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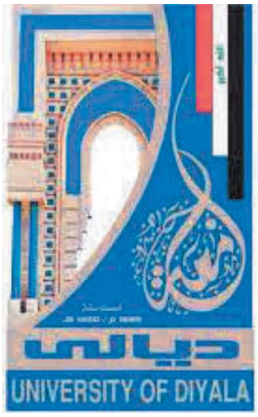

MANAGING OF COST RISKS GENERATED FROM RISK RESPONSES IN CONSTRUCTION PROJECTS

A Thesis Submitted to the Council of College of Engineering, University of Diyala in Partial Fulfillment of the Requirements for the Degree of Master of Science in Civil Engineering

by

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BSC. Civil Engineering, 2014

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2017 A.D IRAQ 1438 A.

بسم الله الرحمن الرحيم

﴿ وَقُلِ اعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ ﴾

صدق الله العلي العظيم

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We certify that we have read the thesis entitled **(MANAGING OF COST RISKS GENERATED FROM RISK RESPONSES IN CONSTRUCTION PROJECTS)** and we have examined the student **(*Rowedah Hussein Ali*)** in its content and what is related with it, and in our opinion, it is adequate as a thesis for the degree of Master of Science in Civil Engineering.

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Date:

Dedication

I dedicate this research

To the Prophet , the savior of the nation Muhammad Abdullah Abdul-Muttalib,to the Imam of the Believers Ali bin Abi Talib, To Imam Al – Mahdi the ultimate savior of human kind and final imam ,To the mother of believers Khadija Umm al-Zahra , to Fatima Zahra the best ladies in the world peace on them.

To my parents whose their prayers and words always inspired and encourage me to give more and pursuit of excellence

My Sisters and Brother, who always encourage me to give the best and supported me.

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Thankful and grateful indebtedness to Dr Nasrallah Salman for helping, support and understanding

Researcher

ABSTRACT

Managing of Cost Risks Generated from Risk Responses in Construction Projects

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Risks and its management are important for the success of the project, as the risks in construction projects must be minimized to achieve the goals of the project which are time ,cost and quality .The risk management compose of planning, identification, analysis, and response which has an important phase, namely risk response that it should not be undermined, as its success gain the projects the capability to overcome the uncertainty and thus an effective tool in project risk management.

The aim of the research is managing the cost risks generated from risk response to control the cost risks in the projects through the adoption of the fuzzy decision tree, system dynamic, highlight the role of risk response in the construction projects, its effect on the cost and the selection of the optimal risky response through Particle swarm and Gravitational Search Algorithm.

To achieve the aim of the research, a review of the scientific literature and sources which deal with risk management, risk responses concept and strategies in construction projects, the costs elements, types, and factors affecting it with investigating the causes of their appearance.

The results of data analysis of samples for the three periods 2006-2007,2008-2009, and2014-2016 have shown that different reason that leads to risk response failure, but the following found in every period, the inability to introduce sophisticated management methods to respond to risk, inadequate strategy with high-risk, failure to complete the risk response plan in a timely manner, neglecting the role of supervisors in the process of monitoring the risk response plan.

While the analysis of cost risk generated from risk response for every period the following found in every period, delay in completing the project, ability to construct, wrong estimation.

In the light of what has been reached by the data analysis of samples in the construction project, a management system has been built which can be used for the qualitative and quantitative analysis of risk by using fuzzy decision tree and system dynamic respectively, and then by analysis these risks, a risk response is being selected by using Particle swarm and the Gravitational Search Algorithm.

The result of the risk response selection shows that the investment (contractor, bank) strategy shows a very good strategy as it saves the cost about 30%, while the Mitigate (pay for advances with interest 0. 1) strategy show saving the cost 40% and giving land to contractors show saving in cost about 40% finally the BIM strategy show saving in cost about 25%.

The results of the assessment questioner approach for the management systems and computer programs, that this system facilitates the analyses of the cost risks and raise the efficiency of decision makers in the risk response selection and reducing the cost of the project by using the optimal strategy. Finally, serval suggestions have been reached for a set of for further research.

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LIST OF ABBREVIATIONS

ACRONYM	ABBREVIATIONS
AI	Artificial Intelligence
Rprop	Resilient Backpropagation
GSA	Gravitational Search Algorithm
WEKA	Waikato Environment for Knowledge Analysis
KNIME	Konstanz Information Miner

CHAPTER ONE

Introduction

Chapter One

Introduction

1.1 An Overview

The construction industry has an important impact and takes an important part in any countries' economies in the world. The construction industry classified that it has a long period and demand for a lot of recourse like manpower, funding, equipment and technical requirement and an addition of to the constraints of the project like cost, time, and quality.

