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Risk Management in Construction Project

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Abstract— Construction projects are considered to be of a special nature and are influenced by many factors, which exposes them to risks due to the long implementation period and multiple stages of the project, starting from the project idea stage through the implementation stage until the final delivery of the project, which leads to increased uncertainty and increase the likelihood of these risks. This research reviews the risks in construction projects and their impact on the project objectives
The main objective of this study is to assess the risk management in construction projects and the specific objectives are: to identify the types of risks in construction projects, assess the level of risk in construction project.
A questionnaire was designed to collect data and identify the risks that may face the stages of construction projects and was distributed to a number of companies in the public and private sector. After the risks that may face these projects were identified through the questionnaire form, these risks
were analyzed by the SPSS program.

The results of the survey showed that the risks of security instability and delayed payments according to the contract are among the most important factors affecting the objectives of construction projects and that the contractor is the most vulnerable among the project

parties.

Keywords— **Management, Risk, liability, Effect, Classification**

I. INTRODUCTION

The increasing creativity in construction, technology, and design has made projects complex with interrelated procedures and activities, and the absence of repetition. Each project is unique in terms of its environment, workforce, and prevailing relationships, and construction projects require many resources such as labor, financing, equipment, materials, and technical capabilities. Construction projects are characterized by a long execution period [1].

Due to these factors, as well as the commitment to specific constraints for each project in terms of cost, time, and quality, construction projects are vulnerable to uncertainty and risks that affect the project's time and cost [2].
It is now necessary to understand the nature of risks and analyze them to develop a strategy for managing and dealing with them [3].

Risk management in projects identifies the most important factors that can affect the project and accurately determines their significance. It evaluates the likelihood of the occurrence of these risks and indicates the impact of each one on the project. It also identifies the methods and procedures used to deal with these risks to reduce the chances of their occurrence and their impact on the project's objectives. Risk management also includes monitoring and attempting to control these risks by identifying them and designing appropriate plans to accept and confront them, as well as monitoring the emergence of new risks and working to follow them up in various stages of the project. Risk management in the project is carried out through various paths, including the preventive path, which involves taking measures to avoid the appearance of the type of risks associated with a stage of the project's work. The corrective path is also present, which involves modifying the work path in a stage of the project's work. This not only results in avoiding realized risks but also contributes to raising the efficiency of the work in the project, in addition to monitoring and supervising the safety of these plans and ensuring that they are being implemented in practice, thus securing the safety of the project's work stages.

II. METHODOLOGY FOLLOWED

The methodology used in the study followed a comprehensive survey approach, where questionnaires were distributed in the city of Tripoli, Libya, in order to obtain the study results. The data collected was statistically analyzed to test the hypotheses of the study, using the research hypotheses. The questionnaire was divided into the following axes:

1. General information about sample characteristics:
This section includes a set of questions that relate to personal and functional characteristics.

2. Evaluation of the degree of risk occurrence, the impact of risk, and risk responsibility:
This axis includes 29 questions divided into 9 items that reflect the degree of risk occurrence, its impact, and who is responsible for it.

III. QUESTIONNAIRE SCALE

The Likert triad scale was adopted for the questionnaire questions, given the type and size of the sample, and the nature of the sentences and items included in the questionnaire.

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The directions were determined according to the Likert triad scale, as shown in Table (1). The length of the period used was (2/3), which is approximately (0.66). The length of the period was calculated based on the weights of the three responses (1-2-3) and was limited to two distances. Table (1) illustrates this.

TABLE (I)

Determining item directions according to the Likert three-point scale

Average Weight Score	Degree of influence	Scal
From 1 to 1.66	Low	1
From 1.67 to 2.33	Medium	2
From 2.34 to 3	High	3

-**Statistical analysis methods used in data analysis**:

- The study relied on the Cronbach's alpha equation a
- Data analysis was performed using Excel files and checklists.
- The Statistical Package for the Social Sciences (SPSS) was used for statistical analysis.

