Risk Management in Petroleum Industry Construction Projects in Malaysia

by

Fardhan Adamy

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CERTIFICATION OF APPROVAL

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Approved by,

_____

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UNIVERSITI TEKNOLOGI PETRONAS

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MAY 2012

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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(Fardhan Adamy, ID: 12298)

ABSTRACT

This research is conducted with main purpose of recognizing the most occurring risk factors in construction projects of petroleum industry in Malaysia. It is also done to emphasize the importance of risk management and give some suggestion to improve it based on the analysis of the current practice in the country. At present, stakeholders worldwide are calling for enhanced risk management in petroleum industry activities due to the fact that it needs enormous number of investment money as well as extensive period of time to perform its highly risk operations. Moreover Petronas as an important contributor of Malaysia economy and as company which intends to be a leading global player in the business shall keep improving its activities in term of quality and efficiency, thus its risk management as well.

Risks to be identified are the ones that may exist in the projects owned by petroleum operator company, Petronas. Therefore survey is conducted to attain necessary data for the study using questionnaires distributed to the upstream subsidiary company of Petronas and the contractor partners working in Petronas' downstream project in Malaysia. Picking out the major project risks occurring in the country and an analysis upon them are carried out based on the rank. These are then followed by developing possible suggestions to mitigate the analysed risks and its improvement measures.

The most often occurring risk factors have been identified based on the survey tests performed in the study, they are: bureaucratic government system & long project approval procedure, design changes, late internal approval process from the owner, delay in signing contract, inadequate coordination among contractors, inefficient & poor performance of constructors and lastly the increase of equipment cost.

TABLE OF CONTENTS

LIST OF FIGURE

LIST OF TABLE

CHAPTER I

INTRODUCTION

1.1. Project Background

Malaysia is an arising economy country in south-east Asia which has had one of the best economic records in the region with its adjusted Gross Domestic Product (GDP) in year 2010 is US$ 230 billion (The World Bank). This number is believed to be significantly supported by the export trading of the country's one of most valuable natural resources, petroleum.

Mehden & Troner (2007) emphasize that the national oil company of Malaysia, *Petroliam Nasional*, or as it is renowned called Petronas, has been an essential supporter to the country national revenue by means of the tax system. It is approximated that 20% of the total Malaysia government revenue in recent years has occurred from petroleum, ultimately from the Petroleum Income Tax (PITA). Petroleum and its products (e.g. Liquefied Petroleum Gas or LPG, gasoline or petrol, fertilizers, plastics, asphalt and thousands of other products) also became Malaysia's top receiver of foreign exchange and contributed to the government revenue, most notably in the year 1983 for as much as 28% (Mehden & Troner, 2007). Due to this fact, it can fairly be said that oil and gas industry has been one of the pillars of Malaysia's economy.

Petronas, who has wide range of operations from upstream to downstream at its home country and abroad is vested with the entire ownership and control of the petroleum resources in Malaysia and has numbers of construction project in doing their business operation. The projects of which may broadly vary from the fabrication of offshore platform and oil rig at the Malay Peninsula in the west part of Malaysia to the development of petrochemical plant at Sabah in the eastern part of the country.

Yanting & Liyun (2011) in their writing point out that in accordance with the theory of Risk Management, projects in petroleum operation generally are exhibited to risks

of natural environment, engineering, management, and economic. These risks are unexceptionally also experienced by Petronas who shall manage them accordingly with their own actual situation, so that they may continue to govern the use of company's finance efficiently hence the industrial resource of natural oil and gas in Malaysia can be fully utilized for the benefits of both company and country.

1.2. Problem Statement

1.2.1. Problem Identification

There is a growing critical sense in term of managing the variation of important projects in oil and gas industry nowadays. Not only due to the facts that petroleum business requires huge investment, long period and high risk operations, but also following of the global economy and corporate revenue descending condition, stakeholders are calling for enhanced risk management, Return on Investment (ROI) and more considerable transparency (Ernst & Young, 2011).

In Malaysia, the participation of foreign partner companies in the country's petroleum industry is believed to make the related projects, including construction, suffer from risks such as differences in practices between domestic and foreign partners, policy and political risks, financial risks, legal and political risks. Furthermore, Petronas' progress to achieve their vision to be a Leading Oil and Gas Multinational of Choice may be decelerated by lack of effectiveness in the risk management system implemented particularly in their construction projects. Regarding the above issues, petroleum industry construction projects in Malaysia sit on lots of risk that may lead to counter-productive impacts on project implementation. Therefore, an improved risk management system is potentially needed by project management of Petronas group of companies.

The importance of risk management as described by Nielsen (2006) in his study, is it has the ability to identify risks and apply improved project management approaches which having a purpose of improving the company's achievement in the project's goals.

1.2.2. Project Significance

As petroleum and its derivatives are one of the country's main pillars industry, and Petronas as the highest authority of the business, Malaysia and Petronas have a bond

that affecting one another. By conducting the project, it is hoped that the problems with respect to the risk management system presence in the body of Petronas and its company partners can be identified and discussed. The possible solutions are also provided for Petronas and its partner companies to take and implement in their business and consequently to improve their business performance with the ultimate goal is to actualize its vision as well as more positively contribute to Malaysia's economy.

