Risk Management of Construction in Sudan

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ABSTRACT This paper aims to study the humanitarian risks in construction projects that affect the objectives of the project from time, cost and quality, and to identify, analyze and develop the appropriate strategy, monitor and control and specifically the risk of factors affecting construction projects. A questionnaire was designed to collect data and identify risks in construction projects and then distributed to several public and private sector companies registered with the Organizing Council for engineering works contractors in Sudan, and after the risks facing the construction projects were identified through the questionnaire and telephone interviews with The engineers and managers of these companies, these risks were analyzed by Google Form. The results of the questionnaire showed that inflation, increased prices of materials in the market, weak site management, delayed payments from the contractor and awarding the design to unqualified designers, that is the most important factors affecting the objectives of construction projects in Sudan, and the contractor is the most vulnerable among the parties to the project.

Keywords: Risk management -Construction-Risks- Contractor-Sudan.

1. GENERAL INTRODUCTION

Sudan's construction industry has been complicated by innovation in construction, design, and implementation, which has put projects at risk.

Projects requiring a number of resources from a workforce, finance, processes, materials, and technical possibilities, and the project describes the length of the implementation period and because of these factors, as well as the commitment to specific terms for each project of cost, time and quality, making the projects vulnerable to uncertainty and risks affecting the time. The project is now operational and its cost is increasing[1], Risk management in the projects determines the most important factors that would affect the project and determine it accurately and significantly and with the assessment of the likelihood of such risks affecting each of them on the project with the limitation sought by the means and procedures used in dealing with those

risks in a way that contributes to reducing the chances of occurring These risks and the risks affecting the project include risk management as well as risk management and attempting to control them by defining those risks and designing appropriate plans to flip and counter those risks, in addition, to follow up on the new risk profiles and work to follow them at various stages of the project.

A. Research Background

Risk is defined an occurrence that has a degree of obscurity and can either be positive or negative. Positive risk is a convenient opportunity, while a negative risk is a threat and hence inconvenient[2]. The risks involved throughout the life of a building project might be causes for variations in project objectives if they are not managed well [3],[4] stated that the construction industry is exposed to more risk and uncertainty than perhaps any other industry. To have an effective risk management plan, according to [5]first, the key risk factors which

have the most effect on project objectives should be identified and classified. Generally, risk factors in a project can be categorized based on their source and effect on project objectives and can be categorized in external, internal and legal categories.

B. Statement of the problems

- Risks can cause losses that lead to increased costs, time delays and lack of quality during the progression of projects and at their end.
- There is no dissemination of awareness of the need to apply risk management in construction projects.

C. Aims

Study of risks in construction projects that affect the objectives of the project.

D. Objectives

The objective of this paper research is to identify the critical risk factors which affect project objectives negatively and categories.

2. LITERATURE REVIEW

A. Introduction to risk

Risk is defined by [6] has a cause, and if it occurs, a consequence. and as defined by [4] risk means possible unfavorable outcomes. "uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective" [7].

"A risk is concerned with unpredictable events that might occur in the future whose exact likelihood and the outcome is uncertain but could potentially affect their interests/objectives in some way [8].

B. Classifying risks in construction projects

Risk classification contributes to their accuracy and to the identifying of potential risks in any project, and determines the appropriate strategy and its choice to mitigate its effects and the possibility of avoiding them. In this paper, the classification was adopted According to [2], the sub-categories of human risks associated with construction projects include technical, political, social, economic, legal, financial, health, managerial and cultural risks, he grouped risk into nine categories, namely:

- Design: Defective design (inaccurate quantities, no coordination in the design phase, Awarding the design to unqualified designers, Lack of consistency between bill of quantities drawings and specifications.
- Financial: Delayed payments, Inflation, Unmanaged cash flow, The financial failure of the contractor, Exchange rate fluctuation.
- Legal: Difficulty to get permits, Legal disputes during the construction phase among the parties to the contract.
- Construction: Gaps between the implementation and the specifications due to a misunderstanding of drawings and specifications, Actual quantities differing from the contract quantities, Design changes, Lower work quality in the presence of time constraints, Undocumented change orders.
- Management: Poor communication between involved parties, Lack of essential information, Ambiguous project planning due to project complexity, Poor resource management.
- Political: New governmental acts or legislations, Unstable security, Security of material and equipment, public security.
- Environmental: Adverse weather conditions, Difficulty to access the site (Remote sites), The occurrence of accidents, because of poor safety procedures.
- Logistical: Inaccurate project program, Unavailable labor, materials, and equipment, Poor transportation facilities, Supplies of defective materials.
- Cultural: Religion, Differing cultural custom.

