RISK ASSESSMENT FOR THE DELAY FACTORS IN PROJECT MANAGEMENT OF ROAD CONSTRUCTION

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DEDICATION

Special dedicated to my supportive husband *Mohd Bakti Farial Bin Khalid*,

To my dearest mother *Waginah Bt Nuri*,

And to my beloved son *Muhammad Qayyum*,

Thank you for untiring Du'a, support, love, understanding and encouragement

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ABSTRACT

The main purpose of project management of road construction is to make sure the project completed in timely manner. Hence, the project shall be managed properly to avoid any failure / delay in the completion of the project that will cause the project be at risk throughout the construction process. One main reason for the failure and delay is when risk management and assessment are not being carried out efficiently and effectively. The objectives of this research is to identify the significant major delay factors, determine the risk ranking for the significant major delay factors and recommend the risk mitigation measures for the significant major delay factors in project management of road construction to reduce the impact of the risk. For this research, the data collected from five (5) case studies and interview sessions of selected project professionals which directly involved in the project management of road construction projects in Johor Bahru. Based on the findings, the five (5) significant delay factors identified were ineffective planning / scheduling, client work / order changes / scope or design changes, payment delays / financial issues, poor site management and supervision, and unexpected site conditions. Hence, the five (5) risks of the significant delay factors identified were ineffective planning / scheduling, client workflow / change of arrangement / scope or design change, poor management and supervision sites, payment delays / financial issues and errors and discrepancies in the design documents. In addition, five (5) measures to mitigate the impact of risk for significant delay factors are also recommended such as effective planning and site management / supervision, Customers and Contractors involved in stage design, cost control, effective Risk Reduction Plan and management of unexpected site conditions in managing road construction projects in Johor Bahru, Johor.

ABSTRAK

Matlamat utama pengurusan projek pembinaan jalan raya adalah bagi memastikan projek dapat disiapkan tepat pada masa yang telah ditetapkan. Sehubungan dengan itu, projek hendaklah diuruskan dengan sebaiknya bagi mengelakkan berlakunya kegagalan / kelewatan dalam penyiapan projek yang boleh menyebabkan projek berisiko sepanjang proses pembinaan dijalankan. Salah satu punca kepada keadaan ini adalah apabila pengurusan dan penilaian risiko projek tidak dijalankan dengan cekap dan berkesan. Objektif kajian ini adalah untuk mengenal pasti faktor kelewatan utama yang ketara, menentukan kedudukan risiko bagi faktor kelewatan utama yang ketara dan mencadangkan langkah-langkah pengurangan risiko bagi faktor kelewatan yang utama dalam pengurusan projek pembinaan jalan untuk mengurangkan kesan risiko. Untuk kajian ini, data telah dikumpulkan melalui lima (5) kajian kes dan lima (5) sesi temuramah bersama golongan profesional projek terpilih yang terlibat secara langsung dalam pengurusan projek pembinaan jalan raya di Johor Bahru. Berdasarkan dapatan kajian, lima (5) faktor kelewatan yang ketara yang telah dikenal pasti adalah perancangan / penjadualan yang tidak berkesan, variasi kerja oleh klien / perubahan tatanan / skop atau perubahan reka bentuk, kelewatan pembayaran / masalah kewangan, pengurusan tapak yang lemah dan pengawasan, dan keadaan tapak yang tidak diduga. Selain itu, lima (5) risiko daripada faktor kelewatan yang ketara telah ditentukan adalah perancangan / penjadualan yang tidak berkesan, variasi kerja oleh klien / perubahan susunan / skop atau perubahan reka bentuk, pengurusan tapak yang lemah dan penyeliaan, kelewatan pembayaran / masalah kewangan dan kesilapan dan percanggahan dalam dokumen reka bentuk. Seterusnya, lima (5) langkah-langkah bagi mengurangkan kesan-kesan risiko bagi faktor kelewatan utama yang ketara juga telah disyorkan seperti perancangan yang efektif dan pengurusan tapak / pengawasan, penglibatan Pelanggan dan Kontraktor semasa peringkat rekabentuk, kawalan kos, Pelan Pengurangan Risiko yang berkesan dan pengurusan keadaan tapak yang tidak diduga dalam pengurusan projek pembinaan jalan raya di Johor Bahru, Johor.