Sometimes required outcomes fail to be achieved in the projects and don't meet the constraints of the project and that lead to risk. The impact of risk must be minimized in order to achieve the success of the project.

Therefore, risk and its management are important for the success of the project, the risk management, which encompassed of planning, identification, analysis, and response has an important phase, which is risk response and it should not be undermined, as its success gain the projects the capability to overcome the uncertainty and thus an effective tool in project risk management. It's normal that when the risk or/and uncertainty occurs, it generates pressure in projects. This is because project manager and contractor want the projects to implement as smoothly as possible to complete without facing obstacle like cost overruns as it causes dispute and other problem, therefore needs a management.

The importance of this research is to provide a methodology to make the plane for unexpected events and control uncertain situations and identify the reasons for risk response failure and response to risks successfully.

1.2 Research Justification

In Iraq, construction projects face a problem which is the risk management and especially risk response is negligible part and thus project management has been failing to meet the expectations of a project manager which lead to risks and especially cost risk. The research justification can be explained as follows:

1- The size of construction projects and its complexity require the existence of an integrated system of risk management.

2-There is a weakness in the decisions taken by beneficiaries regarding risk response and this leads to the generation of risks, especially cost risks

3-There is a neede for a mechanism to manage risk responses and to increase awareness and interest in this phase as well as the need to manage the risks generated from the risk responses

1.3 Research Hypothesis

Based on the justifications that mentioned above the hypothesis is formulated as below:

There is a necessity to design an integrated framework to manage the risks generated from a risk response that effect on the cost of the project and highlight the reasons and the factors that lead to the failure of this phase and development of techniques and tools used to manage the cost risks.

1.4 Research Aim and Objectives

The aim of the research is to build a management system for the computer system that considers an effective to manage the cost risks generated from risk response and highlight the role of risk response in the construction projects and its effect on the cost and the selection of the

optimal risk response. Achieving current aim, there are some objectives must be obtained as follows:

1- Investigation and identification cost risks in construction projects
2- Analyzing the cost risks in the construction projects and this done by adopting quality risk management techniques:
- Fuzzy decision tree
3- Analyzing the cost risks in construction projects and this done by adopting quantitative risk management techniques:
- Measuring the risk using simulation (System dynamic)
4- Investigation and identification cost, risk responses for risks that have been identified in construction projects

5- Determining the risk response effectiveness this done by adopting risk management techniques:

- Fuzzy Decision tree
6-Determining the cause that led to the failure of risk response phase
7- Investigation and identification the cost risks generated from risk response
8- Analyzing the cost risks generated from risk response, this done by adopting this done by adopting risk management techniques

- Fuzzy decision tree
9- Analyzing the cost risks generated from risk response, this done by adopting quantitative risk management techniques

- Measuring the risk using simulation (System dynamic)

10- Determining the effective measures to reduce those risks, this done by using optimization techniques

- Particle swarm
- Gravitational Search Algorithm

1.5 Research Scope

Major projects in the Diyala governorate, especially university of Diyala university projects will be taken due to its significant budgets so it could apply this kind of risk management process which is managing of the cost risks generated from risk responses in construction projects without affecting the budget preparation for the project.

1.6 Research Methodology

A scientific research methodology is adopted which includes three stages:

A-Theoretical Study

1- A review of the scientific literature and sources (books, magazines, engineering, research). Which dealt with all of them

2- Risk responses concept and Strategies in construction projects.

3-Studying cost elements, types, and factors affecting it with the study of the causes of their appearance

4- Studying the artificial intelligence techniques and the steps of its procedures and its uses in the construction projects
5- Studying the simulation method and the steps of its procedures and its uses in the construction projects

B- Field Study

The field study includes the following:

1- Open Questionnaire

This stage includes conducting many interviews with the experts. The interviews include managers and University professors, and other parts of the projects in the following ministries, The Ministry of Higher Education and Scientific Research, The Ministry of Construction and

Housing and Ministry of Education. These interviews have a very important role in helping the researcher in the later stage, also discussion about the questionnaire which is initially prepared from the literature and previous studies as well as doing some modifications on the form and add another question with the help of the experts to make sure of the success of the method and questions presented

2-Closed Questionnaire

After doing interviews with many experts have been finished. The problems of the research were divided into several groups which include, the risks that cause to cost overruns, the top risk and their impacts on the projects, the strategies that used for each risk, the reasons for risk response failure and finally the risks generated from risk response.

C- Stage of System Building and Software Design

In light of the responses received from the questionnaire and the practical study as follow:

-The projects are divided into two types depending on the completing ratio, which are

A-projects below 60% include the following :

1- Planning of Risk.