C. Risk management

According to [9], there are three stages in the methods of managing risk in the construction industry a) risk identification; b) risk analysis and evaluation; and c) risk response.

Risk analysis and management are important parts of the decision-making process in construction [10]. Risk management is about thinking ahead and preventing things from going wrong and about stimulating and searching for better solutions.[11].

According to [12] risk management is a process that consists of the identification of risks, assessment with qualitatively and quantitatively,

responses with a suitable method for handling risks, and then controls the risks by monitoring.

According to [13] risk management is a proactive decision-making process used to minimize and manage the risks in the most efficient and appropriate manner.

D. Risk management process

According to [14] typical risk management process includes the following key steps:

1. Risk identification.
2. Risk assessment.
3. Risk mitigation/ risk response and action.
4. Risk monitoring.

According to [15] there are five steps in risk management:

1. Reporting.
2. Risk identification.
3. Risk assessment and measurement.
4. Risk response and action.
5. Monitoring.

Fig. 2.1 Five steps of risk management

Source:

<https://esub.com/5-stages-project-management-understanding-construction-projects-life-cycle>.

3. RESEARCH METHODOLOGY

The descriptive-analytical method, which is based on the study of reality or phenomenon as it is in fact, was used for the purpose of obtaining the results of the study by collecting and analyzing the data [1]. The sample of the study was used to be the workers of the construction companies in Sudan, including engineers,

contractors, consultants, and owners.

In the collection of data, I adopted on the selection of a random sample of the construction companies registered with the Organizing Council for engineering works contractors in Sudan.

The selection was based on random samples from construction companies and found that the companies registered with the Organizing Council for engineering works contractors that is 2559 companies, excluded companies that are not related to the construction, and the total became about 1700 companies related to the construction, and random selection of 100 companies related to the construction.

Calculating regular randomized study samples (M) =100 samples of community size N=1700 samples

Length of duration(L).

$$L = \frac{N}{M}$$

A random number that is less than the length of the period(L) was chosen.

First random sample =P

Second random sample =P+L

And so, to the last random the same [16].

The data was collected through the work of a questionnaire by (google form) distributed on the study samples online, the questionnaire was done in two parts, the first part consists of six questions concerning personal information, and the second part consists of thirty-four questions specialized in the classification of risks.

4. RESULTS & DISCUSSION

A. Descriptive of the study's data.

The first section of the questionnaire: Personal information.

All responses about 98 responses.

TABLE 1

Age	20-25	25-35	35-45	45-60
Percentage	13.3%	66.3%	14.3%	6.1%

This reflects age of the sample members, and the highest percentage is) 25-35) years.

TABLE 2

Qualification	Diploma	Bachelor	high diploma	master	Ph.D.
Percentage	4.1%	44.9%	5.1%	39.8%	6.1%

results of the survey of questions presented in Table 7 below.

TABLE 7

The sample of research in the academic qualification is limited to the bachelor because of the large number of students of the Bachelor, Compared to other qualifications.

TABLE 3

Practical experience	1-5 A year	5-10	10-15	more than 15 A year
Percentage	49%	30.6%	13.3%	7.1%

And this reflects the experience of the individuals in the sample of the study, the highest percentage is lower Five years, which is a period of awareness of the risk of construction.

TABLE 4

Nature working	Contractor	consultant	Owner
Percentage	65.3%	28.6%	6.1%

And this shows that the contractor is more risks among the parties to the project.

TABLE 5

The type of private sector	public sector	Mixes sector	
Percentage	65.3%	15.3%	19.4%

These are the sectors working in the construction industry.

TABLE 6

Nature of the project	Small size project	Medium size project	Large infrastructure project
Percentage	32.70%	49%	18.40%

These are the sectors working in the construction industry.

B. The second section of the questionnaire

Type of risk:

Impact factors influencing risk management in construction.

