information in the field of this research. The questionnaire was used as a tool for data collection. The respondents were professionals working in the Iraqi construction sector, specifically in road, bridge, and residential complex projects. They included engineers and experts chosen due to their extensive experience in construction projects, comprehensive knowledge of project risks, and understanding of the potential impacts and damages these risks can cause. The risks within the questionnaire were divided into main categories and secondary categories, where each main category includes secondary risks.

The main categories are five categories based on a review of previous studies and expert discussion, and they were as follows:

- Planning risks
- Finance risks
- Execution risks
- Economical risks
- Organizational risks

2.2 Preparation of Questionnaire

There were two sections to the questionnaire. The first section got information about the respondents' demographics. The second portion enumerated 40 financial risk variables and put them into five primary groups. People who answered the question used a five-point Likert scale to rate each component (1 = extremely low, 2 = low, 3 = medium, 4 = high, very high). The questionnaires were distributed via personal interviews and email. Out of 60 distributed questionnaires, 50 were completed 10 questionnaires were neglected due to lack of information and failure to complete them by the respondents. Participants evaluated the likelihood and impact of each factor based on their experience with construction projects. These responses formed the basis for analyzing the study results.

2.3 Respondent's Profile

Despite the relatively small sample size, the responses were considered reliable due to the experience of the construction sector specialists and their understanding of the questionnaire **(Ammar et al., 2022; Lie et al., 2023)**. **Table 2** shows the respondent's profile.

Table 2. Respondent's profile.

Characteristics	Categories	Frequency	Percent
Position	20	20	40.00%
	18	18	36.00%
	12	12	24.00%
Total		50	100.00%
Years of Experience	19	19	38.00%
	20	20	40.00%
	11	11	22.00%
Total		50	100.00%
Qualification	28	28	56.00%
	12	12	24.00%
	10	10	20.00%
Total		50	100.0%
Specializations	28	28	56.00%
	10	10	20.00%
	12	12	24.00%
Total		50	100.00%

2.4 Data Analysis and Ranking

2.4.1 Reliability Test

One of the basic steps when adopting a questionnaire as a tool for collecting data is the reliability test represented by the alpha coefficient, which shows that the results of the study accurately reflect the case being studied **(Marwa and Altaie, 2022)**. Cronbach's alpha: The higher the value (0.70), the more reliable the research tool is and it can be relied upon in statistical analysis **(Rashid, 2023)**. The reliability test was conducted using SPSS-V23 software. **Table 3** shows the test results.

Table 3. Cronbach's Alpha coefficient for the questionnaire.

No.	Risk category	No. of sub. categories	Cronbach's Alpha (α)
1	planning risks	8	0.920
2	Finance risks	7	0.820
3	Execution risks	12	0.940
4	Economical risks	6	0.810
5	Orginazational risks	7	0.780

2.4.2 Probability and Impact Matrix

In this study, a probability and impact matrix were used to represent various financial factors in Iraqi construction projects. **Fig. 1** presents an example of a risk matrix with two axes: horizontal (impact) and vertical (probability), which is considered a reliable method for identifying and classifying risks **(Ammar et al., 2022; Dumbravă and Iacob, 2013; Acebes et al.,2024)**.

