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Identification and Qualitative Evaluation of Risk Factors in the Construction Projects in Iraq

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ABSTRACT

Construction projects in Iraq face many dangers that cause exceeding the estimated cost of the project and not completing the project on time, and since the risk management process in construction projects is of great importance in controlling and reducing the impact of risks in construction projects, so it is necessary to identify these risks and evaluate them correctly in order to increase accuracy and the health of the subsequent stages of the risk management process in construction projects. This paper aims to identify the most important risks in construction projects in Iraq and to conduct a qualitative assessment of the identified risks and arrange them according to their importance. The researcher adopted the questionnaire method as a tool to determine the risks and used the technique of probability and effect matrix to conduct the qualitative assessment of the identified risks. The study found that there are 48 risk factors that constitute the most dangerous factor in construction projects in Iraq, and 9 of the determining factors were within the high level of risk, and at the forefront of which was the inability of the owner to finance the project.

1. Introduction

Risk is an event that may or may not occur and may lead to increase costs, delay of the project, poor quality [1]. The risk is associated with human life and is present in all human endeavors. However, the complex work involved in construction work makes the latter more vulnerable [2], and their successes depending on the level of risk [3]. Construction projects are involved a lot of inherent risks because including many of the contracting parties, such as the owners, contractors, designers, suppliers, subcontractors, etc. [4]. Risk can be evaluated using different types of information [5-7]. The identification of risks and documentation provides the project team with the knowledge and capacity to anticipate events [8]. Reference [1] adds that the project should be viewed systematically and from different angles to obtain complete risk identification. The project risk identification phase facilitates the effective study of activities and spaces in which organizational resources may be at risk, which in turn affects the achievement of its objectives and actions [9]. Many techniques and tools can be used in identifying project risks such as Checklists, Interviews, Past experience, Brainstorming [10-12]. For taking further measures on the risks that have been identified, risks must be evaluating the likelihood of their occurrence and their impact on the project objectives and combining them [13]. The probability and impact matrix can be used to determine the level of risk during the risk evaluation process by comparing the likelihood of risk against the severe consequences, and in this way, it helps clarify risk and make a decision [14], In recent years, construction projects in Iraq suffered from

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exposure to a lot of risks that affect project goals and cause the current research aim to:

1. Identifying risks in construction projects in Diyala governorate for the period from (2020-2021), evaluating and arranging them according to their priorities.
2. Providing a scientific and sound basis that helps in identifying the risks faced by construction projects.
3. Conducting the qualitative assessment of the identified risks and arranging them according to their relative importance.

2. Literature review

In Iraq and many other countries, many studies about risk management in construction projects especially the identification risks stage have been conducted. For example, Reference [15] attempted to Identify and evaluate the business risk management in construction projects in Iraq. A questionnaire survey and personal interviews are the methodologies adopted in this study. The most significant risk factors that identified by this study were poor estimation, inadequate construction planning, project changes during construction, poor contract management, finance, and payment problems. Also, the study reached that enhancing the communication between the project parties is very important for controlling the construction time and cost. Reference [16] attempted to discuss the risk identification phase in Iraq construction projects, classify them, and ranking the identified risk factors depending on their frequency and severity. The study adopted the questionnaire survey and personal interviews as a methodology to achieve its goals. The study identified 63 risk factors in the questionnaire form. The study found that the significance Index for each risk group of factors as follows: management risk, legal risk, market risk, financial risk, technical risk, political risk, social, security risk, and environmental risk. Reference [17] conduct a review on risk management in the construction projects in Iraq for covering the concepts of risk management in the construction projects, also reviewed methods for analyzing risks and control them. the result of this study was the Lack of allocations of additional finances that can be covering the treatment of the risk, there's a weakness of application of risk management methodology and weakness in experience and dealing with it, lack of studies in this field, lack of use of international expertise , lack of training programs and courses, selection of unqualified contractors and companies work in unstable areas, Reference [18]Attempted to classify the main risks in contractual projects. This study aimed to draw up a list of risks facing airport construction projects in Saudi Arabia in addition to clarifying the expected results of this study. An in-depth review of the literature related to risk identification, in addition to structured interviews with experts in airport construction companies and analyzing data using descriptive statistics, has been relied upon. This study concluded with the identification of five main risks facing airport construction companies in the region. Saudi Arabia is among the fifty-four potential risks, and these risks include the absence of a clear risk management plan - delay in payment of dues - changes in design - bureaucratic problems in dealing with the government -Change in demands. Reference [19] tried to identify and evaluate risk factors in construction projects. This study aimed to develop a model that helps in identifying and analyzing risks that affect construction costs and time in Egyptian contracting companies. The descriptive approach was adopted, and the study tool was represented by a questionnaire. Risks Have been characterized based on the descriptive statistics represented by the arithmetic mean and the standard deviation and then weighed, and develop a computer model to predict them. The results of the study were: The development of a model that can predict the main risks that affect the time and cost of projects contracting in Egypt.