Although there have been several risk-management-studies conducted on managing the project's risks prior to this research, risk factors are diverse depends on industry and countries. Therefore this research of "Risk Management in Petroleum Industry Construction Projects in Malaysia" is unmatched and in fact has huge importance for effective project management.

1.3. Objective

This research is mainly focused on two (2) objectives, as follow:

1. To determine the foremost risk factors concerning construction projects in petroleum industry in country Malaysia; and
2. To recommend possibly applicable and beneficial strategies to effectively minimize, monitor, control and alleviate the likelihood or impact of undesired events in doing the business.

1.4. Scope of Study

This study mainly focuses on risk management implemented in construction projects owned by Petronas in Malaysia. Inside the project contents are including risks identification followed by its frequency level of occurrence and ranks by distributing questionnaires to some respondents working on PETRONAS' projects in Malaysia to obtain the data needed.

The questionnaires are prepared to gather data from about 21 respondents voluntarily who are willing to contribute in this study. The target population for this study is people involved in Petronas' construction projects in Malaysia in the upstream and downstream businesses. Target respondent in the upstream business is Petronas Carigali Sdn Bhd, whereas target respondent in downstream business are contractors APEX Energy Sdn Bhd and PT Rekayasa Industri (Rekind). APEX from Malaysia

and Rekind from Indonesia are part of the consortium contractor for Sabah Ammonia Urea (SAMUR) project which was awarded by Petronas Chemicals Group Berhad's (PCG) to perform basic & detail Engineering, Procurement, Construction and Commissioning contract (EPCC).

Accordance with the objectives, the literature and the research hypotheses, two types of questions are developed in the questionnaire. They are multiple choice questions and open-essay questions which were distributed to project managers, functional managers and also project team members. In addition, interviews to certain level of managements were conducted for further analysis.

1.5. Companies Background

1.5.1. Petronas Carigali Sdn Bhd

Petronas Carigali Sdn Bhd (PCSB) is a Petronas' handful subsidiary for its Exploration & Production (E&P) activities in the upstream business. It has developed capability as a hands-on operator with a track record of successful oil and gas developments. Petronas Carigali works alongside a number of petroleum multinational corporations through Production Sharing Contracts (PSC) to explore, develop and produce oil and gas in Malaysia. Not only at home but also abroad, Petronas continue to strengthen its position by securing new acreages while undertaking various development projects.

Figure 1: Petronas Carigali Logo

The Petroleum Management Unit of Petronas acts as resource owner and manager of Malaysia's domestic oil and gas assets. It manages the optimal exploitation of hydrocarbon resources and enhances the prospectivity of domestic acreages to attract investment and protect the national interest. One of the key drivers of its business growth is deepwater E&P, with many positive prospects emerging in Malaysian acreages.

1.5.2. APEX Energy Sdn Bhd

Apex Energy Sdn Bhd is a sister company of a reputable engineering and construction contracting company APEX, that undertakes the oil and gas (petroleum) industry projects, and offshore installation and plant maintenance services. From project management to procurement, construction and after-care services, APEX Energy Sdn Bhd covers full support works for clients in the oil and gas, petrochemical, marine and other industrial sectors.

Figure 2: Apex Energy Logo

Supported by its very own fabrication yards in Kemamam, Terengganu, and Lumut, Perak, APEX has the facilities to carry out fabrication of heavy offshore structures, including topside production facilities. The company's services are streamlined into several key activities including oil and gas projects, maintenance services and product trading & supplies.

1.5.3. PT. Rekayasa Industri

PT Rekayasa Industri (Rekind) was established by the Government of the Republic of Indonesia to develop Indonesia's national capabilities in engineering, procurement, construction and commissioning (EPCC) for large industrial plant into a world-class capability. The company is today one of the foremost EPCC companies in Indonesia and starting to broaden its network to projects abroad. The company's scope of EPCC business includes: Gas, Geothermal, Refinery, Petrochemical, Mineral, Environmental, and Infrastructure. In addition, the company also provides services for Project/Plant Feasibility Studies and Plant Maintenance.

Figure 3: Rekayasa Industri Logo

1.6. Case Study Background of Downstream Business: SAMUR Project

1.6.1. Project General Information

Project Name:	Sabah Ammonia Urea (SAMUR)
Location:	Sungai Mengalong Reserve Land, Sipitang, Sabah, Malaysia.
Project status:	On-going Project
Project Cost:	
• Target cost	USD 394,584,652.86
• Lump sum cost	USD 108,740,549.29
Month start:	August 2011
Month finish:	November 2014
Schedule:	
• MC	End month 33
• PA	End month 36 + Grace period 3 months
Letter of award to Rekind/APEX:	1 October 2011
Effective date:	1 October 2011
Contract signing & ceremony :	6 October 2011 in Sabah

Table 1: SAMUR Project Brief (General Information)

1.6.2. Contract Formation

Owner:	**Petroliam Nasional (Petronas) through Petronas Chemicals Group Bhd (PCG)**
Company:	Petronas Chemicals Fertiliser Sabah Sdn Bhd
Consortium Contractor:	• Mitsubishi Heavy Industries, LTD (MHI), • APEX Energy Sdn Bhd (APEX) and • PT. Rekayasa Industri (Rekind)