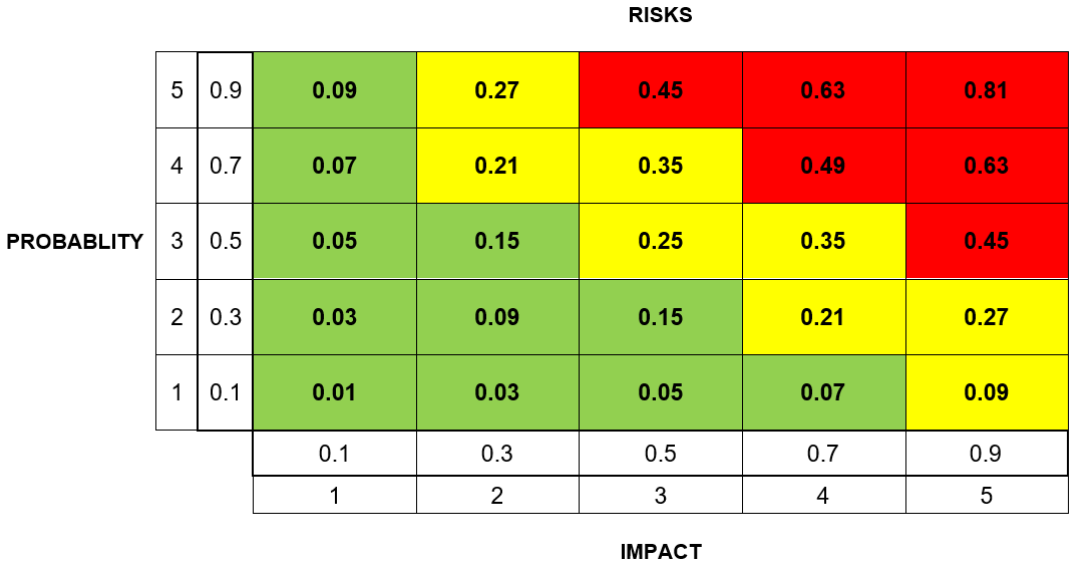

Figure 1. Risk matrix **(Ammar et al., 2022; Dumbravă and Iacob, 2013)**.

Risk severity was then calculated to obtain a score for each risk factor, as shown in (1):

$$Risk\ Severity = P \times I \quad (1)$$

Where P is probability and I is impact.

The risk matrix contains three zones, each representing the severity and impact of the risk. The red zone represents critical risks of the highest priority and importance, requiring special attention to mitigate or eliminate their negative impacts. The yellow zone includes medium risks, which are less impactful than the red zone but must be monitored and controlled. As for the green zone, the risks are low and have no impact on the project and can be ignored because they are under control. Use the relative importance index (RII) statistical method to priorities factors and give an idea of the importance of a risk factor **(Altaie and Onyelowe, 2024)**. The relative importance index for each risk factor was calculated using (2) for all factors classified within the main categories and ranked accordingly **(Khoiry, 2023).**

$$RII = \sum \frac{W}{A * N} \quad (2)$$

Where W is the weight given by the respondents for each factor, ranging from 1 to 5, where; 1 = very low impact, 2 = low impact, 3 = moderate impact, 4 = high impact and 5 = major impact; A is the highest weight (5 in this case); and N is the total number of respondents (50 in this case).

3. RESULTS AND DISCUSSION

The severity of each risk factor identified by the participants was assessed using Eq. (1) to obtain a risk score. Eq. (2) was used to obtain the relative risk index (RII) for each factor, which was then used to rank the risk factors according to their importance. Eq. (3) is the sum of the scores from the participants, while the severity degree was calculated using Equ. (4).

$$Total\ scores\ of\ participants\ (\mathrm{W}) = \ the\ sum\ of\ (P * I)\ for\ each\ risk\ factor \quad (3)$$
$$Degree\ of\ Severity\ = the\ score\ of\ each\ factor\ according\ to\ the\ total \quad (4)$$

So, **Table 4** shows the risk severity, level of severity, and ranking for each risk factor.
The findings showed that eight things are in the red zone of the risk matrix, which means they are high risk. The most important of them is the planning risk group's improper cost prediction, which has a significance score of 0.824. Respondents stressed that project quantity and cost estimates must be based on clear and correct techniques. If they aren't, costs may go over budget, more money may be needed, and the project timetable may be pushed back. The financial stability of the customer was equally important, coming in second and third with scores of 0.792 and 0.763, respectively. Delays in funding from the client were a major source of total project delays, which frequently meant missing delivery dates **(Abd El Mohamed et al., 2017)**. Material price was fourth on the list, with a significance rating of 0.739 in the economic risk category. This is because changes in price might cause financial and contractual problems that can stop a project from moving forward. Some builders may also use lower-quality materials to save money, which impairs the project's long-term quality. Change orders were found to be the fifth most important risk, with a significance index of 0.731. They were a major cause of financial issues in Iraqi projects because of poor planning and not taking market changes into account, which led to expenses going beyond the initial budgets **(Ibraheem, 2025)**. **Table 4** shows the results of the risk factors and their rankings.