TABLE OF CONTENTS

	TITLE	PAGE
DEC	CLARATION	iii
DEI	DICATION	iv
ACI	KNOWLEDGEMENT	v
ABS	STRACT	vi
ABS	STRAK	vii
TAI	BLE OF CONTENTS	viii
LIS	T OF TABLES	xii
LIS	T OF FIGURES	xiv
LIS	T OF APPENDICES	XV
CHAPTER 1	INTRODUCTION	1
1.1	Research Background	1
1.2	Problem Statement	2
1.3	Research Questions	3
1.4	Research Objectives	3
1.5	Scope of Research	4
1.6	The Significant of Research	4
CHAPTER 2	LITERATURE REVIEW	5
2.1	Introduction	5
2.2	Definition	5
	2.2.1 Risk	5
	2.2.2 Project Management	6
	2.2.3 Road Construction	6
2.3	Project Management of Road Construction	7
	2.3.1 Initiating	7
	2.3.2 Planning	7
	2.3.3 Executing	8

	2.3.4 Monitoring and Controlling	8
	2.3.5 Closing	9
2.4	Risk Management	
	2.4.1 Risk Management Plan	9
	2.4.2 Risk Identification	10
	2.4.3 Risk Analysis	10
	2.4.4 Risk Response	10
	2.4.5 Risk Control	12
2.5	Delay	12
	2.5.1 Type of Delay	12
	2.5.2 Factors of Delay	13
2.6	Risk Assessment	18
	2.6.1 Construction Risk	18
	2.6.2 Risk Zone	20
	2.6.3 Risk Likelihood	22
	2.6.4 Risk Impact	23
	2.6.5 Risk Assessment Ranking	23
2.7	Risk Mitigation	25
	2.7.1 Importance of the Risk Mitigation Measures	25
	2.7.2 Risk Mitigation Measures in Road Construction Project	26
2.8	Summary	29
CHAPTER 3	RESEARCH METHODOLOGY	35
3.1	Introduction	35
3.2	Research Approaches	36
5.2	3.2.1 Qualitative Research	37
	3.2.2 Quantitative Research	37
3.3	Research Methodology	37
	3.3.1 First Stage: Preliminary Study	37
	3.3.2 Second Stage: Data Collection and Research	27
	Design	38
	3.3.3 Third Stage: Findings and Discussion	38

	3.3.4	Final Recomm	Stage: endation	Conclusions	and	39
3.4	Appro		Data Collect	tion		39
	3.4.1	Case Stu				39
			actured Inter	rviews		40
3.5	Metho	od of Data	Analysis			44
3.6	Summ		J. J.			44
		J				
CHAPTER 4	FIND	INGS AN	D DISCUS	SION		45
4.1	Introd	uction				45
4.2	Backg	ground of F	Projects			45
	4.2.1	Project B	ackground			45
	4.2.2	Project D	Oocumentati	on		46
4.3	Projec	et A				47
	4.3.1	Delay faconstruct	-	ject management of	of road	47
	4.3.2		_	e delay factors in construction	project	49
	4.3.3	Risk miti	gation meas	sures		52
4.4	Projec	et B				53
	4.4.1	Delay faconstruct	-	ject management o	of road	54
	4.4.2		_	e delay factors in construction	project	55
	4.4.3	Risk miti	gation meas	sures		58
4.5	Projec	et C				59
	4.5.1	Delay faconstruct	-	ject management o	of road	59
	4.5.2		•	e delay factors in construction	project	61
	4.5.3	Risk miti	gation meas	sures		64
4.6	Projec	et D				65
	4.6.1	Delay fa	-	ject management o	of road	65
	4.6.2		_	e delay factors in construction	project	67