IV. RESULTS OF THE DATA ANALYSIS:

- Evaluation of risk responsibility

After collecting and analyzing the questionnaire data, the highest percentage of responsibility for these risks was obtained for contractors, owners, consultants, and other parties, as shown in Table (2).

Table (2) Risk Responsibility

NO	Risk Responsible Party	Risk Responsibility	Percentage
	Physical and Human Risks		
1	Unskilled labor	Contractor	80%
2	Decreased worker productivity / equipment breakdown	Contractor	85%
3	Supply of low-quality materials	Contractor	62.5%
4	Accidents due to lack of safety precautions	Contractor	70%
	Environmental and Natural Risks		
1	Unfavorable weather conditions	Other parties	75%
2	Difficulty accessing the site	Other parties	55%
	Design Risks		
1	Inconsistency between quantities, plans, and specifications	Consultant	72.5%
2	Inconsistency between architectural and structural plans	Consultant	72.5%
3	Inaccurate quantity calculations	Consultant	67.5%
4	Assigning design to incompetent designers	Owner	55%
	Logistics Risks		
1	Inaccurate project scheduling	Consultant	52.5%
2	Weak communication between project parties	Contractor	62.5%
3	Shortage of labor, equipment, and materials	Contractor	87.5%
	Financial Risks		
1	Financial inflation	Other parties	47.5%
2	Unstable exchange rates	Other parties	72.5%
3	Delayed payments according to contract	Owner	92.5%
4	Poor cash flow management by contractor	Owner	55%
	Legal Risk		
1	Difficulty obtaining	Other parties	40%

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	necessary work permits		
2	Emergence of legal disputes during implementation phase and delay in their resolution	Owner	67.5%
	Directly Related to Implementation		
1	Design changes	Owner	82.5%
2	Decrease in worker quality due to time constraints for implementation	Contractor	75%
3	Implementation errors due to misunderstanding of plans, specifications, and conditions	Contractor	75%
4	Difference between actual and contractual quantities	Contractor	47.5%
	Political Risks		
1	New government laws affecting work	Other parties	65%
2	Insecurity and instability	Other parties	65%
	Administrative Risks		
1	Unclear planning due to project complexity	Other parties	42.5%
3	Poor resource management	Contractor	60%
4	Lack of necessary information Consultant	Consultant	57.5%

Using qualitative risk analysis techniques, the risk matrix is divided into three zones table (3) shows:

- Very critical risks, represented by the color red in the matrix (from 6 to 9), are risks with a high likelihood of occurrence and high impact.
- Moderate impact risks, represented by the color green in the matrix (from 3 to less than 6), are risks with a moderate likelihood of occurrence and moderate impact.
- Acceptable risks, represented by the color yellow in the matrix (from 1 to less than 3), are risks with a low likelihood of occurrence and low impact.

Table (3) Qualitative Risk Assessment

Impact	Probability		
	Low 1	Medium 2	High 3
Low 1	1	2	3
Medium 2	2	4	6
High 3	3	6	9

Table (4) shows the description and classification of risk levels, with risks classified in red indicating a high level of importance and the need for their treatment. Risks classified in green indicate a moderate level of importance, while risks classified in yellow indicate a low level of importance, with a very low probability of occurrence and a low impact on the project.

