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Quantitative Insights into Risk Management and Project Success: Evidence from Malaysia's Oil and Gas Sector

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ABSTRACT

The oil and gas sector is a highly competitive and intricate industry, distinguished by the significance and complexity of its undertakings. Initiating and completing projects according to scope, schedule and cost is necessary for oil and gas companies to attain sustainability. This study carefully examines the complex link that exists between risk management practices and techniques and project success in the particular setting of Malaysia's oil and gas industry. This study was based on a quantitative research methodology whereby an online data collection via Google Form questionnaires, were distributed to people working in oil and gas related projects around Malaysia. A total of 120 surveys were sent, and 90 completed questionnaires were received, resulting in a response rate of 75%. The data was analysed using multiple regression analysis, descriptive analysis, and Pearson's correlation analysis. To investigate the relationships between the independent variables (risk identification, risk analysis, risk mitigation, risk monitoring, and risk assessment tools) and the dependent variable (project success), all analyses are carried out using the Statistical Package for Social Science (SPSS). The regression analysis results indicate that only risk analysis, risk mitigation, and risk assessment tools have a statistically significant positive effect on project success. On the contrary, correlations analysis between the project success and risk identification, risk analysis, risk mitigation, risk monitoring and risk assessment tool show positive results, indicating that the project success does have strong correlation with all the independent variables.

1. INTRODUCTION

Successful project completion is essential for organizations to maintain their competitiveness and accomplish their strategic goals in the rapidly evolving business environment of today, particularly in the intricate and risk-filled world of Malaysia's oil and gas industry. Nevertheless, there are many uncertainties and unknowns on the road to project success, especially when it comes to the risks that come with working on oil and gas projects. Project risk is an event that might have a positive or negative outcome, but risk is typically understood as getting exposed to a scenario that could have an unforeseen effect. (Anantatmula & Fan, 2013), (Voetsch, R. J., 2004). Oil and gas project risks can take many different forms, including scope creep, budget overruns, delays in scheduling, and quality problems. Project failure has consequences that go beyond monetary losses; they can also result in missed opportunities and damage to one's reputation. Acknowledging these difficulties makes it essential for organisations to practise effective risk management in order to successfully navigate the complex web of unknowns and guarantee project success.

2. LITERATURE REVIEW

2.1 Project Success Theory

The notion of the Iron Triangle, which is also known as the Project Management Triangle or the Triple Constraint, is a

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foundation of our understanding of project success. The Iron Triangle, which is based on core project management concepts, outlines the essential criteria that determine a project's success. According to Pollack, Helm, and Adler (2018), it consists of three main components: fulfilling deadlines, staying within budgetary restrictions, and reaching pre-established standards for performance, quality, or scope. The Iron Triangle is a crucial reference point for understanding and assessing project success in a variety of industries.

The Iron Triangle offers a thorough framework for assessing the performance of Malaysian projects connected to oil and gas in the context of this study. The Iron Triangle, which encapsulates timeliness, financial prudence, and the realisation of predefined project scopes, serves as the foundation for evaluating the efficacy of risk management strategies.

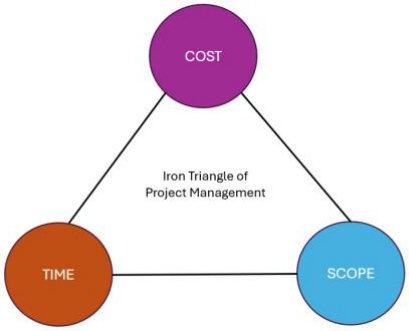

Fig. 1. The Iron Triangle of Project Management

2.2 *Risk Management Theories*

Wakker, (2010) indicated that *Decision Theory* and *Prospect Theory* provide insights into how individuals and organizations perceive and respond to risks and additionally, theories on risk appetite, tolerance, and transfer strategies form the foundation for effective risk management frameworks. Decision theory offers an organised method for making decisions in unpredictable situations by serving as a lens through which people and organisations view and react to risks. Conversely, Prospect Theory clarifies the cognitive biases that affect how risk is perceived, and decisions are made. Together, these theories advance our understanding of risk perception, assessment, and management in a more complex way.

Effective risk management frameworks are based on fundamental ideas about risk appetite, tolerance, and transfer strategies in addition to cognitive theories. The study acknowledges the complex interplay between these theoretical constructs and their practical implications for the oil and gas industry in Malaysia.

