UNIVERSITI PUTRA MALAYSIA

A COMPREHENSIVE METHOD FOR EVALUATING AND REDUCING RISK FACTORS FOR PROJECT IMPLEMENTATION

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By

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Risk analysis has been broadly used to make assessments for many business sectors. Consequently, risk-based decision-making is a dynamic practice that should be deliberated when a list of projects and restrictions are being assessed. Risk management practices are comprehensive in recognizing and evaluating all potential risks. Risk management events as well as risk evaluation assist the project managers to achieve the related risks factors and take applicable arrangements in decreasing the degree of significant risks thus give a significant contribution to a manageable enhancement. It is needed to create a technique and system to assess evaluate as well as manage risk elements effectively in advance. A questionnaire-based survey approach was chosen in the study to investigate risk factors allocated to manufacturing companies in Malaysia. Survey questions were adopted from previous works with slight amendments, pre-tested, and weighed for validity and reliability. Four key risk factors sets: project scope and organization, project management, business/financial, and operational, with 89 specified risk sources/ causes processes were considered in the model. The likelihood of occurrence of each risk factors was assessed by respondents with the use of a 5-grade Likert scale. This approach was used to quantify risk elements, and use them to estimate the overall project risk. The collected data has been analysed through SPSS. Results showed that more consideration was observed for Operational risk factors with respect to occurrence and influence. The proposed of this risk assessment model is developed based on the use of situational factors to predict project risks. As a result, a questionnaire based software was developed to fit the process of evaluation and reducing risk factors before and during implementation of projects execution phase. In this research, by suggesting a comprehensive

risk based decision making model, the effective agents of resource impact in the process of risk identification, plan and control during financial global crisis have be identified and also identification of the effective criteria and sub-criteria in each of the identified agents. The software with a high ability of modelling and analyzing risks of the projects which is most suitable for industrial application was developed. The method, was be ready to use by the industrial practitioners for the successful completion of their projects, and also indirectly improves manufacturing project management practices, and as a result minimizes losses and increases profitability.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KAEDAH KOMPREHENSIF BAGI PENILAIAN DAN PENGURANGAN FAKTOR RISIKO DALAM PELAKSANAAN PROJEK

Oleh

BADER M. S. M. AL-ADWANI

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Analisa risiko telah digunakan secara meluas untuk membuat keputusan dalam banyak sektor perniagaan. Oleh itu, membuat keputusan berasaskan risiko adalah satu proses penting yang perlu dipertimbangkan bilamana senarai projek-projek dan kekangan sedang dinilai. Amalan pengurusan risiko adalah komprehensif dalam mengesan dan menilai semua risiko yang berpotensi. Aktiviti pengurusan risiko termasuk penilaian risiko menyokong pembuat keputusan untuk menguruskan risiko yang berkaitan dan mengambil tindakan yang sewajarnya untuk mengurangkan tahap risiko kritikal dan menyumbang pembangunan mampan. Adalah penting untuk mewujudkan satu kaedah dan sistem untuk menguruskan faktor-faktor risiko dengan berkesan terlebih dahulu. Pendekatan kajian berdasarkan soal selidik telah dipilih dalam penyelidikan ini untuk menganalisa risiko bagi penilaian kuantitatif. Soalan kaji selidik telah diambil dari penyelidikan terdahulu dengan sedikit pindaan, dilakukan ujian perintis dan dinilai untuk kesahihan dan kebolehpercayaan. Empat set faktor risiko utama dengan 89 sumber risiko yang khusus/penyebab telah dipertimbangkan dalam model: skop projek dan organisasi, pengurusan projek, perniagaan atau kewangan, dan proses operasi. Kemungkinan berlakunya faktor-faktor risiko yang dinyatakan telah dinilai oleh responden dengan menggunakan skala Likert 5-gred. Pendekatan ini telah digunakan untuk mengukur unsur-unsur risiko, dan menggunakannya untuk menganggarkan nilai normal risiko projek. Data yang dikumpulkan telah dianalisis melalui SPSS. Keputusan kajian menunjukkan bahawa lebih banyak pertimbangan diperhatikan untuk faktor risiko Operasi berkenaan dengan kejadian dan pengaruh. Penilaian risiko dalam model ini adalah bergantung kepada jenis projek dan keadaan semasa, kerana ia dibangunkan berdasarkan kepada penggunaan faktor situasi untuk meramalkan risiko projek. Sehubungan itu, satu perisian