3. The research methodology

In this paper, the author will use the questionnaire tool to identify the risks in construction projects in Iraq and adopt the probability and impact technique for evaluating the risks after identification. The research methodology can be summarized as follows:

1- Collecting information about the risks in construction projects from previous studies and personal interviews that conducted by the author with many project managers, consultants, supervisors, and contractors to benefit from their experience for designing the questionnaire form.
2- Designing the initial questionnaire form and presenting it to a group of arbitrators and experts for evaluation and submit their proposal.
3- Designing the final questionnaire form which includes two parts: General information about the study sample, and the probability of risk occurrence and its impact on construction projects.
4- distribution the questionnaire forms to a number of engineers specialized in the field of engineering
5- Using the Statistical Package for Social Sciences (SPSS) V25 software and Microsoft Excel 2010 software for analyzing the data.
6- Using the probability and impact matrix technique for qualitative risks evaluation by calculating the risk score for each risk factor through using equation 1.

$$RS=P*I \quad (1)$$

where the risk score, RS, risk probability P and risk impact, I.

7- Arranging the risks according to the priority of attention

4. Probability and impact matrix

Risks in construction projects must be classified according to their severity by using probability and impact matrix as shown in Table 1. This matrix is constructed around the probability and impact of risks event. The matrix is split into several parts that present very high, high, moderate, low, and very low. These parts can be colored to distinguish one part relative to the other. Where the red color represents the very high and high level, and the yellow color represents a moderate level and the green color represents the low and very low level. These levels facilitate the classification of risks according to their severity and controlling them.

Table 1: Probability and impact matrix

	Impact of Risks				
Probability	Very low (1-1.8)	Low (1.8-2.6)	Moderate (2.6-3.4)	high (3.4-4.2)	Very high (4.2-5)
Very low (1-1.8)	(1-3.24)	(1.8-4.68)	(2.6-6.12(	(3.4 -7.56)	(4.2-9)
Low (1.8-2.6)	(1.8- 4.68)	(3.24 -6.76)	(4.68-8.84)	(6.12 -10.92)	(10.4-13)
Moderate (2.6-3.4)	(2.6-6.12)	(4.68 -8.84)	(6.76-11.56)	(8.84 -14.28)	(10.69-17)
High (3.4-4.2)	(3.4 -7.56)	(6.12 -10.92)	(8.84-14.28)	(11.56 -17.64)	(14.28-21)
Very high (4.2-5)	(4.2-9)	(7.56 -13)	(10.92 -17)	(14.28 -21)	(17.64-25)

5. Data collection

The construction and housing sector in Diyala governorate were chosen as the study sample to ensure the reliability and accuracy of the results because the supervision and implementation of most construction projects in Iraq is the responsibility of this sector. The minimum sample number of respondents is (30) or more (Hogg et al., 2014) and it is necessary to collect more than this number to ensure the reliability of the results.