	4.6.3	Risk mitigation measures	70	
4.7	Projec	et E	71	
	4.7.1	Delay factors in project management of road construction	71	
	4.7.2	Risk ranking for the delay factors in project management of road construction	73	
	4.7.3	Risk mitigation measures	76	
4.8	Analy	rsis of all Projects	77	
	4.8.1	Delay factors in project management of road construction	77	
	4.8.2	Risk ranking for the delay factors in project management	79	
	4.8.3	Risk mitigation measures	82	
4.9	Sumn	nary	84	
CHAPTER 5	CON	CONCLUSION AND RECOMMENDATIONS		
5.1	Introd	luction	85	
5.2	Concl	Conclusion		
	5.2.1	Objective 1 : Delay factors in project management of road construction	85	
	5.2.2	Objective 2 : Risk ranking for the delay factors in project management of road construction	86	
	5.2.3	Objective 3: Risk mitigation measures to reduce the risk impact	87	
5.3	Limit	ations	87	
5.4	Recor	mmendations	88	
REFERENCES	S		89	

LIST OF TABLES

TABLE NO.	TITLE	PAGE
Table 2.1	Risk zones for factors	21
Table 2.2	Probability Occurrence of Operational Risks in Highway Projects in Malaysia	22
Table 2.3	Top 10 Risks - Likelihood & Impact and the Most Contributors	25
Table 2.4	Factors of Delay from Previous Studies	30
Table 2.5	Type of Risk from Previous Studies	31
Table 2.6	Risk Mitigation Measures from Previous Studies	33
Table 3.1	Categories of Research Question for Questionnaire Interview	41
Table 3.2	Description of Respondent's Background	42
Table 4.1	Project Background	46
Table 4.2	Details of Project A	47
Table 4.3	Delay Factors for Project A	48
Table 4.4	Risk Ranking for Project A	50
Table 4.5	Details of Project B	53
Table 4.6	Delay Factors for Project B	54
Table 4.7	Risk Ranking for Project B	56
Table 4.8	Details of Project C	59
Table 4.9	Delay Factors for Project C	60
Table 4.10	Risk Ranking for Project C	62
Table 4.11	Details of Project D	65
Table 4.12	Delay Factors for Project D	66
Table 4.13	Risk Ranking for Project D	68
Table 4.14	Details of Project E	71
Table 4.15	Delay Factors for Project E	72
Table 4.16	Risk Ranking for Project E	74

Table 4.17	Delay Factors for All Projects	77
Table 4.18	Risk Ranking for All Projects	79
Table 4.19	Risk Mitigation Measures for All Projects	82

LIST OF FIGURES

FIGURE N	O. TITLE	PAGE
Figure 2.1	Risk Ranking Assessment Matrix	24
Figure 3.1	Research Methodology Flowchart	36

LIST OF APPENDICES

APPENDIX		TITLE	PAGE
Appendix A	Interview Questions		93

CHAPTER 1

INTRODUCTION

1.1 Research Background

The title of this research is "Risk Assessment for the Delay Factors in Project Management of Road Construction".

Delay is one of the big challenges for the construction project parties who had involved in the construction industry (i.e. client, consultant and contractor) and it has been a very common phenomenon especially in the construction project. The construction delay could affect and risk the construction project in terms of the cost overrun, dispute, time overrun, arbitration and litigation and total abandonment (Sambasivan & Soon, 2007).

Risk management have been the key role for the project management in the construction industry nowadays. According to (Szymanski, 2017) the risk management cycle consists of four main stages and the stages are risk identification, risk analysis, risk response and risk monitoring and risk control. The most difficult and crucial part in the risk management is the risk identification process and the assessment of the identified risk. Determining what are the project's risk and how should the identified risk being prioritized is essential to ensure that all the necessary risk is effectively handled, monitored and controlled. The effective and systematic risk assessment should be in placed to avoid or reduce the unnecessary risk before it impacted the management and the construction process.

1.2 Problem Statement

Aziz F. and Abdel-Hakam A. (2016) stated that the construction delays are normal situation in every civil engineering projects including the road construction projects. Delays is happen when project activities extended from the project schedule due to the risk impact (Al-Hazim et. al, 2017). Delay from the owner of the project perspective means profit loss due to the non-availability of production facilities and rentable space or a dependence on present facilities or in some cases, longer working period, increasing of material costs through inflation and higher labor cost are the major factors of delay (Ramanathan, C et al.,2012).