By combining these theories of project success and risk management, this study aims to clarify the complex interactions that determine how risk management strategies, guided by Prospect and Decision theories, interact with the Iron Triangle's benchmarks. By doing this, the study hopes to contribute to the advancement of knowledge in both the theoretical and practical domains by providing a thorough understanding of how risk management practices influence important aspects of project success.

2.3 Conceptual Framework

The conceptual framework for this research is as per the diagram below. The best practices for identifying, analyzing, mitigating, monitoring project risks and risk assessment tools have been included in this framework. It acts as a manual for comprehending how various risk management techniques are related to one another and affect the outcome of projects.

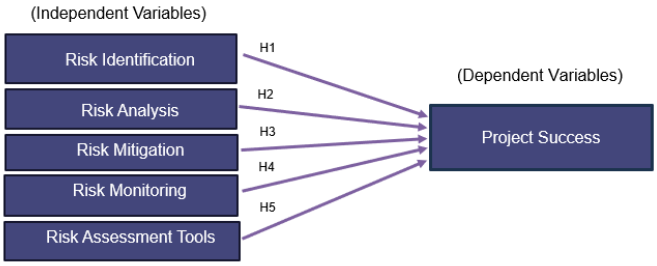

Fig. 2. Conceptual Framework

2.3.1 Research Hypotheses

Based on the proposed conceptual framework and the reviewed literature, the following hypotheses are developed to examine the relationships between the independent variables (risk identification, risk analysis, risk mitigation, risk monitoring and risk assessment tool) and the dependent variable (project success) among technical/engineers and non-technical employees involved in various kind of oil and gas projects in Malaysia:

H1: Effective risk identification has a positive impact on project success in oil and gas related projects in Malaysia.

H2: Effective risk analysis has a positive impact on project success in oil and gas related projects in Malaysia.

H3: Effective risk mitigation has a positive impact on project success in oil and gas related projects in Malaysia.

H4: Effective risk monitoring/tracking has a positive impact on project success in oil and gas related projects in Malaysia.

H5: Effective use of risk assessment tools has a positive impact on project success in oil and gas related projects in Malaysia.

Effective risk management practices which include, risk identification, risk analysis, risk mitigation, risk monitoring throughout the project and utilisation of risk assessment tools correlate with project success criteria, including adherence to schedules, budgets and scope.

3. RESEARCH METHODOLOGY

3.1 Sampling Method and Target Population

The sampling method used was simple random sampling, a type of probability sampling that ensures there is an equal chance of selection for every member of the population. This is the easiest probability sampling approach to understand because it just needs one random selection and minimal prior population knowledge. The population chosen for this study are generally professionals who are directly involved in project management, risk identification, assessment,

mitigation, monitoring, using risk assessment tools and stakeholders across a range of industries.

3.2 Research Design

This study is based on a quantitative research design where it involves gathering and examination of numerical data. The relationship between risk management procedures and project success in Malaysian oil and gas projects was investigated. The variables of interest include risk identification, risk analysis, risk mitigation, risk monitoring, and risk assessment tools. Numerical data on these variables were gathered, and statistical techniques were applied to analyse the data and find patterns.

3.3 *Operationalization and Measurement*

Risk identification, analysis, mitigation, monitoring, and risk assessment tools / techniques are among the independent variables which were being operationalized in this study including the project success which is the dependent variable.

The respondents were given a questionnaire that contains the measurement scales and items. A Likert scale, spanning from strongly disagree to strongly agree, very unsuccessful to very successful and few others will be used to score each item. The reliability and validity of the data gathered are guaranteed by the use of established scales, verified assessment items, and control variables. It takes possible confounding factors into account and permits the investigation of the correlations between the independent and dependent variables.

4. RESULTS AND DISCUSSIONS

4.1 Data Analysis Techniques

The results of this study are provided in this chapter. The first section of the chapter will describe the demographics and the response rate of the respondents participated in the survey. The variable's descriptive value will also be presented where thorough examination of correlation and regression analysis will be discussed and marked the end of this study by the researcher.

4.2 Response Rate

The survey questionnaires were prepared via Google Form and were circulated to intended respondents including those working on such projects who are engineers or technical specialists as well as those with non-technical or non-engineering backgrounds. A total of approximately 120 surveys were circulated via various platforms such as email, WhatsApp and LinkedIn messages and they were given two weeks to complete the online form. 90 of the 120 survey participants completed and returned the survey which constitutes 75% of the total, which is greater than the typical online survey response rate of 44.1% (Wu et al., 2022).