Table 2: SAMUR Project Contract Formation

1.6.3. Scope of Works

Scope of works: Rekind/APEX Lump-sum

Engineering	Engineering services for equipment package Rekind/APEX's scope of supply
Procurement	Procurement services for equipment package Rekind/APEX's scope of supply
	Inland transport nad custom (services only)
	Regulatory approval (EIA/EPD, development plan, etc)
Construction	Construction services

Table 3: SAMUR Project Lump-Sum Work Scope

Scope of works: Rekind/APEX Target cost

Procurement	EDG
	Cooling tower
	BUSH package
	KD tank
	WWTP
	Raw water & demin unit
Construction	Site preparation
	All construction work

Table 4: SAMUR Project Target Cost Work Scope

1.6.4. Risk Identification

Sitorus (2011) in his report presentation for PT. Rekayasa Industri (Rekind), highlights the followings identified risks and problems occurring on the SAMUR project at time to date, as follow:

No.	Risk Registered by Rekind
1.	WHT & stamp duty, service tax, levy for CIDB, PIT for Non Malaysian
2.	RW and NG supplied month 30
3.	Labor shortage in Sabah due to many projects being run
4.	Join team with APEX
5.	L/D
6.	Loss and over budget for target cost
7.	Schedule delay in site preparation
8.	Custom and clearance in KK
9.	Inexperienced subcontractor
10.	Sabah state regulatory for RA
11.	Collateral for LC
12.	Review and approval for engineering and purchasing/subcontract document in Yokohama

Table 5: Risk Registered by PT. Rekayasa Industri

No.	Problems of Rekind in Undergoing the Project
1.	Working permit in Sabah/KL
2.	Detail scope of work between APEX and Rekind is not clear yet
3.	APEX's assigned engineer and involvement
4.	Target cost submitted was discounted → Most potential over budget → Rekind liability
5.	Team building for employees from different companies

Table 6: PT. Rekayasa Industri's Problems in the Project

1.6.5. SAMUR Project Activities in Pictures

Figure 4: Top Soil Removal

Figure 5: Gate Installation

Figure 6: Retention Pond Development

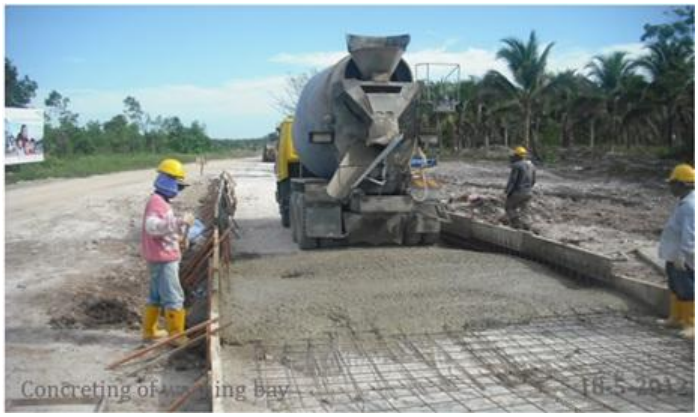

Figure 7: Concreting Activities

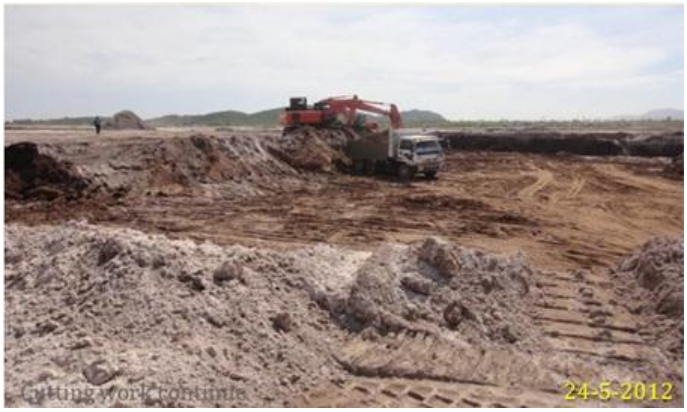

Figure 8: Cutting Work Activities

Figure 9: Filling Work Activities

CHAPTER II

LITERATURE REVIEW

2.1. Risk Management in Petroleum Industry Overview

Yanting & Liyun (2011) say that risk management has a definition of a scientific approach in managing risks done by identifying measuring and analyzing them to effectively attain highest security at lowest cost. Globally, risk management has been utilized as a vital component in many petroleum companies nowadays due to the facts that the business enterprise management of the industry has been attempting to minimize more the occurrence of the risk factors. The development of risk management and analysis/evaluation towards oil enterprises takes place up to present which developed from the fusion of its theory and practice.

2.1.1. Risk Analysis

Dissimilar with the risk in investment, petroleum operation risk is classified into several categories developed from the risk management theory and petroleum operation's characteristics (Yanting & Liyun, 2011). The brief analysis of which include:

1. Natural environment risk:
    a. *Climatic risk*:

        Different climates or weather have been found affecting the operations of petroleum industry. For instance during a snowing or raining season, borehole operation will have higher risk. Subsequently there is also higher risk of heat stroke faced in very hot weather.

    b. *Geologic risk*:

        The petroleum operation processes are also subjected risks related to geological conditions. Among them are the petroleum pool's structure and complexity, reserves and abundance, the nature, burial depth.