berasaskan soal selidik telah dibangunkan untuk memproses penilaian dan mengurangkan faktor risiko sebelum dan semasa melaksanakan fasa projek pelaksanaan. Dalam kajian ini, dengan mencadangkan model membuat keputusan berasaskan risiko yang komprehensif, ejen berkesan kesan sumber dalam proses mengenal pasti risiko, merancang dan kawalan semasa krisis kewangan global akan dikenal pasti dan juga pengenalan satu kriteria berkesan dan sub-kriteria dalam setiap daripada ejen yang dikenal pasti. Perisian ini berkeupayaan tinggi dalam pemodelan dan pengesanan risiko projek akan sangat sesuai untuk kegunaan industri. Kaedah ini, akan sedia digunakan oleh pengamal industri dalam menjayakan pelaksanaan projek mereka, jkdan juga secara tidak langsung menambahbaik amalan pengurusan projek industri pembuatan, dan hasilnya meminimumkan kerugian dan meningkatkan keuntungan.fasa projek pelaksanaan. Senarai soalan-soalan untuk penilai risiko telah dirangka dengan menyediakan pilihan "ya atau tidak" untuk setiap faktor risiko kritikal di atas. Jawapan daripada penilai dikira mengikut skor-tahap risiko. Dalam kajian ini, dengan mencadangkan model membuat keputusan berasaskan risiko yang komprehensif, ejen berkesan kesan sumber dalam proses mengenal pasti risiko, merancang dan kawalan semasa krisis kewangan global akan dikenal pasti dan juga pengenalan satu kriteria berkesan dan sub-kriteria dalam setiap daripada ejen yang dikenal pasti. Perisian ini berkeupayaan tinggi dalam pemodelan dan pengesanan risiko projek akan sangat sesuai untuk kegunaan industri. Kaedah ini, akan sedia digunakan oleh pengamal industri dalam menjayakan pelaksanaan projek mereka, jkdan juga secara tidak langsung menambahbaik amalan pengurusan projek industri pembuatan, dan hasilnya meminimumkan kerugian dan meningkatkan keuntungan.

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This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Philosophy of Doctorate. The members of the Supervisory Committee were as follows:

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CRF	Critical Risk Factors
PRM	Project Risk Management
VAR	Value At Risk
HS	Historical Simulation
EVT	Extreme Value Theory
CAPM	Capital Asset Pricing Model
CRIMS	Cost/Risk Identification & Management System
ART	The Aggregate Risk Tool
PRA	Probabilistic Risk Assessment
AOA	Activity On Art
RCPSP	Resource-Constrained Project Scheduling Problem
MRCPSP	Multi-Mode Resource Constraint Project Scheduling Problems
GA	Genetic Algorithm
SA	Simulated Annealing
FLG-HGA	Fuzzy Logic Controller
HGA	Hybrid Genetic Algorithm
RC-MPSP	Resource-Constrained Multiple Project Scheduling Problem
PSO	Particle Swarm Optimization
NPV	Net Present Value
TS	Tabu Search Algorithm
DSS	Decision Support System
DBMS	Database Management System
MMS	Mail Management System
GDSS	Group Decision Support Systems
EIS	Executive Information Systems
CMCS	Computer-Mediated Communication Systems
OLAP	On-Line Analytical Processing
WWW	Worldwide Web
HTTP	Hypertext Transfer Protocol
HTML	Hypertext Mark-Up Language
LAN	Local Area Networks
MSP	Microsoft Office Project
SPSS	Statistical Package For Social Science
PRAM	Project Risk Analysis & Management
TTM	Time To Market
HR	Human Resources
SME	Small and Medium Enterprise