4.3 Demographic Analysis

The average age group of the respondents is between 41 and 50 years old (52.2%) and with the additional involvement of 14.4% of respondents from age group 51-60 and more than 60 years suggests that most of the respondents have relatively lots of experience in the industry, which may increase the validity of their opinions to this research.

4.3.1 Age Group

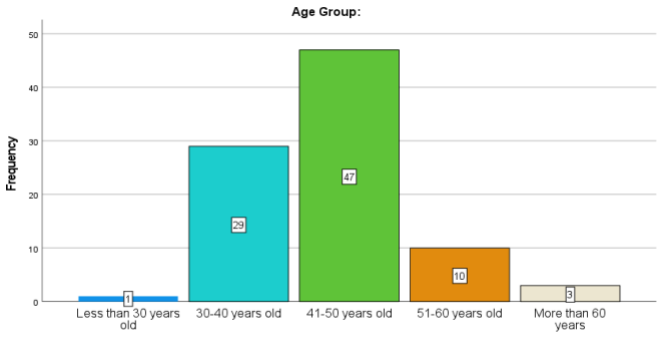

Fig. 3. Statistics of Respondent's Age Group

4.3.2 Respondents' Gender

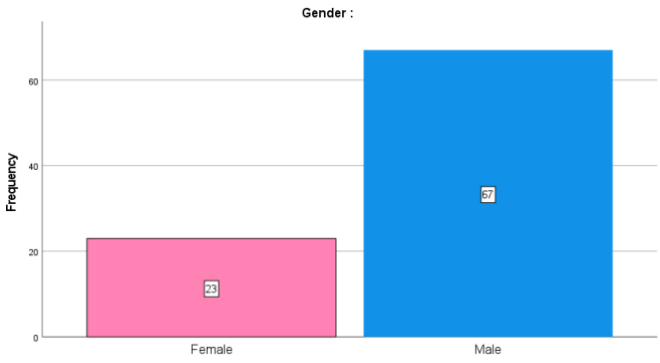

Fig. 4. Statistics of Respondents' Gender

The gender breakdown of the 90 respondents who work in the oil and gas sector is displayed in the table. The data indicates a notable gender disparity, with men making up 74.4% of the respondents and women making up only 25.6%. This illustrates how the oil and gas projects is mainly dominated by men as compared to women. According to the data, respondents' viewpoints and experiences are likely to differ depending on their gender, which could influence how they answer to the survey questions.

4.3.3 Respondents' Highest Level of Education

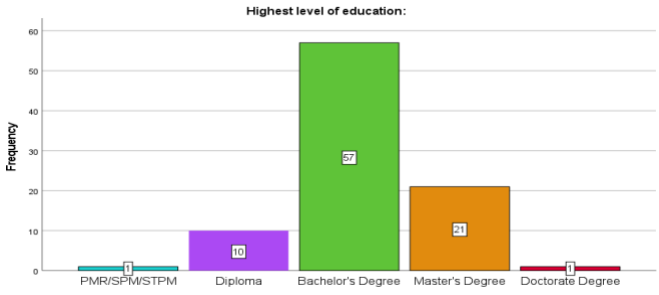

Fig. 5. Statistics of Respondents' Highest Level of Education

According to the data displayed above, the majority of respondents (63.3%) hold a bachelor's degree, while those with a master's degree (23.3%) come in second. Those with diplomas account for 11.1% of the total, compared to just 1.1% for those with doctorates and PMR/SPM/STPM. This

suggests that the majority of respondents are well-educated, which may indicate that they have a well-informed and informed perspective on risk management in the oil and gas sector.

4.3.4 Respondents' Position and Role

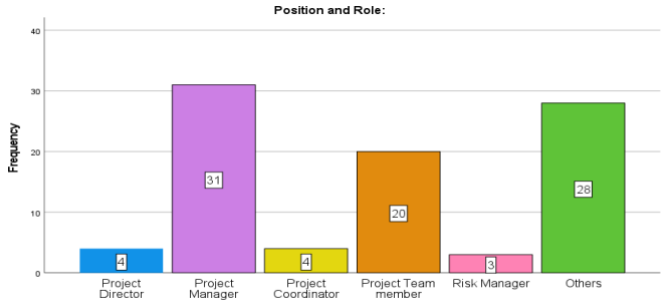

Fig. 6. Statistics of Respondents' Position and Role

According to the data, project managers make up the majority of respondents (34.4%), followed by people who fall into Others category (31.1%). Project Coordinators, Project Directors, and Risk Managers account for 4.4% and 3.3% of the total, respectively, while Project Team Members make up 22.2%.