2. Engineering risk:
    a. *Exploration risk:*

       Within this type of risks are including improper use of exploration methods, inaccurate interpretation of seismic data and inaccurate positioning of the exploration wells in the exploration process.

    b. *Development risk:*

       In the process of project development, risks may due to inappropriate mining method, delay in progress, engineering design changes and technical problems. For example, due to incorrect understanding of the stratum, casing damage, formation pressure too high, lack of well control awareness the security will subject to high risks.

    c. *Construction risk:*

       Due to shortage of technical components, unmatched equipment and extended construction period during the process of construction a project may subject to construction risk.

3. Management risk:
    a. *Human resource risk:*

       Related to social relationship, the operational level, cultural level, age composition of employees and the overall quality, management ability, leadership and charisma of managers are among the factors that affect petroleum operations.

    b. *Organization risk:*

       This type of risk is occurring when there is presence of unreasonable organizational mechanisms, inappropriate staffing, and irrational allocation of responsibilities. Due to these, different understanding, attitudes and actions of the sectors of the petroleum operations may also occur and contribute to cause further disadvantages.

    c. *Operating equipment risk:*

       To enhance the products of running oil wells, management of this operating equipment risk is necessary. This is because it immediately affects the progress of the petroleum operations in the process of oil and gas exploration and development.

d. *Dispute risk:*

In case of farmer's fields surround oil wells are presence, there are risks related to argument between the company and the farmers. This involves a number of compensation expenses, and may affect the progress of the well construction and further risk to economic losses.

e. *Environmental protection risk:*

Petroleum operations pollute the environment, so petroleum enterprise must comply with relevant environmental regulations and policies, and invest some money to treatment. If the petroleum enterprise creates environmental pollution because of its failure to take treating measures, it will be fined or even be ordered to suspend work, and petroleum operations will face the risk.

4. Economic risk:

a. *Financial risk:*

The uncertainties such as financing, fund turnover, interest and exchange rate in the course of petroleum operations are among the factors classified into economic risks. This is due to its nature that petroleum business has a long cycle, wide geographical distribution, needs a large number of employees and a large amount of funds.

b. *Market risk:*

Uncertain market factors such as rising material and fuel prices leads to higher needed costs, and further causing a decreased effectiveness of the petroleum operations.

c. *Economic policy risk:*

Various taxes applied in different countries are important method for them to control petroleum production, supply and demand, and directly affect the profit gained by the companies related to it. Moreover, petroleum enterprise also undertakes implicit taxes including the coordination costs of workers and peasants, river maintenance costs, road bridge compensation, comprehensive management costs, security guard costs, build projects and direct losses of stolen oil, gas and water.

2.1.2. Strategies and Measure

Risk management is a quickly improving knowledge and there are numbers of different view as well as description of what risk management involves, how it should be implemented and what it is for. According to (Yanting & Liyun, 2011), there are some strategies to manage the mentioned risks as a favour to oil company to achieve more efficiency in doing their construction projects, they are including:

1. Risk awareness:
    a. *Sense of crisis:*

        With sense of crisis toward the risk awareness, employees may analyse the various risks faced, and take a proactive approach to resolve risk and control it at the early stages.

    b. *Safety habits:*

        Human error or illegal operation is the main cause of safety issue problems in any projects. Hence there is a need for petroleum enterprise to enhance the awareness of employees regarding this matter. To improve their safety habits, first petroleum enterprise should use various methods to improve their safety knowledge such as providing safety related posters, quiz contests, and technical competition.
2. Fine management:
    a. *Quality control system:*

        To emphasize respective employees' responsibilities and strictly control all aspects, a firm quality assurance system and quality responsibility system are needed. Petroleum companies should strengthen their quality accident management, pay attention to the report, investigation and treatment of the accident and analyze the mass loss in time to minimize accidents to happen.

    b. *Safety supervising and managing system:*

        Besides supervisory and inspection of job site safety must be strengthened, petroleum enterprise should also improve the system of penalty for violation of safety regulation to make a clear definition of various types of acts in violation of regulations. In managing system,

there must be clarity in term of organizational hierarchy to avoid clash of interest and authorization.

3. Core technology:

   The best indicator of core competitiveness between different companies in the same business may be differentiated in possession of technology used. Moreover by focusing on market needs, and continue to carry out technical innovation, petroleum companies may as well mitigate the impact of risk occur in their projects.

4. Highly qualified personnel:

   The development of a petroleum company is relevant to whether they own man power capable enough to control the commanding heights of the industry. In term of personnel mechanism, a petroleum company has to develop their human resources planning to use pioneering personnel. While at the same time they have to retain talented staff by focusing on staff training.

2.1.3. Discussion

In context of industry comparison, risk factors in petroleum business are more complex and larger in term of numbers compare to any other industry. The facts that this business requires big capital as well as long term planning are very true hence it makes petroleum industry subjects to bigger economic risks. In addition, the contribution of various global foreign companies in a single project forces the oil and gas enterprise to be more aware of risks related to human resource and organizational management. Finally, the factors including its harsh conditions and engineering difficulties in extracting this natural resources from underneath the earth's surface, create petroleum industry has to manage the risks occurring if they want to survive.

Even though petroleum operations results very complex risks, the companies involved can control those risks by identifying their causes, characteristics and nature, to some extent so that it can be prevented. By developing risk awareness such as sense of crisis and safety habit among the employees, as well as improving the company's quality control, safety supervising and management system, petroleum companies may manage such risks to be more efficient in their construction projects. Other strategies such as focusing on core technology improvement and highly qualified people to be hired are also some of other efforts for petroleum companies to maximize their performance.

