

**Sudan University of Science and Technology**



**College of Graduate Studies**

**Allocation of Risk Factors and its Impact on  
Construction Projects in Sudan  
(Khartoum state as a Model )**

توزيع عوامل المخاطر وأثره في مشروعات التشييد في  
السودان  
( ولاية الخرطوم نموذجاً )

Submitted in partial fulfilment for the requirements the  
Master degree (Construction Management)

**by :**

**Diana Victor Gabra Butros**

**Supervised by:**

**Dr. Salah Eldin Abdalziz Ajban**

## ***Dedication***

***This thesis is dedicated to my family. A special feelings of gratitude to my loving parents, Victor Gabra, Afaf William whose believe in the richness of learning and word of words of encouragement. And also my sister Cathrine and brother Kirolos whose have supported me all the way since the beginning of my studies.***

***Also, this thesis is dedicated to my fiancé Rami Izat Ayad who***

***has been a great source of motivation and inspiration.***

### **Acknowledgement**

First and above all, I praise God, the almighty for providing us this opportunity and granting the capability to proceed successfully. I am very grateful that I had the chance to this Master Thesis.

This thesis could not be accomplished without the help of many people to I desire to express my appreciation. First I would like to express my sincere gratitude to my supervisor Dr. Salah Abdalziz Ajbani for giving me the opportunities to raise my opinion and participate in open discussions, and for his appreciate instructions and very valuable comments. He gave me support and encourage me than I ever expect.

A special thank you goes to Dr. Catherine Boutros from whom I had received expert advises and help.

I would also like to express my appreciation to Eng.Ali Khair, Eng. Ahmed Saeed, Eng. Reem Yaseen, Eng. Amir Lof Gilini

,Eng.Marwa Mahdi, Eng.Ahmed Noor for helping me to fill my questionnaire.

### **Abstract:**

Construction is a risky industry compared to many other industries where it requires proper application of business practices.

The Sudanese construction sector is characterized by many small and large projects and high labor intensity .The basic problems facing the Sudanese construction projects are the risk factors that affect construction project performance. The main objectives of this research include identifying the risk factors affecting the performance of Sudanese construction projects .The study aims also to investigate the usage of risk preventive and mitigative methods.

The objectives of this research have been achieved through data collection questionnaires in Khartoum city. The results obtained from the data analysis where interpreted and discussed thoroughly. The output concluded that the most

important risk factors are: poor / defective supply of materials, natural disasters, awarding the design to unqualified designers, shortage of human resources/ machinery and material resources, instability of currency exchange, delays in resolving disputes, gaps between the implementation and the specifications and poor resource management. The results show that there are many risk factors which could not be allocated to any party. Such risks should be predetermined in the project plan. The study findings show that the contractors, consultants and the owners suffer from lack of innovative methods to prevent or mitigate risks.

The results of this study recommended that there is an essential need for more standardization and effective forms of contracts, which address issues of clarity, fairness, roles and responsibilities, allocation of risks, dispute resolution and payment. Owners, consultants and contractors are advised to identify the possible risk factors that could confront their projects and to allocate them contractually. The recommendations of this research are useful for the policy makers to establish legislations towards the welfare of the industry.

### **مستخلص الدراسة**

البناء هو صناعة محفوفة بالمخاطر أكثر من أي صناعة أخرى وتتطلب التطبيق السليم لممارسة الأعمال بقدر صناعة البناء والتشييد. يتميز قطاع البناء والتشييد السوداني بالعديد من المشاريع الصغيرة والكبيرة والكثافة العالية لليد. والمشاكل الأساسية التي تواجه مشاريع البناء السودانية هي المخاطر التي تؤثر على أداء مشروع البناء. وتشمل

الأهداف الرئيسية لهذا البحث التعرف على المخاطر التي تؤثر في أداء المشاريع الإنشائية السودانية. وأيضاً وتهدف الدراسة للتحقيق في استخدام طرق منع وتقليل المخاطر.

وقد تم تحقيق أهداف هذه البحث من خلال جمع المعلومات عن طريق استبيانات في مدينة الخرطوم. النتائج التي تم الحصول عليها من تحليل الاستبيانات تم تفسيرها ومناقشتها بأستفاض، لخصت أن أهم عوامل الخطر هي: إنخفاض القدرة الإنتاجية للعمال/عطل الآلات، والكوارث الطبيعية، توكيل تصميم للمصممين غير مؤهلين، نقص الموارد البشرية / الآلات والموارد ، عدم استقرار صرف العملة، التأخير في حل الخلافات، اخطاء في التنفيذ بسبب سوء فهم المواصفات ،سوء إدارة الموارد. وتظهر النتائج أنه من الصعب تحديد مسؤولية عدد من المخاطر لأي طرف. وتشير نتائج الدراسة إلى أن المقاولين والاستشاريين والملاك يعانون من عدم وجود طرق مبتكرة لمنع أو تقليل المخاطر.