And objective of the research is to identify the 33 classified risk factors that affect building construction projects in Sudan and respondents were asked to indicate which of the risk factors classified had more than a high incidence. The

Risk category	Risk factors	More than High%	Rank
Financial	Inflation.	56.40	1
Financial	Exchange rate fluctuation.	52.2	2
Management	Poor resource management.	52.1	3
Financial	Delayed payments.	51.1	4
Financial	Unmanaged cash flow.	47.8	5
Financial	The financial failure of the contractor.	45.8	6
Political	Unstable security.	42.6	7
Environmental	The occurrence of accidents, because of poor safety procedures.	42.5	8
Logistics	Supplies of defective materials.	40.5	9
Design	lack of consistency between bill of quantities drawings and specifications.	39.4	10
Construction	Lower work quality in the presence of time constraints.	39.3	11
Construction	Undocumented change orders.	39.3	12
Logistics	Unavailable labor, materials, and equipment.	38.3	13
Design	Awarding the design to unqualified designers.	37.2	14
Construction	Actual quantities differing from the contract quantities.	37.2	15
Logistics	Poor transportation facilities.	37.2	16
Construction	Gaps between the implementation and the specifications, due to a misunderstanding of drawings and specifications.	36.2	17
Management	Poor communication between involved parties.	36.2	18
Management	Lack of essential information.	36.1	19
Construction	Design changes.	35.1	20
Political	New governmental acts or legislations.	35.1	21
Logistics	Poor communications between the home and field offices (contractor side).	34	22
Legal	Legal disputes during the construction phase among the parties to the contract.	31.9	23
Political	security of material and	31.9	24

	equipment, public security.		
Design	Defective design	30.8	25
	·inaccurate quantities.		
Legal	Difficulty to get permits.	27.7	26
Management	Ambiguous project planning due to project complexity.	26.6	27
Design	No coordination in design phase.	26	28
Environmental	Adverse weather conditions.	25.5	29
Environmental	Difficulty to access the site (Remote sites).	25.5	30
Construction	Varied labor and equipment productivity.	25.5	31
Cultural	Religion.	19.2	32
Cultural	Differing cultural customs.	11.7	33

5. CONCLUSIONS & RECOMMENDATIONS

A. Conclusions

Building projects in Sudan face several challenges during the construction phase, through the study, the results of the questionnaire following:

1. There is no risk management in most construction companies in Sudan.
2. Inflation, Exchange rate fluctuation, Poor site management and delayed payments for the contractor and security stability and accidents during work and implementation errors due to misunderstanding of plans, conditions and specifications, and supply of low-quality materials as well as changing orders , and Awarding the design to unqualified designers, as well as the difference between quantities and contract quantities, is one of the most serious risks in construction projects in Sudan.
3. Knowledge of the risk, identification, analysis, and development of response strategies are the most important factors that help in the success of construction projects in Sudan.

B. Recommendations

1. The need to apply the concept of risk management in construction projects by applying the basics of risk management (identification, analysis, follow-up, and monitoring) to reduce risk.
2. Rehabilitation of cadres and workers in construction projects, engineers and labor, managing risks through educational courses to benefit them in these projects.

3. Develop the forms of the contract between the owner and the contractor with regard to risk management to ensure the rights of all parties.
 4. The executor should take into account the risks when preparing the estimated cost of the project and the increased rise in raw material prices.
 5. Companies have to make risk management.
- The most important risks in construction projects in Sudan are inflation, market price fluctuations, poor site management, delayed payments in accordance with contract and security stability, change of design and give it to incompetent designers.

C. Recommendation for Future Research

1. Study of risks classified by different weights.
2. Study and analysis of the possibility of more than one risk of its different weights at the same time.

REFERENCES

- [1] A. S. Salih, "RISK MANAGEMENT OF CONSTRUCTION PROJECTS IN KHARTOUM STATE," PhD Thesis, Sudan University of Science and Technology, 2015.
- [2] B. Y. Renault and J. N. Agumba, "Risk management in the construction industry: a new literature review," 2016.
- [3] A. Mesfin, "A study on construction contract risk management practices in Ethiopian building construction projects," 2014.
- [4] "Available at: <http://www.kimberlywillcox.com/risk-management-process-overview/auditing-business-risks-directors-global-7/> - بحث Google." [Online]. Available: https://www.google.com/search?xsrf=ACYBGNR0CcvG4dmYir23K1PR7BHd1STezg:1580753256377&q=Available+at:+http://www.+%22kimberlywillcox.%22+com/risk-management-proce ss-overview/auditing-business-risks-directors-global-7/&sa=X&ved=2ahUKEwiFrMvi_LXnAhXFIIAKHRDmBsUQ5t4CMAB6BAGDEAw&xsrf=ACYBGNR0CcvG4dmYir23K1PR7BHd1STezg:1580753256377&biw=1366&bih=625. [Accessed: 03-Feb-2020].
- [5] P. Rezakhani, "Classifying key risk factors in construction projects," Bul. Institutului Politeh. Din Lasi Sect. Constr. Arhit., vol. 58, no. 2, p. 27, 2012.
- [6] E. W. Larson and C. F. Gray, "Project management: The managerial process," 2011.
- [7] Newtown Square, 2017. PMBOK. Pennsylvania: Project Management Institute, Inc.
- [8] A. B. Raidén and A. R. Dainty, "Human resource development in construction organisations," Learn. Organ., 2006.
- [9] R. A. Bahamid and S. I. Doh, "A review of risk management process in construction projects of developing countries," in Materials Science and Engineering Conference Series, 2017, vol. 271, p. 012042.
- [10] Shahid Iqbal, Rafiz M. Choudhry, Klaus Holschemacher, Ahsan Ali & Jolanta Tamosaitiene, 2015. Risk management in construction projects. Development of Economy, pp. 65-78.
- [11] Simu, K., 2007. Risk management in small construction projects. Lulea Sweden, Lulea tekniska university of technology, pp. 259-270.