The researcher distributed (60) questionnaire forms to a number of engineers working in Diyala Governorate Directorates. (50) questionnaire forms were adopted in the statistical analysis, where (6) questionnaires were rejected because the responses are not completed in it, and 4 others were not recovered.

4. Result and discussion

6.1 Reliability test

For any research, the acceptable results require using the tool of accurate measurement as one of the basic requirements before analyzing the data, a reliability test was conducted to check the internal consistency degree of the data collected from a questionnaire form. Cronbach's coefficient alpha (Cα) was used to measure the inner consistency for the data. Cronbach's coefficient alpha is characterized by a value between the numbers (0 – 1), where the number one indicates for high consistency (Cronbach & Lee J,1951). The result of the reliability test showed a high degree of questionnaire reliability as illustrated in Table 2.

Table 2: Results of Cronbach's alpha test

Cronbach's Alpha	No. of Item	Category	No.
1	Probability of risk occurrence	48	0.992
2	Impact of risk	48	0.987

6.2 The statistical data analysis

6.2.1General information

This section consisted of general information about the sample of the research. The frequency ratio for the first questionnaire part was calculated according to the references [20],[21]by using the equation (2)

$$P\% = (fi / n) *100 \quad (2)$$

where the frequencies ratio, P %

6.2.1.2 The workplace responses

The questionnaire forms were distributed to 4 governmental institutions in the Diyala governorate. Figure (1) shows the percentage of the questionnaire sample in each institution.

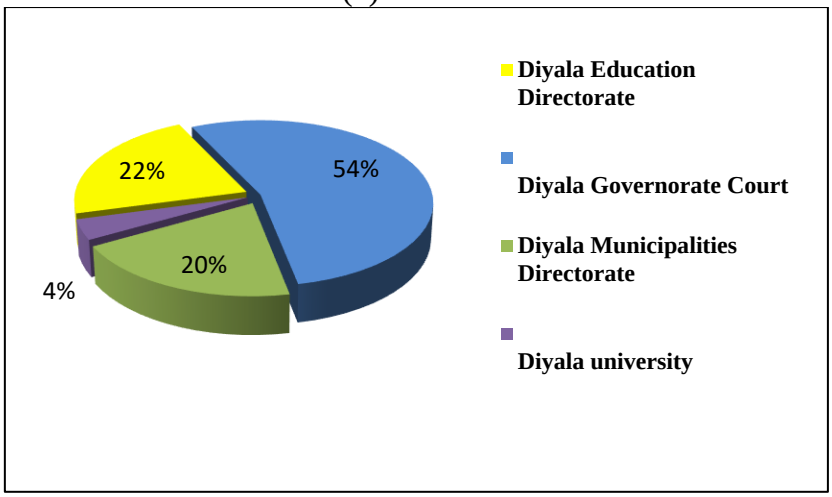

Figure 1. The workplace responses

6.2.1.2 Work sector

The private sector and public sectors are the main work sectors that involving in the sample of the research. Figure 4. shows the percentage of the work sector of the respondents.

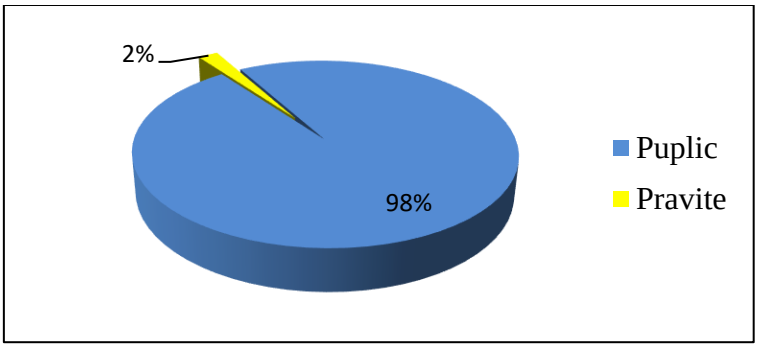

Figure 4. Work sector

6.2.1.3The academic qualification

The academic qualification of the engineers included in the questionnaire sample was illustrated in Figure 5.