أوصت نتائج هذه الدراسة أن هناك حاجة ضرورية لتوحيد العقود بطريقة فعالة وقياسية ، بحيث التي تتسم بالوضوح والعدل، وتحديد الأدوار والمسؤوليات بصورة واضحة، وتوزيع المخاطر، وتسوية المنازعات والسداد. ودعوة لكل أصحاب البناء والاستشاريين والمقاولين لتحديد عوامل المخاطر المحتملة التي يمكن أن يواجهها وتخصيص لهم تعاقدية، ونتيجة لذلك يجب تطبيق أنواع مختلفة من العقود وينبغي بذل المزيد من الجهد لتطبيق صحيح لإدارة المخاطر في صناعة البناء والتشييد.

## Table of contents

Dedication.....	ii
Acknowledgement.....	iii
Abstract.....	iv
مستخلص الدراسة.....	v
Table of Contents.....	vi
List of Figures.....	vii
List of Tables.....	viii
<b>CHAPTER ONE: INTRODUCTION</b>	
1.1 Background.....	1
1.2 Project life cycle.....	2
1.2.1 Conceptualization Phase.....	3
1.2.2 Planning & Design Phase.....	4
1.2.3 Implementation (Execution) Phase.....	5

1.2.4 Closing Phase.....	6
1.3 Research problem.....	6
1.4 Justification of the study.....	7
1.5 Research questions.....	7
1.6 .1Research objectives.....	7
1.6.1 General Objectives.....	7
1.6.1 Specific Objectives.....	8
1.7 Hypotheses.....	8
1.8 Research Importance and limitation.....	8
1.9 Research Methodology.....	9

## **CHAPTER TWO: THEORETICAL PART**

<b>2.1 The nature of the construction industry.....</b>	<b>10</b>
<b>2.2 The Size of the Construction Industry.....</b>	<b>11</b>
<b>2.3 Construction industry in Sudan.....</b>	<b>11</b>



<b>2.4 Management in Construction</b> .....	12
<b>2.5 The risk management</b> .....	12
2.5.1 Defining OF Risk.....	13
2.5.2 Risks in Construction.....	15
2.5.3 Sources of Risks.....	16
2.5.4 Typical Risks on a Construction Project.....	16
2.5.5 Risk Categories.....	17
<b>2.6 Risk Management Process</b> .....	18
<b>2.6.1 Risk Identification</b> .....	20
2.6.1.1 Brainstorming.....	21
2.6.1.2 Delphi Technique.....	21
2.6.1.3 Interview/Expert Opinion.....	21
2.6.1.4 Past Experience.....	21
<b>2.6.2 Risk Analysis</b> .....	21

2.6.2.1 Methods of Risk Analysis.....	22
A. Methods of Quantitative Risk Analysis.....	22
Sensitivity Analysis.....	22
Monte Carlo Simulation.....	22
Breakeven Analysis.....	22
Scenario Analysis.....	22
Decision Trees.....	23
B. Methods of Qualitative Risk Analysis.....	23
<b>2.6.3 Risk response.....</b>	<b>23</b>
2.6.3.1 Risk Avoidance.....	24
2.6.3.2 Risk Transfer.....	24
2.6.3.3 Risk Retention.....	25
2.6.3.4 Risk Reduction.....	25
<b>2.6.4 Monitor &amp; Control Risks.....</b>	<b>25</b>

## **CHAPTER THREE: DATA COLLECTION**

### **3.1 Research tool (Questionnaire)**

.....26

### **3.2. Study variables.....**

.....26

3.2.1 Demographic variables .....  
.....26

3.2.2. Variables according to the specific  
objectives.....26

### **3.3 Scope of the research.....**

..... 26

### **3.4 Research population .....**

..... 27

### **3.5 Data collection.....**

.....27

### **3.6 sample selection.....**

.....27

## **THAPTER FOUR: RESULTS AND DISCUSSION**

### **4.1 Introduction.....**

.....28

### **4.2 Risk factors.....**

..... 28

#### **4.2.1 Physical Factors.....**

.....29

#### **4.2.2 Environmental Factors.....**

.....30

4.2.3 Design Factors.....	31
4.2.4 Logistics Factors.....	33
4.2.5 Financial Factors.....	34
4.2.6 Legal Factors.....	35
4.2.7 Construction Factors.....	37
4.2.8 Political Factors.....	38
4.2.9 Management Factors.....	40
<b>4.3 Risk Management Action.....</b>	<b>41</b>
4.3.1 Risk Preventive method.....	41
4.3.2 Risk Mitigation method.....	43
<b>CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS</b>	
<b>5.1 Conclusions.....</b>	<b>4</b>
<b>5.2 Recommendations.....</b>	<b>45</b>

## List of Figures

Figure 1.1.....	3
Figure 2.1 .....	18
Figure 2.2 .....	19
Figure4.1.....	29
Figure4.2.....	30
Figure4.3.....	33
Figure4.4.....	34
Figure4.5.....	36
Figure4.6.....	37
Figure4.7.....	39
Figure4.8.....	40
Figure 4.9.....	42
Figure 4.10.....	43
Figure 4.11.....	44

## List of tables

Table 2.1.....	13
Table 4.1.....	28
Table4.2.....	31
Table4.3.....	29

Table4.4.....	32
Table4.5.....	35
Table4.6.....	33
Table4.7.....	36
Table4.8.....	38
Table4.9.....	38
Table4.10.....	41