Yanting & Liyun (2011) are very definite: "Risk management is not entirely a method to eliminate all the risks. Instead, it is a way only to reduce considerable amount of risk loss by preventing and controlling risks. Risk management also may provide compensation for the risks to make more social resources and funds reasonably flow to the desired sectors". (p.2334)

2.2. The Importance of Risk Management

Oil and gas construction projects stretches from the development of pipelines and oil refinery in upstream activity, until the construction of petroleum retail station in downstream activity. Not only has large investment, but also petroleum operation has long period and high risk, which determine risk management is required for to be implemented in this industry. The significance of risk management both globally and in Malaysia's national industry are discussed in this section.

2.2.1. In Global Pipelines Project

Nielsen (2006) indicates that all the parties related to the project execution want to be ensured achieving its commercial and professional goals. Due to that, there is a growing need of risk management techniques to be applied globally in today's project management bodies of knowledge to minimize negative consequences in pipeline constructions. The risk management application is so important mainly because of its ability to identify risks and apply enhanced project management methods for the purpose of improving the company's achievement in the project's goals.

Nielsen (2006) conducts study in 6 continents around the world, and shows that risk management is a fundamental practice to identify and create input to fulfil all the needs throughout the stages of a pipeline project's life. The stages are described as from the early stage of concept and feasibility study, to execution and operations stages, until its sustainable recycling process. Although risk management is equally important to be applied in any stages of the project, the difference of its nature make specific risk management must be developed for each stage.

Despite more and more project management standards are being generated and applied, yet engagement of risk management in pipeline projects is not concentrated on the wide range of its risk factors (Nielsen, 2006). Therefore there is a lot of room

to be improved in term of specification of region or company in developing risk management standards.

2.2.2. In Malaysia's Petroleum Operation

Yusuwan, Adnan & Omar (2008) specifies that construction industry in Malaysia is one of the country's significant contributors to its economy growth with activities are including specific civil engineering projects of petroleum industry such as pipelines and oil refinery. This sole fact is representative enough to show how important the efficiency is in performing the construction projects in Malaysia's oil and gas industry.

Moreover, there are numbers of journal and research showing high level of awareness among organizations toward the risk management and believe that risks can affect productivity, performance, quality and the project budget. The construction industry in Malaysia is among those industries with the most subjected to diverse risks (Yusuwan, Adnan & Omar, 2008). These risks may affect negatively on the productivity, performance, quality and the budget of the project. As a result, for the sake of certifying the successful of the project, it is desired to have an accurate and well-ordered risk management strategy in place. Subsequently, a risk management is also hoped to be performed with certain characteristics in order to manage the risk factors in the most efficient manner.

2.3. Petronas as Main Stakeholder in Malaysia

2.3.1. Company Overview

Malaysian National Oil Company, Petronas (stands for *Petroliam Nasional* in Bahasa Melayu), is the wholly owned by Malaysian government given the highest authority for the entire of petroleum resources in Malaysia through the Petroleum Development Act 1974. The company is the controlling body in performing exploration, development, refining, marketing and distribution of petroleum and its products in the country. (Chua & Oh, 2010)

Mehden & Troner (2007) mentions in their study that within only about 30 years plus since it was founded in 1974, Petronas has entered into overseas operations in some 35 countries, became a powerful player in global oil and gas shipping business, and financially helped a set of mega projects in Malaysia.

Although it is 100% state owned, Petronas is considered as a well-run company and free from corruption. Petronas is a business entity with orientation of profit as their prime objective. The company has been free from Malaysia's government interference in its daily business but has significantly supported government-sponsored mega projects outside its interest such as Twin Towers and Putrajaya (Mehden & Troner, 2007).

2.3.2. The Relation of Petronas to the Malaysian Economy

Started as the huge exporter of tin and manufacturing products, Malaysia has now became a country which its petroleum resources have continued to bring healthy income to its economy since the era of late 1970s and 1980s. Not only that, study conducted by Mehden & Troner (2007) indicates that Petronas as the main stakeholder petroleum resource in the country is also contributing through the income tax payment system until 20% of all total of the government's revenue.

Petronas is doing both exploration and production business inside the country and overseas. With its corporate strategy being to maximize returns for the Malaysia's government as shareholders, Petronas has a willingness to become an overseas investor both in upstream and downstream sectors and also promoting the foreign investments to come to Malaysia. Besides that, Petronas is also trying to give advantage to local demand by providing a long-term activity involving Malaysia, the host countries and other firms (Mehden & Troner, 2007).

2.3.3. Petronas and Risk Management

As one of the key players in the country's energy development, Petronas' actions in managing risks exposed to their business have been becoming really essential not only to its own business performance, but also Malaysia's economy growth.

Mehden & Troner (2007) also draw attention to the time during Asian Energy Forum in 2005, when the Vice President of Petronas insisted that it is vital for Petronas to have good partners for several reasons including risk mitigation. According to him, although risks cannot be totally eliminated, mitigating risks still requires highly credible partners to spread financial risk and attract other financial institutions.