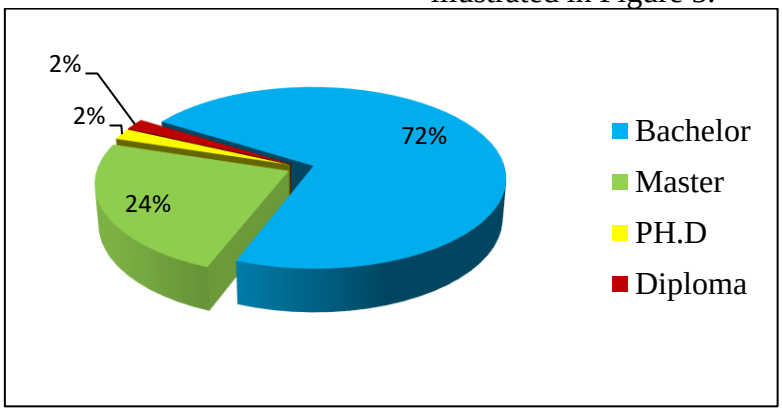

Figure 5. Academic qualification

6.2.1.4 Engineering specialization

Figure 6. illustrates the specialization of the sample where the percentage of Civil engineering was the highest percentage of the sample size

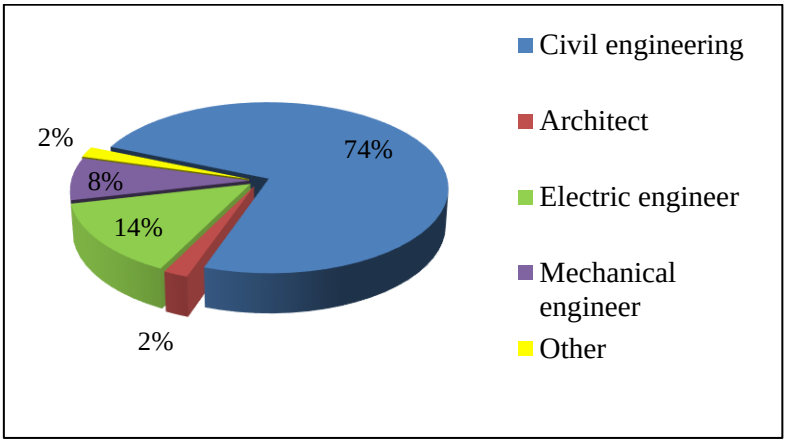

Figure 6. Engineering specialization

6.2.1.5 Work field

Figure 7. illustrates the work field of the engineers involved in the sample of the questionnaire.

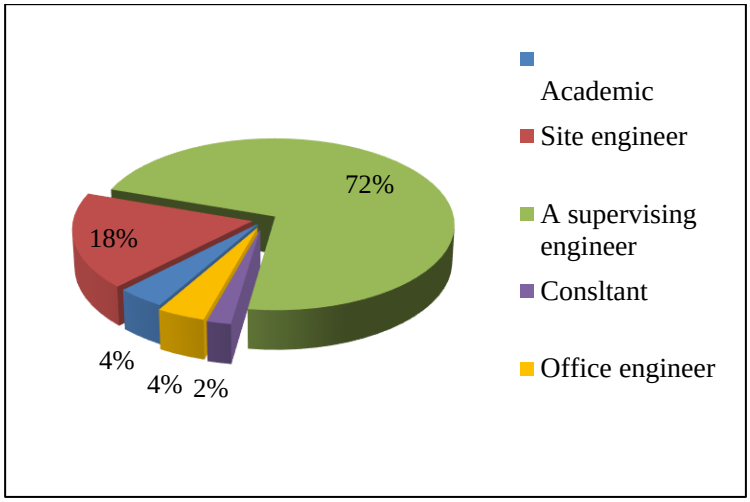

Figure 7. Work field

6.2.1.6 Years of experience

Figure 8. illustrates the years of experience for engineers involved in the sample of the questionnaire form. where the highest percentage of the questionnaire sample was (46%) for the engineers who have experience years that ranged from (6-10 year). The average years of experience for the research sample was (2.3800) as shown in Table 3.