Table (4) Description of risk severity and classification

NO	Risk	Mean Average Probability of occurrence	Mean average of risk impact	Risk severity	Risk classification
	Physical and Human Risks				
1	Unskilled labor	2.15	2.50	5.375	Medium
2	Decreased worker productivity / equipment breakdown	1.95	2.50	4.875	Medium
3	Supply of low-quality materials	1.93	2.53	4.882	Medium
4	Accidents due to lack of safety precautions	2.05	2.68	5.494	Medium
	Environmental and Natural Risks				
1	Unfavorable weather conditions	1.85	2.15	3.977	Medium
2	Difficulty accessing the site	1.45	1.98	2.871	Low

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Design Risks					
1	Inconsistency between quantities, plans, and specifications	2.05	2.53	5.186	Medium
2	Inconsistency between architectural and structural plans	1.92	2.50	4.85	Medium
3	Inaccurate quantity calculations	2.15	2.35	5.052	Medium
4	Assigning design to incompetent designers	2.10	2.62	5.502	Medium
Logistics Risks					
1	Inaccurate project scheduling	2.15	2.25	4.837	Medium
2	Weak communication between project parties	1.75	2.13	3.72	Medium
3	Shortage of labor, equipment, and materials	1.90	2.35	4.465	Medium
Financial Risks					
1	Financial inflation	2.07	2.20	4.554	Medium
2	Unstable exchange rates	2.37	2.42	5.735	Medium
3	Delayed payments according to contract	2.47	2.67	6.595	High
4	Poor cash flow management by contractor	2.00	2.40	4.8	Medium
Legal Risk					
1	Difficulty obtaining necessary work permits	1.90	2.38	4.522	Medium
2	Emergence of legal disputes during implementation phase and delay in their resolution	1.93	2.50	4.825	Medium
Directly Related to Implementation					
1	Design changes	2.32	2.40	5.568	Medium
2	Decrease in worker quality due to time constraints for implementation	2.17	2.28	4.948	Medium
3	Implementation errors due to misunderstanding of plans, specifications, and conditions	2.17	2.50	5.425	Medium
4	Difference between actual and contractual quantities	2.05	2.23	4.572	Medium
Political Risks					
1	New government laws affecting work	1.63	2.18	3.553	Medium
2	Insecurity and instability	2.53	2.73	6.906	High
Administrative Risks					
1	Unclear planning due to project complexity	1.93	2.30	4.439	Medium
2	Poor communication between project parties	1.88	1.95	3.666	Medium
3	Poor resource management	2.00	2.25	4.5	Medium
4	Lack of necessary information Consultant	1.78	2.23	3.969	Medium

V. CONCLUSIONS

The study has reached a number of conclusions, including:

1. The results of the study showed that the highest risks facing engineering companies in projects are those that are classified as high-risk due to their potential occurrence and their significant impact on the project. These risks include:

- Failure to address security concerns, which can cause delays in project completion and can be caused by parties not related to the project.
- Delay in the owner's payment of the contractually-due payments, which can lead to increased costs, delays in project completion, and a decrease in quality of execution.

2. The contractor bears full responsibility in most construction companies and institutions in Libya.

3. The results also showed a direct correlation between the probability of occurrence of most risks, indicating a relationship between risks and the occurrence of some risks leading to the occurrence of other risks. The study emphasizes the importance of monitoring and surveillance stages, as reducing the probability of the occurrence of some risks can also lead to a reduction in the probability of the occurrence of other risks.

4. Most risks in construction projects are addressed when the danger occurs.

5. It is important to identify, analyze and determine the causes of risks and to develop strategic plans to respond to them.

RECOMMENDATIONS

The study has arrived at several recommendations, including:

1. The importance of paying attention to risk management and its impact, and allocating a specialized team to study and identify the various risks that the project may be exposed to. It is also important to take into account previous similar projects in order to benefit from the risks that those projects were exposed to and to take the necessary measures to mitigate or reduce their impact.

2. Holding workshops and training sessions to familiarize project management personnel with risk management in construction projects.

3. Strictly applying safety standards in companies and projects.

4. Conducting a thorough project study in terms of cost, required specifications, and the specified time frame for implementation to avoid exceeding them.

5. Evaluating the probability and impact of risks once they have been identified. This step will help prioritize the risks that need to be focused on and develop strategies to mitigate them.

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6. Considering environmental risks. Environmental risks, such as weather events and climate change, can have a significant impact on the project.

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