CHAPTER III

METHODOLOGY

3.1. Project Activities

There are several activities comprising six (6) main activities in performing this project, they are as follow:

1. Background study: analyse previous related journals
2. Develop questionnaires for respondents
3. Collect primary and secondary data
4. Analyse the data obtained from the respondents
5. Write recommendation and project report towards the data finding
6. Final Year Project (FYP) final report writing

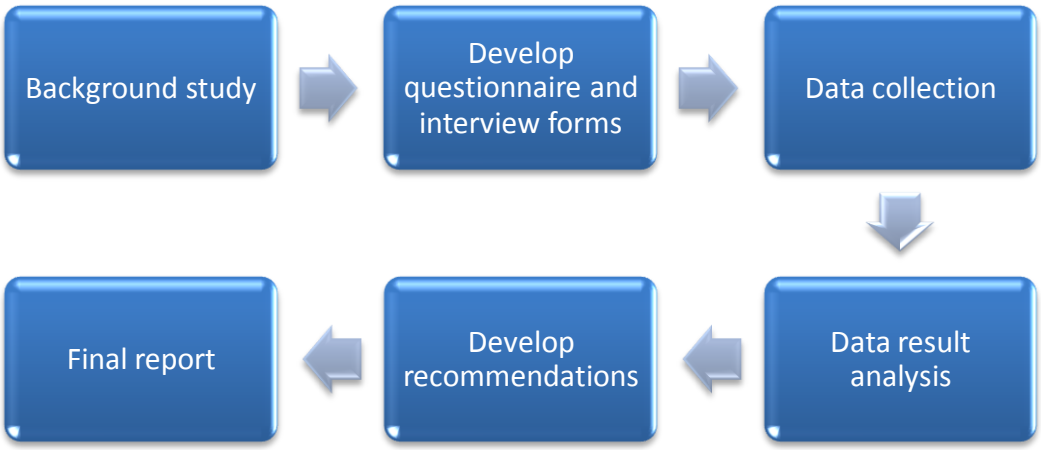

Figure 10: Methodology

3.2. Tool Required

In performing this study, the tools needed to acquire data are questionnaire form, online survey form and interview questions based on results.

3.2.1. Questionnaire Form

QUESTIONNAIRE

"RISK MANAGEMENT
IN PETROLEUM INDUSTRY CONSTRUCTION PROJECTS IN MALAYSIA"

Objectives:

1. To highlight the major risk factors mostly occur in performing construction projects in petroleum industry in Malaysia.
2. To suggest some of the possible approach in risk management for the Malaysian oil & gas industry in general and Petronas in particular.

Instructions:

1. Please fill in the space available and tick (✓) in the respective box.
2. All information will be treated as CONFIDENTIAL and shall be used for academic purposes only.
3. All the data information will be on aggregated basis and no individual data will be published.
4. Please be considerate and honest in answering each question.

SECTION A: DETAILS OF THE RESPONDENT

Instruction: Please write or place a tick (✓) at the space/box provided below

1. Name: ……

2. Gender: [1] Male [2] Female

3. Age (years old): [1] 25-30 [2] 31-35 [3] 36-40 [4] 41-45 [5] 46-50 [6] Over 50

4. Working duration in the current company: [1] Less than 10 years [2] 10 years or more

5. Job position: [1] Management [2] Project team members [3] Others (*specify*: ……..)

6. Highest education: [1] Bachelor [2] Master [3] Doctor

7. Major field of study: [1] Industrial & Civil Engineering [2] Mechanics [3] Petroleum Engineering [4] Geology [5] Business Administration [6] Petrochemistry [7] Finance & Accounting [8] Management System [9] Others (*specify*: …….....…….……)

SECTION B: LIKELIHOOD OF RISK FACTORS TO OCCUR

Instruction: <u>Based on your experience undergoing projects in your current company</u>, please indicate the Frequency Level of Occurrence of respective risk factor to the statements below by ticking (✓) at the provided box.

Never (N)	Rarely (R)	Sometimes (S)	Often (O)	Very Often (VO)
1	2	3	4	5

I. Natural Environment Risks

		N	R	S	O	VO
No.	**Risk Factor**	**1**	**2**	**3**	**4**	**5**
1.	Unusual weather (flood, earthquake, etc)					
2.	Dispute with residents around site					
3.	Lack of coordination among public agencies concerned					
4.	Damage to work by third party					
5.	Environmental protection pressure of other groups					

II. Governmental and Policy Risks

		N	R	S	O	VO
No.	**Risk Factor**	**1**	**2**	**3**	**4**	**5**
6.	Changes of policies					
7.	Government interference					
8.	Corruption and bribery					
9.	Bureaucratic government system and long project approval procedure					
10.	Lack of cooperation from government					
11.	Change in laws and regulations					
12.	Insufficient laws on projects					
13.	Inefficiency of legal process					

III. Project Management and Engineering Risks

		N	R	S	O	VO
No.	**Risk Factor**	**1**	**2**	**3**	**4**	**5**
14.	Inadequate tendering process					
15.	Delay in signing contract					
16.	Ambiguous conditions of contract					
17.	Poor design					
18.	Design changes					
19.	Improper project feasibility study					
20.	Improper project planning and budgeting					
21.	Improper selection of project location					
22.	Inadequate project organization structure					
23.	Incompetence of project team					
24.	Inadequate coordination among contractors					
25.	Late internal approval process from the owner					
26.	Lack of knowledge and experience on construction					
27.	Inadequate tendering price					
28.	Inefficient and poor performance of constructors					

IV. Economic Risks

		N	R	S	O	VO
No.	**Risk Factor**	**1**	**2**	**3**	**4**	**5**
29.	Exchange rate changes					
30.	Interest rate fluctuation					
31.	Increase of tax rate					
32.	Increase of labor cost					
33.	Increase of material cost					
34.	Increase of equipment cost					
35.	Increase of resettlement cost					
36.	Economic and financial crisis					
37.	Low credibility of lenders					

SECTION C: CURRENT PRACTICE OF RISK MANAGEMENT

Instruction: Please specify your answers at the space provided below.