2- Identification of Risk.

3- Analysis of Risk using fuzzy decision tree and system dynamic.

4- Risk response selection using Particle swarm and Gravitational Search Algorithm.

B- projects above 60% include the following:

1-Risk response identification using fuzzy decision tree.

2- Risk analysis using fuzzy decision tree and system dynamic.

3-Risk response selection using Particle swarm and Gravitational Search Algorithm.

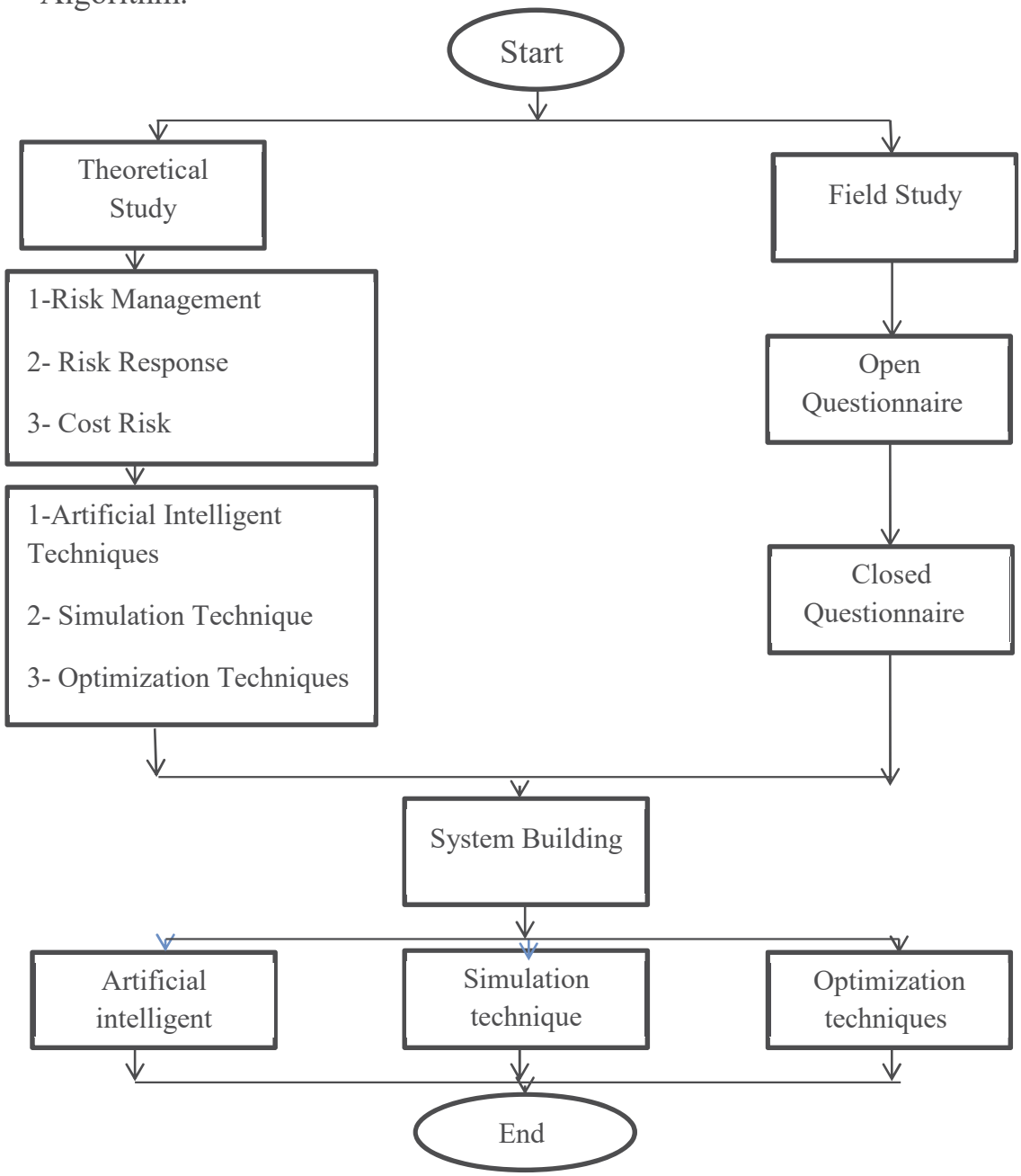

Figure (1.1) Methodology Flow Charts of the Research

1.7 Research Structure:

The research includes several chapters, which are:

1. **Chapter One:** This chapter includes a general introduction to the research, research problem, justifications, hypothesis, scope, research

objectives, research methodology, the structure of the thesis and previous studies.