Table 3: Average years of experience

No. of Research Sample	Average
50	2.3800

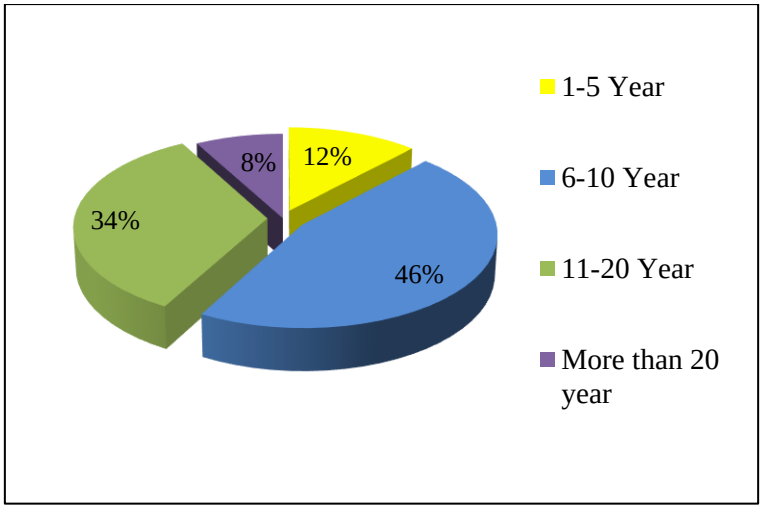

Figure 8. Years of experience

6.2.1.7 Current job position

Figure 9. shows the percentage of the current Job Position of engineers that involving in the sample of the questionnaire. It concluded that the biggest percentage was (38%) for Senior engineer,

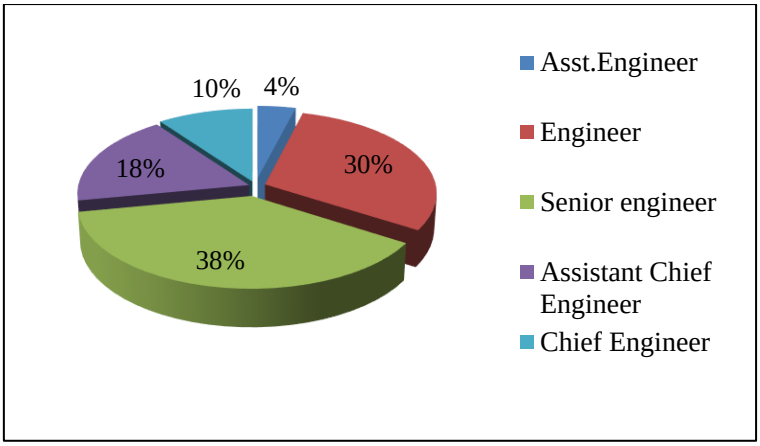

Figure 9. Current job position

6.2.1.8 Type of Project Implemented

Figure 10. shows the percentage of the type of project implemented for engineers that involving in the sample of the questionnaire.