Table 4. Ranked significance of the risk factors.

Category	Risk Factor	$(\sum W)$	Degree of Severity $(\sum W/N)$	RII	Rank
Planning risks	Government permits	273.5	5.47	0.437	23
	Inaccurate cost estimates	826.5	16.53	0.824	1
	The sponsor makes the short contract duration	638.5	12.77	0.699	9
	Poor communication between clients, consultants, and contractors	349.5	6.99	0.499	21
	Change orders	695.5	13.91	0.731	5
	Complicated administration process	264.5	5.29	0.419	25
	Unclear and inadequate detail drawing	246.5	4.93	0.413	26
	Awarding the design to unqualified designers	592.5	11.85	0.683	10
financial risks	Client's ability to meet financial requirements	200.5	4.01	0.373	28
	Interference between sponsors	98.5	1.97	0.275	34
	Clients' financial stability	750.5	15.01	0.763	3
	Funding problems from contractors	80	1.60	0.256	35
	A delay in the payment process by the client	792.5	15.85	0.792	2
	Poor financial market	302	6.04	0.464	22
	Delay in paying staff salaries	135.5	2.71	0.333	33
Execution risks	Capability of subcontractors/suppliers	86	1.72	0.253	36
	Delay in performing the final inspection	263	4.72	0.408	27
	Unsuitable Construction Planning	580.5	11.61	0.672	11
	Cost of materials	451.5	9.03	0.518	20
	Policies of the contractor	406	8.12	0.528	19
	Delay in approving design documents	564.5	11.29	0.656	12
	Unavailability of competent staff	78.5	1.57	0.24	37
	Changing the material specification in the construction phase	542	10.84	0.629	13
	Lack of design requirements	232	4.64	0.437	24
	Mistakes/errors during construction	434	8.68	0.563	18
	Availability of equipment	74.5	1.49	0.24	38

	Poor performance of subcontractors	537.5	10.75	0.627	14
Economical risks	Material price fluctuations	721.5	14.43	0.739	4
	Inflation	59.5	1.19	0.219	39
	Changes in regulations	532.5	10.65	0.624	15
	Strong political opposition	678	13.56	0.709	7
	Unstable government	106.5	2.13	0.333	32
	Frequent currency fluctuation	55.5	1.11	0.203	40
Orginazational risks	Frequent changes in statutory regulations	500	10.00	0.619	16
	Weakness in the decision-making process	146.5	2.93	0.341	31
	corruption	692	13.84	0.725	6
	Changing of scope	466.5	9.33	0.589	17
	Misunderstanding of the authorities' requirements	154.5	3.09	0.347	30
	Working in dangerous areas	662.5	13.25	0.704	8
	Delay in solving disputes	333.5	6.67	0.368	29

Corruption was rated sixth with a significance score of 0.725. It is made worse by insufficient technical and administrative skills and a lack of strong control, which leads to a lack of funds and the execution of projects that are not up to par or are not finished. Strong political opposition (economic risk) and working in risky locations (organizational risk) were in seventh and eighth place, with relevance indices of 0.709 and 0.704, respectively. Political intervention often influences the choice of firms that may lack adequate expertise or technological requirements. Projects in governorates with unpredictable security situations also face extra risks that make the timetable and total costs worse. This study corroborates the results of prior research, emphasizing the need of precisely identifying the critical financial risk elements by quantitative risk analysis.

4. CONCLUSIONS

To reach project objectives on schedule and within budget, it's important to use the likelihood and effect matrix to figure out the financial risks of projects. The study's findings indicate that these projects are significantly susceptible to financial issues. The primary hazards that have been found include a broad variety of problems, such as wrong cost estimates, late payments from clients, clients that are not financially stable, prices that vary quickly in the market, change orders, corruption, political resistance, and working in unsafe places. These findings clearly show that companies that manage construction projects don't have dedicated systems and programs for risk management and don't do important risk management tasks like identifying, evaluating, treating, and monitoring risks at every stage of the project. This lack represents a severe danger to the project's long-term success, its expected results, and the bigger goals of economic growth.