CHAPTER 1

INTRODUCTION

1.1 Introduction

These days in the realm of creation contention, clearly every nation has its own nearby economy that is produced by such a large number of interior and outer variables like industries, production, technology, foreign relationship, and import and export opportunities. It is likewise evident that an economic model of a nation is influenced by the interrelation of commonwealth countries, and in addition inside and outside elements. From this time forward, different nations can be influenced by a worldwide crisis, and every nation is included with a huge scope of chances and dangers at the time. Some of the time they may change to end up an emergency of colossal extents. There are a few characteristic causes e.g. quake, surge, dry spell and so on, and some unnatural causes like oil, gold, and trade economic situation that can set off a worldwide emergency base. As generally known a worldwide crisis can harm a nation's economy and even pulverize it. Truth be told, the world has encountered a widespread slump since 2007. This sort of emergency can influence wide areas of the economy, for example, innovation, businesses, the travel industry, and so on.

Project managers assume that when precarious conditions happen to ventures in such a territory, they should stop the project execution there since it might turn into a global crisis. Many undertaking supervisors don't give careful consideration to cautions cautioning of such conditions despite the fact that they will endure much misfortune. Such attitude often jeopardizes the success of the project. Subsequently, in some circumstances the company may fall into bankruptcy. Furthermore, Globerson and Zwikael (2002) stated that improper procedures or guidelines in communicating by project managers and lack of skills and equipment by the support team members that could help them in managing their works efficiently results in poor risk management and communications. In the other words, improper guidelines or procedures of risks control at the beginning stage and altering the processes with unclear judgments in the alterations, yet nothing is gained except wastage of much money and energy, firing personnel, accumulating loans or sliding into bankruptcy.

According to Wang and co-workers (2004), risk management is define as a systematic practice of recognizing, analyzing and countering to risks all over the lifecycle of a project to achieve the optimal degree of risk elimination, mitigation and/or control. Wang et al. (2004) mentioned that the process should originates by identifying of risk applicable and possible risks related issues to the manufacturing project. A satisfactory process of risk

identification is crucial to effective risk management, since unidentified risks cannot be systematically managed and remained (Peter et al, 2005). The task of risk identification will be terrible if the risk management system has no history record. The risk management system should maintain an up-to-date records of potential risks evaluated through identification of environments, assumptions, brainstorming, quantitative and qualitative estimates, etc. (Meredith, et al, 2006).

1.2 Problem Statement

Risk Management is a process to identify, analyze and response to risk factors during the life of a project in order to deliver a rational basis for decision-making in regards to all risks. Risk, however, increases with increase in issues like difficulty, globalization and un-familiarized technology types of risk, regulators requests and pressure for rational capital allocation (Mulu, 2013). Despite the abundance of tools, performances and methodologies to apply risk management, there are still some problems in addressing of uncertainties in associated with decision-making in every phases in a project life cycle. Thus, decision-making is a vital tool for any company, especially manufacturing project based firms that work in a hostile, vibrant, and multifaceted environment. Accordingly, the selection of project and scheduling is a complicated decision-making activities and is affected by various factors such as market conditions, the readiness of materials, government rules and regulations, etc. (Liu and Wang, 2011). A risk-based decision-making is a dynamic process that should be considered when a list of projects and constraints are being considered. As risk is associated with unknown factors, more risks should be unidentified at the beginning of a project. However, risk must be deliberated in the beginning phase and assessed to the possible advantage of the project‘s success in order to choose if the project should or can be accepted.

In project management, there are a few classifications of assets which fundamentally impact the projects, regardless of whether common or megaprojects. A number of risk management models regularly centered on conceivable dangers between firms, ventures, modern associations and government have been presented. The confinements of such models are an absence of centralization of the effect of various assets on the undertakings risks arranging and control amid worldwide money related emergency. A far reaching calculated model is then required to have the capacity to evaluate the most suitable technique. As per Biaraf (2011), managing risk activities including hazard identification and risk assessment support project managers to manage the related risks and put appropriate actions to reduce the critical risks levels and contribute sustainable development. Consequently, it is essential to set up a strategy and framework to oversee risk factors successfully ahead of time. Additionally, due to the increasing on needs and new technologies development, more organizations choose to develop their own risk based management software in the organization. The goal of using risk management was to define how a company could

guarantee the optimum level of revenue by evaluating and undertaking various risks that arise during the initial phase of projects.