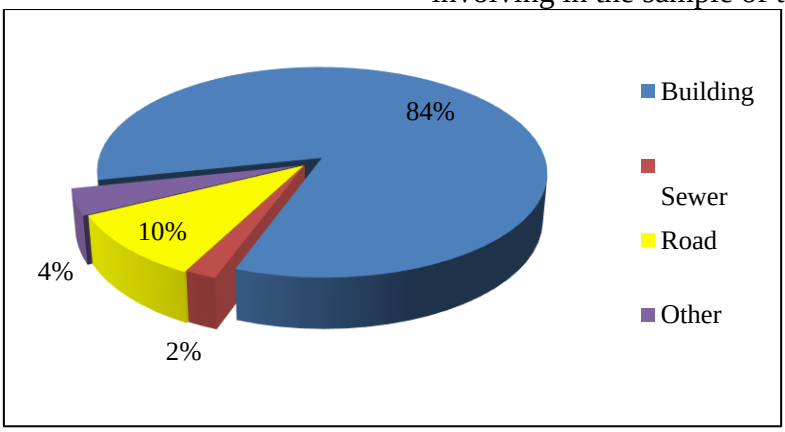

Figure 10. Type of project implemented

6.2.2 Occurrence probability of risks and its impact

The data of probability occurrence of risks and its impact on construction projects in Iraq was analyzed by using the software of SPSS v.25, for calculating the arithmetic mean for both probability occurrence of the risk and its impact and calculating the score of risk according to equation 1 and application it in the probability and impact matrix to identify the level of risk. finally arranging them according to severity level. Table 3 illustrates the arithmetic mean for both probability occurrence of the risk and its impact and the risk score for the identified risks. It was divided from very high to low level of influence. The risk factor of the inability of the owner to finance the project showed in the first rank according to influence level of the risk indicator was (19.46), which belongs to the category of risks of financial origin, while the risk of changes in the design appeared in the second rank with a risk index of (18.30), and in the third rank the risk of errors in estimating the quantitative with a high-risk index of (17.48) while the risk of mismatch the structural and architectural design appeared in the fourth rank with a high-risk index of (15.13), followed by the risk of the impact of change orders at the fifth rank with a score risk (14.56) and other ranking of risks was illustrated in Table 4. The risks that have very high and high influence level represents the most significant factor and critical risks that mast be monitoring and controlling. These risks are ranked according to their category belong as shown in Table 5.

Table 4: Qualitative evaluation and the risk factors ranking

NO.	Risk Factor	Occurrence Probability	Impact	Risk Score	Influence Level	Rank
1	The inability of the owner to finance the project	4.7	4.14	19.46	Very High	1
2	Risk of design changes	4.16	4.4	18.30	High	2
3	Errors in estimating quantities	4.6	3.8	17.48	High	3
4	Design mismatch between structural and architectural	3.9	3.88	15.13	High	4
5	The effect of change orders	4.16	3.5	14.56	High	5
6	Lack of experience of the contractor in the implementation of construction works	3.04	4.6	13.98	High	6
7	Inaccurate scheduling	3.58	3.76	13.46	High	7
8	Mismatch between the specifications in the BOQ and the charts	3.34	4	13.36	High	8
9	The un clarity of the owner requirements	3.48	3.38	11.76	High	9
10	The occurrence of exempt risks (unforeseen circumstances by both parties to the contract)	3.68	2.84	10.45	Medium	10
11	Contract disputes	3.02	3.22	9.72	Medium	11
12	Delay in approval of tests and examinations	3.3	2.74	9.04	Medium	12
13	Failure to choose the type of contract appropriate to the nature of the project (such as turnkey contract, unit price contract, and other types)	3.42	2.58	8.82	Medium	13
14	Design grants to unqualified designers	2.5	3.44	8.6	Medium	14
15	Inflation and changes in prices and currencies	2.92	2.9	8.47	Medium	15
16	The lack of clarity of the contract terms in the implementation phase	2.58	3.08	7.95	Medium	16
17	Risks arising from work conditions, for example (temporary suspension of work by the employer or anybody legally authorized by him for reasons related to the employer	2.9	2.72	7.89	Medium	17
18	Change in the official instructions for carrying out business	3.04	2.58	7.84	Medium	18
19	Lack of control over financial flows	2.64	2.96	7.81	Medium	19
20	Project damages due to war conditions, insecurity and thefts	2.54	3.02	7.67	Medium	20
21	reduction the quantities significantly from what is in the bill of quantities	2.9	2.6	7.54	Medium	21
22	The disagreement over the periods granted on the change orders	2.74	2.74	7.51	Medium	22
23	Lack of a clear quality plan	2.3	3.18	7.31	Medium	23
24	Non-compliance with the terms of the contract by one of the parties	2.52	2.84	7.16	Medium	24
25	Risks of human errors at the site (for example accidents of site workers or improper work by them)	2.32	3.08	7.15	Medium	25
26	Not documenting change orders on time and upon change	2.78	2.56	7.12	Medium	26
27	Reducing costs at the expense of quality and time (for example, acceptance of the lowest bids affects the quality of implementation and the time of the project)	2.32	3.06	7.10	Medium	27
28	Technically unqualified labour	2.56	2.76	7.07	Medium	28
29	Unavailability of raw materials	2.56	2.7	6.91	Medium	29