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Declaration of Competing Interest

The author declares that she has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES

Abd El Mohamed, S.B.A., El Nawawy, O.A.M., and Abdel-Alim, A.M., 2017. Identification and assessment of risk factors affecting construction projects. *HBRC Journal*, 13(2), pp. 202-216. https://doi.org/10.1016/j.hbrcj.2015.05.001

Altaie, M.R., and Onyelowe, K., 2024. Identifying failure factors in the implementation of residential complex projects in Iraq. *Journal of Engineering*, 30(02), pp. 1-15. https://doi.org/10.31026/j.eng.2024.02.01.

Amca, Y., Yorucu, V., and Kırıkkaleli, D., 2025. Construction cost index: political, economic, and financial risk indices within the european continent. *Sustainability*, 17(3), P. 917. https://doi.org/10.3390/su17030917.

Ammar, T., Abdel-Monem, M., and El-Dash, K., 2022. Risk factors causing cost overruns in road networks. *Ain Shams Engineering*, 13(5), P. 101720.

Acebes, F., González-Varona, J.M., López-Paredes, A., and Pajares, J., 2024. Beyond probability-impact matrices in project risk management: A quantitative methodology for risk prioritisation. *Humanities and Social Sciences Communications*, 11(1), pp. 1-13. https://doi.org/10.1057/s41599-024-03180-5

Adafin, J., Rotimi, J.O.B., Wilkinson, S., 2020. Risk impact assessments in project budget development: quantity surveyors' perspectives. *International Journal of Construction Management,* 20, pp. 13–28. https://doi.org/10.1080/15623599.2018.1462441

Bahamid, R.A., Doh, S., and Al-Sharaf, M.A., 2019. Risk factors affecting the construction projects in the developing countries. *IOP Conference Series: Earth and Environmental Science*, 244(1), P. 012040. https://doi.org/10.1088/1755-1.012040/1/244/315

Bajwa, I.A., and Syed, A.M., 2020. Identification of major construction sector risks in Saudi Arabia. *World Transactions on Engineering and Technology Education*, 18(2), pp. 247-256.

Burcar Dunovic, I., Radujkovic, M., and Vukomanovic, M., 2016. Internal and external risk based assesment and evaluation for the large infrastructure projects. *Journal of Civil Engineering and Management*, 22(5), pp. 673-682. https://doi.org/10.3846/13923730.2015.1128479.

Cheng, X., Liu, S., Sun, X., Wang, Z., Zhou, H., Shao, Y., and Shen, H., 2021. Combating emerging financial risks in the big data era: A perspective review. *Fundamental Research*, 1(5), pp. 595-606. https://doi.org/10.1016/j.fmre.2021.08.017

Dumbravă, V., and Iacob, V.S., 2013. Using probability–impact matrix in analysis and risk assessment projects. *Journal of Knowledge Management, Economics and Information Technology*, 42, pp. 76-96.

Ibraheem, R.A.R., 2025. Exploring the risk factors of the international companies in Iraqi construction projects. *Journal of Sustainable Studies*, pp. 196-210.

Genc, O., 2023. Identifying principal risk factors in Turkish construction sector according to their probability of occurrences: a relative importance index (RII) and exploratory factor analysis (EFA) approach. *International Journal of Construction Management*, 23(6), pp. 979-987. https://doi.org/10.1080/15623599.2021.1946901

Gashaw, T., and Jilcha, K., 2022. Risk prioritisation using fuzzy analytic network process: A case of Addis–Djibouti railway construction project. *Journal of Multi-Criteria Decision Analysis,* 29(3-4), pp. 313-324. https://doi.org/10.1002/mcda.1776