1.3 Objectives

The purpose of this study is to develop a comprehensive decision making method for risk assessment of projects during implementing project activities in order to minimize the impact of risk factors. Hence, there must be policies to identify, analyze, plan, monitor and control the agents of the global crisis. The application of 'Risk Management' is one of basic ways to obtain power to survive in a critical environment.

A quantitative approach applying online survey was conducted with respondents who are involved in the management of projects in various manufacturing companies around Malaysia. The aim of this study is to develop a risk management decision support system for projects that will be implemented at the initial phase, the software will help users or project owners in the selection or identification of their risk at an early stage, as well as they could mitigate the risk for early prevention and corrective actions.

The main aims of this research study are as follows:

1. To recognize and analyze Critical Risk Factors (CRF) in Management of Projects particularly in Risk Management Process
2. To classify the effectiveness of resources to influence projects during planning the projects or implementing project.
3. To evaluate the identified critical risk factors directly allocated to the projects.
4. To implement a risk-ranking methodology to prioritize risks within and through projects and identify and analysis key causes which lead to Risk Controlling failures of the model.

1.4 Significance of This Study

The study outcomes significantly contribute towards improvement in develop a comprehensive decision making method for risk assessment of projects during implementing project activities in order to minimize the impact to the project. Hence, the results of the study will helps the project‘s owners to obtain the a manage the in relation to the risk management decision support system for projects that will be implemented at the initial phase, the software will help users or project owners in the selection or identification of their risk at an early stage, as well as they could mitigate the risk for early prevention and corrective actions.

1.5 Scope of Work

The scope of work of this study is limited to project's management in small and medium enterprise (SME) in Malaysia and Kuwait which are directly involves in project management. The pilot study was conducted in Kuwait and Malaysia while the actual project management risk based questionnaires was also conducted in Malaysia and Kuwait SME's. This study will be accomplished in the following four major stages: 1) identifying and analyzing Critical Risk Factors (CRF) in Management of Projects particularly in Risk Management Process, 2) identifying the effectiveness of resources to influence projects during planning the projects or implementing project, 3) evaluating of the identified critical risk factors directly allocated to manufacturing industries, 5) finally the implementing a risk-ranking methodology to prioritize risks within and across projects and identify and analysis key causes which lead to Risk Controlling failures of the model.

1.6 Thesis Organization

This study has been divided into six stages: Stage 1: development of survey's questionnaires and data collection, stage 2: identifying and analyzing CRF, stage 3: identifying the effectiveness of resources to influence projects during planning the projects or implementing project, 4) evaluating of the identified critical risk factors directly allocated to manufacturing industries, 5) providing an holistic perspectives of identified risk factors as international and national, and 6) finally implementing a risk-ranking methodology to prioritize risks within and across projects and identify and analysis key causes which lead to Risk Controlling failures of the model.

Chapter 1 provides with overviews of the study and the objectives of the study. Chapter 2 represents a comprehensive literature review from the related issues, Chapter 3 provides the methodology used in this study, Chapter 4 represents the result and discussion from surveys and finally Chapter 5 consists of the summary or conclusion of this study. In this chapter a general conclusions are presented for each sections and lastly, a recommended for upcoming study are presented.

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LIST OF PUBLICATIONS

M. K. A Ariffin, Bader, A (2016), A Review of risk management and different resources in scheduling problems for mega Projects, Journal of Scientific Research and Development 3 (5): 157-163.

M. K. A. Ariffin, Bader Al-Adwani, Faieza A. Aziz, F. Mustapha and R. Mohammad, Development of Risk Assessment Software for Project Implementation, FICEER, November 2019, Accepted

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