30	Delay in disbursing advances	2.56	2.68	6.86	Medium	30
31	High competition during bidding	2.6	2.56	6.66	Low	31
32	Bad and harsh weather conditions	2.44	2.72	6.64	Low	32
33	Soil investigations for the project site are insufficient	2.48	2.66	6.60	Low	33
34	Insufficient information about the nature of the project (uncertainty) such as weak feasibility studies for the project	2.56	2.5	6.4	Low	34
35	Unexpected financing for the project by the contractor	2.62	2.44	6.40	Low	35
36	Difficulty obtaining permits to work (such as building permits or delay by the employer in handing over the site to the contractor to start work)	2.4	2.64	6.34	Low	36
37	Poor coordination between contractor and owner	2.38	2.62	6.24	Low	37
38	Lack of flow of material preparation for the site	2.56	2.38	6.09	Low	38
39	The contractor does not return to the consultant designer when adding any construction work requested by the owner	2.2	2.76	6.07	Low	39
40	The effect of holiday events and holidays on project time	2.5	2.42	6.05	Low	40
41	Lack of machinery and equipment	2.48	2.42	6.00	Low	41
42	Unavailability of labour	2.36	2.54	5.99	Low	42
43	Damage to nearby buildings due to construction	2.1	2.74	5.75	Low	43
44	Changing the techniques used during implementation	2.16	2.62	5.66	Low	44
45	Supplying materials that are not valid or conform to specifications	2.28	2.46	5.61	Low	45
46	The risk of disagreeing over the sums granted on change orders	2.28	2.38	5.43	Low	46
47	The risk of implementing the engineer's orders to conduct additional checks that are not included in the contract, and the contractor is not responsible for performing them	2.16	2.36	5.10	Low	47
48	Site or business conditions	2.04	2.38	4.86	Low	48

Table 5: The most significant risk factor

NO.	Risk Factor	Risk Score	Category Belong
1	The inability of the owner to finance the project	19.46	Financial
2	Risk of design changes	18.30	Design and Planning
3	Errors in estimating quantities	17.48	Design and Planning
4	Design mismatch between structural and architectural	15.13	Design and Planning
5	The effect of change orders	14.56	implementation
6	Lack of experience of the contractor in the implementation of construction works	13.98	human or physical source
7	Inaccurate scheduling	13.46	Design and Planning
8	Mismatch between the specifications in the BOQ and the charts	13.36	Design and Planning
9	The un clarity of the owner requirements	11.76	Design and Planning

6. Conclusions

Construction projects face many risks that cause exceeding the estimated project cost and not completing the project within the specified time and the identification of these risks is an important phase for managing and controlling them. Therefore, the authors attempt to identify risks that face the construction projects in Diyala governorate which help in construction project management. From the results, the authors concluded the follows:

1. The study identified 48 risk factors, which represent the most common risks in construction projects in Iraq.
2. From the result of qualitative risk analyses, 9 risk factors showed in the red zone of probability and impact matrix which reflects the high probability and impact of such factors, and these risks represented the most significant risk factors.
3. The inability of the owner to finance the project represents the main risk factor that faces the construction projects and has the first rank according to influence level.

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