Poor risk assessment could severely impact in the project management of road construction through a delay to project benefits effecting to the revenue / profit streams and according to (U.S. Department of Transportation Federal Highway Administration, 2006), the effective Risk Management should include the risk assessment process, but unreasonably numerous undertakings still opinion that the risk assessment process is only a documentation to be filed once fully completed. Improper management of project risks can significantly influence the achievement of project objectives (Zou et. al, 2007). The capabilities of organization to develop the risk management team for the project and conducted the proper assessment to the risk could minimize the risk impact (Mohamed et. al, 2018).

(Voetsch et. al, 2004) stated that the effective risk management practices, periodically risk monitoring with sufficient risk mitigation measures was found significantly affected the project success with the management support. Other research also found out that managing the identified potential risks is essential and the organization collaboration is crucial to enhance the awareness on the project risk management (Thamhain, 2013). In order to effectively manage / minimizing the risk impact and achieve success in project delivery, there is a need to improve the understanding about the client requirements and approaches used by the project team in regard to control and response to the risks during a construction project (Jin et. al, 2017).

This study aims to determine the risk ranking for the delay factors in project management of road construction by using the method of risk identification and assessment (matrix of risk) and identify the suggestion to reduce the risk impact. Therefore, it is essential to study and analyses causes of road construction delays, risk ranking and recommendation of risk mitigation measures to minimize the risk impact.

1.3 Research Questions

The questions of this research are:

- i. What are the significant major delay factors in the project management of road construction?
- ii. What is the risk ranking for the delay factors in project management of road construction?
- iii. What are the risk mitigation measures for the significant major delay factors in project management of road construction?

1.4 Research Objectives

The objectives of this research are:

- To identify the significant major delay factors in project management of road construction;
- ii. To determine the risk ranking for the delay factors in project management of road construction; and
- iii. To recommend the risk mitigation measures for the significant major delay factors in project management of road construction to reduce the risk impact.

1.5 Scope of Research

The scope of this research shall encompass the feedback from the professionals that involved in the project management of road construction which is also experienced in risk management especially in the risk assessment process. Semi-structured interview is targeted to be conducted with the professionals from five (5) chosen case study of road construction project in Johor Bahru, Johor.

1.6 The Significant of Research

This research should give a brief review on the factors affecting time delay in project management of road construction that occur frequently during project lifetime which usually leading project to the disputes and litigation proceeding. A risk identification and assessment are essential for the parties involved in the construction especially the contractor to analyse each factor and identify the significant major delay factors and determine the risk ranking for the delay factors in project management of road construction. It is hoped that the finding from this research will assist to enhance the risk management in construction industry especially in road construction, ensure the completion of the project goes smoothly thus avoid the disputes and litigation proceeding in the future.

REFERENCES

- Al-Hazim, N., Abu Salem, Z., & Ahmad, H. (2017). Delay and Cost Overrun in Infrastructure Projects in Jordan. *Procedia Engineering* 182, 18-24.
- Assaf, S. A., & Al-Hejji, S. (2006). Causes of delay in large construction projects. International Journal of Project Management 24, 349-357.
- Aziz, R. F., & Abdel-Hakam, A. A. (2016). Exploring delay causes of road construction projects in Egypt. *Alexandria Engineering Journal* 55, 1515-1539.
- Chan, D. W., & Kumaraswamy, M. M. (1997). A comparative study od causes of time overruns in Hong Kong construction projects. *International Journal of Project Management Vol. 15, No. 1*, 55-63.
- Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed methods approaches (3rd ed.). Los Angeles: SAGE Publications, Limited.
- Doloi, H., Sawhney, A., Iyer, K., & Rentala, S. (2012). Analysing factors effecting delays in Indian construction projects. *International Journal of Project Management*, 479-489.
- Dziadosz, A., & Rejment, M. (2015). Risk Analysis in construction project chosen methods. *Procedia Engineering* 122, 258-265.
- Frimpong, Y., Oluwoye, J., & Crawford, L. (2003). Causes of delay and cost overruns in construction of groundwater projects in a developing countries; Ghana as a case study. *International Journal of Project Management 21*, 321-326.
- Gardezi, S. S., Manarvi, I. A., & Gardezi, S. J. (2014). Time Extension Factors in Construction Industry of Pakistan. *Procedia Engineering* 77, 196-204.
- Ghazali, F. E. (2009). Operational Risks for Highway Projects in Malaysia. International Journal of Humanities and Social Sciences Vol:3, No:5, 366-369.
- Goh, C. S., & Abdul Rahman, H. (2013). The Identification and Management of Major Risk in the Malaysian Construction Industry. *Journal of Construction* in Developing Countries 18 (1), 19-32.