3- **Chapter Two**: This chapter deals with the risk definition, risk management, the stages adopted in the plan of action and its techniques. It also includes the risk response strategies and the knowledge gap in this stage, also the factors that lead to the success of this stage and the study of elements of costs and the factors affecting them, the risks they face, and the applications of risk management on construction projects.

4- **Chapter Three:** The study includes techniques of artificial intelligence and simulation as well as optimization techniques and how to use these techniques

5- **Chapter Four:** This chapter includes two parts the first one is the various stages of the field survey. It includes the aspects related to the field questionnaire, the selection of the sample, the scheduling of the results obtained, the method of finding the qualitative assessment of the notification from the probability and impact calculation, and finally analyzing the results obtained from the field questionnaire. The second one is investigating and analyzing the current status of cost risk in construction projects, including the following items below:

1) Identifying the cost risk in construction project using qualitative and quantitative techniques

2) Indicating the risk response failure in construction projects using qualitative techniques.

3) Indicating the reasons for risk response failure.

4) Identifying the cost, risk generated from risk response in construction project using qualitative and quantitative techniques

6-Chapter Five: The chapter deals with the stages in which the quantitative and qualitative management system development. It also

includes the development and design of the management system for selecting the best strategy for risk response.

7-Chapter Six: This chapter contains a collection of the conclusions that gain by the researcher as well as recommendations and proposals for subsequent research.

1.8 Previous Studies

This includes the following:

A- Previous Studies in The Cost Risk

1- **Koushki et al. (2005)**: the foundation of their study was that the problems related to the contractor, the problems related to the material and financial constraints of the owners were major causes of cost overrun in Kuwait's Private residential projects

2- **BinmeiZhu, et al. (2011):** The study the relationship between time, quality and cost, in their study the show the influence of the time and the quality on the cost and then evaluate the total cost using artificial neural network BP algorithm, and identify the most important factors on the cost of the project.

3- **Gul pot et al.(2014)**: They made a study to investigate the reason to lead to cost overruns in micro-scaled construction companies, the questionnaire includes ten questions which collected from the previous studies and distributed to 136 companies, the fount of their results that the reason for cost overruns were, related factors in the contract, time factors, quality factors, cost factors, human resource factors, communication factors and other risks.

4- **Savita Sharmai& Pradeep K. Goyal (2014)**: The foundation of their results of cost overrun was, variable of climatic condition has highest occurrence frequency, then poor scheduling and planning, lack of construction material, fluctuation of material price, the process of

making decision is slow, shortage in the labors, govt considers inappropriate, laws and policies, duration of the contract considers unrealistic, various conditions of site (ground), inflation, contractor with little experience and frequent change in design.

5- **Nabil El Sawalhi and Abdelsalam H Nasser(2015):** The study the disputes that resulted from the effect of delay in Payment , the questionnaire was taken from the point view of the contractor .The factor that identified was evaluate using Support Vector Machine (SVM) was used to predict the overrun of cost due to payment delay and the accuracy of the techniques was of 93.47%.

B- Previous Studies in The Risk Response

1- **Rehab Iftikhar and Suneeta Menon (2011)**: The study determines the factors for project risk response success and their relative importance of Sweden, A quantitative study is undertaken by the administration of questionnaires For data analysis, SPSS is used. The results are drawn from the use of statistical tools like ANOVA, correlation, and t-tests. A revised conceptual model is finally developed to address the findings. The results lead to finding a group of seven factors of success that can consider as guideline success in response to project risk. These factors are, Hierarchical structure, Communication that effective, leadership that considers active, coordination and negotiation, Behavior, competency of the team and Empowerment of skills. These determinants of response to the risk in the project successfully can be generalized to the construction industry in Sweden.

2- **Yao Zhang and Zhi-Ping Fan (2013)**: The study provides an approach to solve the selection problem of risk response strategy in PRM. In the approach, they developed an optimization model, which combine three critical elements that are the project cost, project quality,

and project schedule. When the model solved, the optimal solution might be obtained so that the most required risk response strategies to overcome the risk events can be determined. If this method doesn't satisfy the manager another method used which cakes tradeoff. The method of the optimization discrete optimizer LINGO.

3- **Omayma Hashim (2014)**: In this study a Risk Response Model was developed to treat construction projects delays in the United Arab Emirates, first strengths and weaknesses were analyzed for current risk response processes by a comprehensive critical previous study. The methodology that used involved a survey of the questionnaire, study cases and interviews to ensure that research goals are matched with the previous study.

4- **Rahman Soofifard, Morteza Khakzar Bafrue (2017):** They produce a mathematical model that study the effect of the risk response reduction measures and the effect on each other, and also the capability of optimizing different criteria regarding the objective function depending on the type of project.