- [12] K. Mhetre, B. A. Konnur, and A. B. Landage, "Risk management in construction industry," *Int J Eng Res*, vol. 5, pp. 153–155, 2016.
- [13] Muhammad Abdul Rehman, Tahir Iqbal, Muhammed Shakil, 2017. Identification of Risk Factors associated with Pakistan's construction Industry. *International Journal of Business & Social Science*, pp. 152-153.
- [14] N Banaitiene and A. Banaitis, "Risk management in construction projects," *Risk Manag. Issues Chall*. N Banaitiene Ed *Risk Manag. Issues Chall.*, pp. 429–448, 2012.
- [15] "The 5 Stages of Project Management - Understanding a Construction Project's Life Cycle - eSUB," eSUB Construction Software, 27-Jan-2017. [Online]. Available: <https://esub.com/5-stages-project-management-understanding-construction-projects-life-cycle/>. [Accessed: 06-Feb-2020].
- [16] "العينات وطرق اختيارها/موضوع", *awdoo3.com/العينات_وطرق_اختيارها/*. [Accessed: 15-Feb-2020].

APPENDICES

Questionnaire: Risk Management of Construction in Sudan.

Complementary research paper to obtain a master's degree in civil engineering, master of Structural Engineering at the University of Khartoum.

NOTE: The data obtained for the purpose of scientific research.

PART1: Personal information.

Name:

Choose a single answer by marking (×).

1.Age:

20-25 (...) 26-35(...) 36-45(...) 46-60(...)

2.Qualification:

Diploma (...) bachelor (...) diploma high (...) master (...)
Ph.D. (...)

3. Experience works:

Less than 5 years (...) 5-10(...) 10-15(...) more than15 years (...)

4.Nature of work:

Contractor (...) consultant (...) owner (...)

5.Type sector:

Private sector (...) Public sector (...) Mixed sector (...)

6.Nature of projects:

Small size project (...) Medium size project (...) Large infrastructure project (...).

Part2: Impact factors influencing risk management in construction.

Choose the degree of risk impact factors classified by marking (*).

TABLE 8 IMPACT FACTORS INFLUENCING RISK MANAGEMENT IN CONSTRUCTION.

Risk	Risk factors	Impact
		categories
		V. L Med H V L . H
		1.Design
		2.Financial
		3.Legal
		4.Construction
		5.Management
		6.Political
		7.Environmental

Defective design
inaccurate quantities.
No coordination in the design phase.
Awarding the design to unqualified designers.
lack of consistency between bill of quantities drawings and specifications.
Delayed payments.
Inflation.
Unmanaged cash flow.
The financial failure of the contractor.
Exchange rate fluctuation.
Difficulty to get permits.
Legal disputes during the construction phase among the parties to the contract.
Gaps between the implementation and the specifications. due to a misunderstanding of drawings and specifications.
Actual quantities differing from the contract quantities.
Design changes.
Lower work quality in the presence of time constraints.
Undocumented change orders.
Varied labor and equipment productivity.
Poor communication between involved parties.
Lack of essential information.
Ambiguous project planning due to project complexity.
Poor resource management.
New governmental acts or legislations.
Unstable security.
security of material and equipment, public security.
Adverse weather conditions.
Difficulty to access the site (Remote sites).
The occurrence of accidents, because of

	poor safety procedures. Unavailable labor, materials, and equipment.
8.Logistics	Poor communications between the home and field offices (contractor side). Poor transportation facilities. Supplies of defective materials.
9.Cultural	Cultural Risks. Religion.