In interpreting the Others category, a strong assumption can be made as to whom does fall or identified themselves within this category. The survey questions that were circulated did cover quite a number of people who are in the C-Suite, senior management positions and the Head of Departments. They are not relatively forming part of the project teams as the Project Director or even Project Manager but predominantly play the role as the stakeholders for the projects which are run by their project teams.

Therefore, this could suggest that most of the respondents are either in the managerial roles in the project or leadership roles in the organisation itself, which may indicate a high degree of accountability and authority regarding risk management in the oil and gas sector and well-understand how risk management practices work in this field.

4.3.5 Respondents' Background

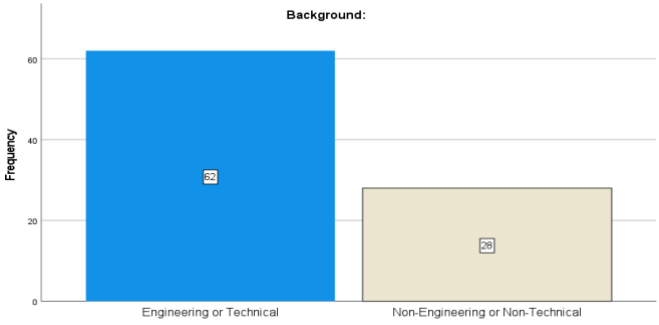

Fig. 7. Statistics of Respondents' Background

According to the data, 31.1% of respondents have a non-engineering or non-technical background, whereas the majority of respondents (68.9%) had an engineering or technical background. Given that most of the respondents had experience in the oil and gas sector, this suggests that they have a solid understanding of risk management in this setting. With over two-thirds of the respondents having a similar professional or educational background, the data also reveals a limited variation in background. This might make it harder to interact and work together with stakeholders from various backgrounds, as well as reduce the variety of viewpoints and insights on risk management in the oil and gas sector.

4.3.6 Respondents' Years of Experience

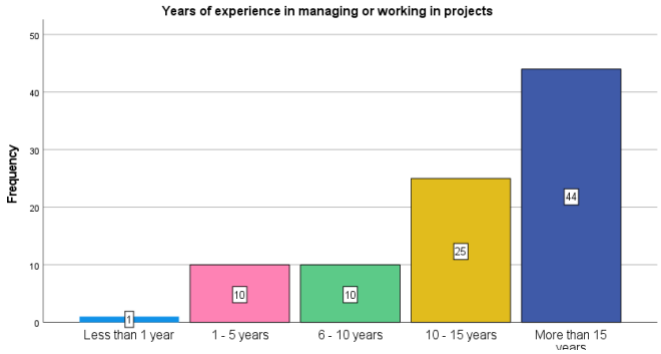

Fig. 8. Statistics of Respondents' Years of Experience

According to the above data, the majority of respondents (48.9%) have managed or worked on projects for more than 15 years, with those with 10–15 years of experience coming in second (27.8%). Less than a year's experience makes up only 1.1% of the total, whereas those with 1–5 years and 6–10 years of experience each make up 11.1%. This suggests that most of the respondents had extensive project management or project work experience, which may indicate a high degree of competency and assurance regarding risk management in the oil and gas sector.

4.3.7 Type of Oil and Gas Projects involved by Respondents

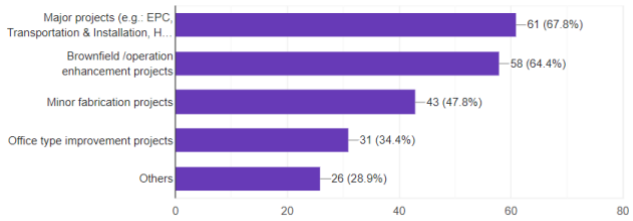

Fig. 9. Statistics of Types of Oil and Gas Projects

The projects that the 90 respondents are working on in the oil and gas industry are displayed in a horizontal bar chart. Given that big projects and brownfield/operation enhancement projects have the highest respondent counts and percentages, it is statistically clear that these projects involve most of the participants. These projects, which entail intricate, extensive, and hazardous tasks, are the most prevalent kinds in the oil and gas sector. This data may be utilised to comprehend how different project kinds and levels of skill are distributed among the professionals in this sample of the oil and gas industry. It can also be useful in determining the possible risks and difficulties connected to every kind of project, as well as the industry's best practices and approaches to risk management.