Ildarabadi, P., and Alamatian, J., 2021. Proposing a new function for evaluation of the financial risk of construction projects using Monte Carlo method: Application on Iranian construction industry. *Journal of Building Engineering*, 43, P. 103143. https://doi.org/10.1016/j.jobe.2021.103143

Jarkas, A.M., and Haupt, T.C., 2015. Major construction risk factors considered by general contractors in Qatar. *Journal of Engineering, Design and Technology*, 13(1), pp. 165-194. https://doi.org/10.1108/JEDT-03.0012-2014-

Jin, C., Li, B., Ye, Z., and Xiang, P., 2021. Identifying the non-traditional safety risk paths of employees from Chinese international construction companies in Africa. *International Journal of Environmental Research and Public Health*, 18(4), P. 1990. https://doi.org/10.3390/ijerph18041990.

Kamaruddeen, A.M., Sung, C.F., and Wahi, W., 2020. A study on factors causing cost overrun of construction projects in Sarawak, Malaysia. *Civil Engineering and Architecture*, 8(3), pp. 191-199. https://doi.org/10.131/89cea.2020.080301.

Khaleel, T.A., and Flayeh, M.A., 2020. Evaluation of risk factors affecting the implementation time for residential complex projects in Iraq. *IOP Conference Series: Materials Science and Engineering*, 671, P. 012002. https://doi.org/10.1088899-1757/X/671/1/012002.

Kraidi, L., Shah, R., Matipa, W., and Borthwick, F., 2019. Analyzing the critical risk factors associated with oil and gas pipeline projects in Iraq. *International Journal of Critical Infrastructure Protection*, 24, pp. 14-22. https://doi.org/10.1016/j.ijcip.2018.10.010.

Khoiry, M.A., 2023. Using relative importance index method for developing risk map in oil and gas construction projects. *Jurnal Kejuruteraan*. https://doi.org/10.17576/jkukm-2020-32(3)-09

Lei, Y., Qiaoming, H., and Tong, Z., 2023. Research on supply chain financial risk prevention based on machine learning. Computational Intelligence and Neuroscience, 2023(1), P. 6531154. https://doi.org/10.1155/2023/6531154

Lin, X., and Shang, G., 2025. Comprehensive evaluation method of enterprise financial risk based on fuzzy grey correlation analysis. *International Journal of Business Intelligence and Data Mining*, 26(1-2), pp. 147-160. https://doi.org/10.1504/ijbidm.2025.143928

Marwa, M., and Altaie, M.R., 2022. Use risk score method to identify the qualitative risk analysis criteria in tendering phase in construction projects. *Journal of Engineering*, 28(7), pp. 31-42. https://doi.org/10.31026/j.eng.2025.02.04.

Mishra, A.K., and Mallik, K., 2017. Factors and impact of risk management practice on success of construction projects of housing developers, Kathmandu, Nepal. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, 36(7), pp. 206-232.

Mohammed, A.J., 2021. The impact of financial crisis on construction projects-a case study: The Erbil governorate in Kurdistan region of Iraq. *International Review Civil Engineering (IRECE)*, 12(1). https://doi.org/10.15866/irece.v12i1.18722

Obodo, C.E., Xie, Z., Cobbinah, B.B., and Yari, K.D.Y., 2021. Evaluating the factors affecting contractors tender for project construction: an empirical study of small scale indigenous contractors in awka, Nigeria. *Open Journal of Social Sciences*, 9(7), pp. 381-397. https://doi.org/10.4236/jss.2021.97028.

Rashid, H.A., 2023. Empirical study for capturing and allocating significant risk factors in school construction projects in Iraq. *Journal of Engineering*, 29(12), pp. 81-103. https://doi.org/10.31026/j.eng.2023.12.06.