- Hamzah, N., Khoiry, M., Arshad, I., Tawil, N., & Che Ani, A. (2011). Cause of construction delay - Theoretical Framework. *Procedia Engineering* 20, 490-495.
- Hwang, B. G., & Ng, H. B. (2016). Project Network Management: Risk and Contributors from the viewpoint of Contractors and Subcontractors. *Technological and Economic Development of Economy Volume 22 (4)*, 631-648.
- International Organization for Standardization. (2015). *Quality management systems Fundamentals and vocabulary*. Retrieved from International Organization for Standardization: https://www.iso.org/obp/ui/#iso:std:iso:9000:ed-4:v1:en
- Jayasudha, K., & Vidivelli, B. (2016). Analysis of Major Risks in Construction Projects. ARPN Journal of Engineering and Applied Sciences Vol.11, No. 11, 6943-6950.
- Jin, X., Zhang, G., Liu, J., Feng, Y., & Zuo, J. (2017). Major Participants in the Construction Industry and Their Approaches to Risks: a Theoretical Framework. *Procedia Engineering* 182, 314-320.
- Kaliba, C., Muya, M., & Mumba, K. (2009). Cost escalation and schedule dalays in road construction projects in Zambia. *International Journal of Project Management*, 522-531.
- Mahamid, I. (2011). Risk Matrix for Factors Affecting Time Delay in Road Construction Projects: Owners' Perspective. *Engineering, Construction and Architectural Management, Vol. 18 Issue:* 6, 609-617.
- McNamara, C. (1999). *General Guidelines for Conducting Interviews*. Minneapolis, Minnesota: Authenticity Consulting, LLC.
- Mohamed, A., Maarouf, K. I., & Annany, Y. (2018). Special studies in management of construction project risks, risk concept, plan building, risk quantitative and qualitative analysis, risk response strategies. *Alexandria Engineering Journal* 57, 3179-3187.
- Niazi, G. A., & Painting, N. (2017). Significant Factors Causing Cost Overruns in the Construction Industry in Afghanistan. *Procedia Engineering* 182, 510-517.
- Project Management Institute, Inc. (2013). A Guide To The Project Management Body of Knowledge (PMBOK Guide) Fifth Edition. United States of America: Project Management Institute, Inc.

- Radujkovic, M., & Sjekavica, M. (2017). Project Management Success Factors. *Procedia Engineering* 196, 607-615.
- Remon, F., & Asmaa, A. H. (2016). Exploring delay causes of road construction projects in Egypt. *Alexandria Engineering Journal* 55, 1515-1539.
- Sambasivan, M., & Soon, Y. W. (2007). Causes and effects of delays in Malaysian Construction Industry. *International Journal of Project Management* 25, 517-526.
- Szymanski, P. (2017). Risk management in construction project. *Procedia Engineering* 208, 174-182.
- U.S. Department of Transportation Federal Highway Administration. (2006, October). Guide to Risk Assessment and Allocation for Highway Construction Management. Washington DC: U.S. Department of Transportation. Retrieved from Office of International Program: https://international.fhwa.dot.gov/pubs/pl06032/guide_to_risk_assessment_al location_for_highway.pdf (accessed 14 August 2018)
- Voetsch, R. J., Cioffi, D. F., & Anbari, F. T. (2004). Project risk management practices and their association with reported project success. *IRNOP VI Conference*, *Turku*, *Finland*.
- Zavadskas, E. K., Turskis, Z., & Tamosaitiene, J. (2010). Risk Assessment of Construction Projects. *Journal of Civil Engineering and Management 16* (1), 33-46.
- Zou, P. X., Zhang, G., & Wang, J. (2007). Understanding the key risks in construction projects in China. *International Journal of Project Management* 25, 601-614.