4.4 Correlation Analysis

The dependent variable, which is related to the project success, and the independent variables, which are risk identification, risk analysis, risk mitigation, risk monitoring and risk assessment tools, are measured, and their associations are examined using correlation analysis.

Table 1. Findings of Pearson Correlation

CORRELATIONS							
		DV	IV1	IV2	IV3	IV4	IV5
Project Success (DV)	Pearson Correlation	1	.363**	.672**	.665**	.601**	.580**
	Sig.(1-tailed)		<.001	<.001	<.001	<.001	<.001
	N	90	90	90	90	90	90
Risk Identification (IV1)	Pearson Correlation	.363**	1	.354**	.295**	.357**	.576**
	Sig.(1-tailed)	<.001		<.001	<.001	<.001	<.001
	N	90	90	90	90	90	90
Risk Analysis (IV2)	Pearson Correlation	.672**	.354**	1	.621**	.670**	.563**
	Sig.(1-tailed)	<.001	<.001		<.001	<.001	<.001
	N	90	90	90	90	90	90
Risk Mitigation (IV3)	Pearson Correlation	.665**	.295**	.621**	1	.567**	.385**
	Sig.(1-tailed)	<.001	<.001	<.001		<.001	<.001
	N	90	90	90	90	90	90
Risk Monitoring (IV4)	Pearson Correlation	.601**	.357**	.670**	.567**	1	.609**
	Sig.(1-tailed)	<.001	<.001	<.001	<.001		<.001
	N	90	90	90	90	90	90
Risk Assessment tool (IV5)	Pearson Correlation	.580**	.576**	.563**	.385**	.609**	1
	Sig.(1-tailed)	<.001	<.001	<.001	<.001	<.001	
	N	90	90	90	90	90	90

**Correlation is significant at the 0.01 level (1-tailed)

4.5 Multiple Regression

Regression analysis was performed on the collected data in this study to examine the connection between different risk management techniques and project success in Malaysian oil and gas-related projects. The analysis specifically looked at how successful risk identification, analysis, mitigation, tracking, and monitoring and using risk management tools related to project success.

Table 2. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.778[a]	.605	.582	.28658

a. Predictors: (Constant), Risk assessment tool (IV5), Risk Mitigation (IV3), Risk Identification (IV1), Risk Monitoring (IV4), Risk Analysis (IV2)

According to Table 2 above, 60.5% of the variance in the project success can be explained by the five independent variables (risk identification, risk analysis, risk mitigation, risk monitoring and risk assessment tool). It can also be concluded that there are 39.5% of the variance in the success of the oil and gas projects in Malaysia rests in other external factors which are not covered under this study.

4.6 Hypothesis Result

Table 3. Summary of Findings

Hypothesis	Multiple Regression	Correlation
H1: Effective risk identification has a positive impact on project success in oil and gas related projects in Malaysia.	Not supported	Supported
H2: Effective risk analysis has a positive impact on project success in oil and gas related projects in Malaysia.	Supported	Supported
H3: Effective risk mitigation has a positive impact on project success in oil and gas related projects in Malaysia.	Supported	Supported
H4: Effective risk monitoring/tracking has a positive impact on project success in oil and gas related projects in Malaysia.	Not Supported	Supported
H5: Effective use of risk assessment tools has a positive impact on project success in oil and gas related projects in Malaysia.	Supported	Supported

5. CONCLUSION

The study's main conclusions show that using risk assessment tools, risk mitigation strategies, and risk analysis significantly increase project success. However, there was no statistically significant relationship found between project success and risk monitoring or risk identification. These results imply that while risk management is crucial in all respects, some components might have a more immediate influence on project performance in the context of Malaysian oil and gas industry. In summary, this study offers insightful information about how successful risk management contributes to Malaysian oil and gas project success. Nevertheless, it is also important to note that there is a need for methodological improvements and greater investigation into other variables that can affect project performance in order to provide a more thorough understanding of project success in the oil and gas industry in the future.

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