Rahmati, S., Mahdavi, M.H., Ghoushchi, S.J., Tomaskova, H., and Haseli, G., 2022. Assessment and prioritize risk factors of financial measurement of management control system for production companies using a hybrid Z-SWARA and Z-WASPAS with FMEA method: a meta-analysis. Mathematics, 10(2), P. 253. https://doi.org/10.3390/math10020253

Saleh, A.M., and Hilal, M.A., 2024. Identification risks in road construction projects using weighted product model: Iraq as a case study. *Journal of Engineering*, 30(12), pp. 76-95. https://doi.org/10.31026/j.eng.2024.12.06.

Srinivasan, N., Dinesh, A., Munshi, S., and Karthick, A., 2022. Factors influencing financial risk management in construction projects. *IOP Conference Series: Earth and Environmental Science*, 1125(1), P. 012025. https://doi.org/10.1088/1755-1315/1125/1/012025.

Shibani, A., Hasan, D., Saaifan, J., Sabboubeh, H., Eltaip, M., Saidani, M., and Gherbal, N., 2024. Financial risk management in the construction projects. Journal of King Saud University-Engineering Sciences, 36(8), pp. 552-561.https://doi.org/10.1016/j.jksues.2022.05.001

Taylan, O., Bafail, A.O., Abdulaal, R.M.S., and Kabli, M.R., 2014. Construction projects selection and risk assessment by fuzzy AHP and fuzzy TOPSIS methodologies. *Applied Soft Computing*, 17, pp. 105-116. https://doi.org/10.1016/j.asoc.2014.01.003.

Valaskova, K., Kliestik, T.K, and ovacova, M., 2018. Management of financial risks in Slovak enterprises using regression analysis. *Oeconomia Copernicana*, 9(1), pp. 105-121.

Viswanathan, S.K., and Jha, K.N., 2020. Critical risk factors in international construction projects: An Indian perspective. *Engineering, Construction and Architectural Management*, 27(5), pp. 1169-1190. https://doi.org/10.1108/ECAM-04-2019-0220.

Yousri, E., Sayed, A.E.B., Farag, M.A., and Abdelalim, A.M., 2023. Risk identification of building construction projects in Egypt. *Buildings*, 13(4), P. 1084. https://doi.org/10.3390/buildings13041084.

تحليل المخاطر المالية الكامنة في قطاع البناء العراقي باستخدام مصفوفة الاحتمالات والتأثير

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الخلاصة

تُمثل المخاطر المالية أحد أهم التحديات التي تواجه قطاع الإنشاءات في جميع أنحاء العالم، وخاصةً في مشاريع الإنشاءات العراقية. وغالبًا ما تؤدي هذه المخاطر إلى تأخير المشاريع وإرهاق الميزانيات. تهدف هذه الدراسة إلى استخلاص أسباب المخاطر المالية وتحديد آثارها. وقد استُخدم استبيان لتحديد العوامل الفرعية واستخلاصها. بالإضافة إلى ذلك، استُخدمت مصفوفة الاحتمالات والتأثير لإجراء تحليل كمي لهذه العوامل. كما استُخدم مؤشر الأهمية النسبية لتحديد أولويات المخاطر. وأشارت نتائج الدراسة إلى أن ثمانية عوامل أثرت بشكل كبير على المشروع، وصُنفت على أنها عالية المخاطر: تقديرات التكلفة غير الدقيقة، وتأخر عمليات دفع العملاء، وعدم الاستقرار المالي للعملاء، وتقلبات أسعار المواد، وأوامر التغيير، والفساد، والمعارضة السياسية القوية، والعمل في مناطق خطرة. ستساعد هذه الدراسة المختصين المشاركين في مشاريع الإنشاءات، بمن فيهم صانعو القرار والمهندسون والمالكون والمقاولون، على تحديد العوامل التي تُسبب المخاطر المالية. كما ستساعدهم على وضع خطة عملية لإدارة المخاطر للتخفيف من آثار هذه المخاطر في مشاريع الإنشاءات المستقبلية. كما أنها تُقلل من الخسائر المالية والزمنية في المشاريع، بالإضافة إلى تحسين جودة المشاريع واستدامتها.

الكلمات المفتاحية: قطاع البناء، المخاطر المالية؛ التأثير، االعراق، مؤشر الأهمية النسبية.