1. How does your company manage/handle the risk factors as mentioned?

……

……

……

……

……

……

2. What do you think about the current practice of risk management in your company?

……

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……

3. How to improve the efficiency in doing construction projects in your company?

……

……

……

……

……

……

-End of questionnaire-

3.3. Data Collection

Data used for this study is classified into primary and secondary data. While the primary data is acquired by questionnaires, online survey and possible casual interviews with certain people in management level, secondary data is collected from resources such as journals, previous paperwork and thesis.

3.3.1. Primary Data

Obtained from extant literatures, a list of risk factors was prepared and given to the 21 respondents. There are three (3) sections in the questionnaire, as follow:

1. **Section A** consists of details of the respondent.
2. **Section B** multiple choice questions focus on possibility or likelihood of stated risk factors to occur during the construction projects of the company judged by the respective respondent.
3. **Section C** open-essay (interview) questions to get the respondents opinion about the current practice of risk management being implemented at the company.

In-depth interviews are conducted with selected respondent of the questionnaires. In order to collect data by direct interview, firstly list of more analytical and focused questions are to be developed. A digital voice recorder is to be used to maintain the accuracy of the interview results.

3.3.2. Secondary Data

Some of journals, paperwork and thesis related to this study are looked up as reference. Those materials are largely obtained from UTP's Information Resource Centre (IRC), library and e-Resources. Besides that, the SAMUR project's general information from PT. Rekayasa Industri are also obtained for the use of this research.

3.4. Data Analysis Method

In order to determine the main risks in construction projects in the company, a qualitative measurement or ranking system is used in the analysis of this study. From the reasoning answers obtained from the respondents, a value of Average Index will be obtained by using the rating for the questionnaire, as follow:

1 – Never; 2 – Rarely; 3 – Sometimes; 4 – Often; 5 – Very Often.

The Average Index Formula:

$$\textbf{Average Index (AI)} = \sum (ß \times n)/N$$

Where, ß is weighing given to each risk factor by respondents

n is the frequency of the respondents

N is the total number of respondents

With the rating scale (Majid & McCaffer, 1997), as shown below:

- 1 = Never/Strongly disagree (1.00 < Average Index < 1.50)
- 2 = Rarely/disagree (1.50 < Average Index < 2.50)
- 3 = Sometimes/Neutral (2.50 < Average Index < 3.50)
- 4 = Often/agree (3.50 < Average Index < 4.50)
- 5 = Very often/strongly agree (4.50 < Average Index < 5.00)

The risk factor with highest Average Index score means that risk is the most often to occur in Petronas' construction projects. Subsequently, the lower Average Index score indicates that the risk factors are less often to happen.

3.5. Reporting

The report is to include the analysis on data obtained by classifying the risk factors into group of the "top five" from the rank resulted from the survey performed. Further discussion towards these top five risk factors with the possible strategies to manage them are also comprised in this report.

3.6. Gantt Chart

No	Activity	Time (Year 2012)								
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
1.	Title selection									
2.	Literature review									
3.	Develop questionnaire									
4.	Respondent confirmation									
5.	Extended proposal									
6.	Viva/Project defence									
7.	Draft final report				FYP1				FYP2	
8.	Final report				FYP1				FYP2	
9.	Data Collection									
10.	Data result analysis									
11.	Progress report									
12.	Viva final									End

* = **Key Milestone**

3.7. Key Milestone

No	Activity	FYP	Date (Week)
1.	Topic selected	1	26 January 2012 (Week 1)
2.	Extended proposal submission		29 February 2012 (Week 6)
3.	Proposal defence presentation (Viva)		21 March 2012 (Week 9)
4.	Literature review studies and questionnaire development done		11 April 2012 (Week 12)
5.	Draft of final report submission		18 April 2012 (Week 13)
6.	final report submission		25 April 2012 (Week 14)
7.	Questionnaire distribution and interview done	2	30 May 2012 (Week 2)
8.	Result analysis done		27 June 2012 (Week 6)
9.	Progress report done		11 July 2012 (Week 8)
10.	Draft of final report submission		8 August 2012 (Week 12)
11.	final report submission		15 August 2012 (Week 13)

CHAPTER IV

RESULTS AND DISCUSSION

4.1. Data Gathering

4.1.1. Survey on Petronas Carigali Sdn Bhd (PCSB)

Study was performed towards upstream business practitioners with a total of thirteen (13) respondents, who are currently working in various departments of Petronas Carigali Sdn Bhd, including Risk Management Department. The number 1 risk factors according to the survey are Risk Factor, RF-18 "Design Change" and RF-28 "Inefficient and poor performance of constructors". Whereas the rest of top 5 most occurring risk factors are as follow:

Rank	Risk Factors	Average Index
1.	Design changes (Risk Factor, RF-18)	3.615
	Inefficient and poor performance of constructors **(RF-28)**	
2.	Late internal approval process from the owner (RF-25)	3.538
3.	Delay in signing contract (RF-15)	3.461
4.	Inadequate coordination among contractors (RF-24)	3.385
	Bureaucratic government system and long project approval procedure (RF-9)	
5.	Increase of equipment cost (RF-34)	3.308

Table 7: Survey on Petronas Carigali Sdn Bhd

4.1.2. Survey on SAMUR Project's Consortium Contractor

Study was also performed towards downstream business practitioners with a total of eight (8) respondents from APEX Energy Sdn Bhd and PT. Rekayasa Industri (Rekind) which result the number 1 risk factor is RF-9 "Bureaucratic government system and long project approval procedure". Whereas the rest of top-five risk factors are as shown below.

Rank	Risk Factors	Average Index
1.	Bureaucratic government system and long project approval procedure **(Risk Factor, RF-9)**	3.875
2.	Late internal approval process from the owner (RF-25)	3.50
3.	Design changes (RF-18)	3.375
4.	Delay in signing contract (RF-15)	3.125
	Improper project feasibility study (RF-19)	
	Inadequate coordination among contractors (RF-24)	
	Increase of equipment cost (RF-34)	
5.	Government interference (RF-7)	3.00
	Improper project planning and budgeting (RF-20)	
	Inadequate project organization structure (RF-22)	
	Increase of labor cost (RF-32)	
	Increase of material cost (RF-33)	
	Increase of resettlement cost (RF-35)	

Table 8: Survey on SAMUR Project's Consortium Contractor

4.1.3. Survey Summary (Combined Results)

Total number of respondents is twenty one (21) people comprises of thirteen (13) from Petronas Carigali Sdn Bhd and eight (8) from APEX Energy Sdn Bhd and PT. Rekayasa Industri. The result of the combined survey data is as follow:

Rank	Risk Factors	Average Index
1.	Bureaucratic government system and long project approval procedure **(Risk Factor, RF-9)**	3.571
2.	Design changes (RF-18)	3.524
	Late internal approval process from the owner (RF-25)	
3.	Delay in signing contract (RF-15)	3.333
4.	Inadequate coordination among contractors (RF-24)	3.286
	Inefficient and poor performance of constructors **(RF-28)**	
5.	Increase of equipment cost (RF-34)	3.238

Table 9: Survey Result Summary

4.2. Analysis on the Top-Five Risk Factors

As highlighted in tables above, the result in summary shows that the top-two rank of risk factors are similar with the risk factors from the upstream business alone. They are both risk factors RF-18 “Design changes” and RF-25 “Late internal approval process from the owner”. This similarity can be rationally predicted as the rank 2 and rank 3 results of downstream business are also RF-25 “Late internal approval process from the owner” and RF-18 “Design changes” respectively. This means, these risk factors are the ultimate risk that mostly occur in both upstream and downstream businesses of Petronas and petroleum industry in general in Malaysia.

As written in tables above in bold, number 1 risk factor in the upstream business is RF-28 “Poor performance of the constructors” whereas number 1 in downstream business is RF-9 “Bureaucratic government system and long project approval procedure”. These two risk factors are contributing to the combined result greatly, thus result rank 4 and rank 1 respectively.

Although the number of respondents from upstream business (13 persons) is larger than the ones from downstream business (8 persons), surprisingly the rank 1 risk factor from downstream, RF-9 “Bureaucratic government system and long project approval procedure”, is still in the number 1 of risk in the summary combined, ahead of the rank 1 risk factor from upstream, RF-28 “Poor performance of the constructors”, which is ranked 4 in the combined result. This means that the RF-9 “Bureaucratic government system and long project approval procedure” is more prone to exist in the construction projects in petroleum industry in Malaysia than any other risk factors.

In general, these surveys had recognized the risks in addition to the impact on petroleum upstream and downstream construction projects in Malaysia. Each one of risk factor from the combined result survey ought to be analyzed and specified suitable strategy for an improved project development.

The most important ideas of this writing as stated in the objective are the top-five risks. These top-five of most often occurring risks on the projects in Malaysia according to the respondents of the survey will be analyzed in depth in the next paragraphs. Analysis will be performed with the aim of formulating proper and useful strategies to lessen the occurrence and effectively minimize the impact of each

risk factor. Another analysis is also done to discover the causes based on characteristics in relation to the project situation in Malaysia.

4.2.1. Bureaucratic Government System and Long Project Approval Procedure (Risk Factor, RF-9)

With the average index score of 3.571, the risk which is most likely to occur in construction projects in petroleum industry in Malaysia is "Bureaucratic government system and long project approval procedure". Long bureaucracy in performing any project could invite bribes and corruptions to come from any individuals or groups who desire to speed up the procedures or their applications. Not only can this reduce the effectiveness of a company in term of budget (because they have to provide extra money in order to achieve their target within time frame), this also can be vital for the country Malaysia itself if they are to build good image of the country which is "corruption free" in attracting the infestation.

According to the interviewed engineer, who is working on SAMUR project from PT. Rekayasa Industri (Rekind), some possible mitigating strategies are suggested to be applied by the company and also Petronas. From the perspective of Petronas' partner, the probable approaches are including demanding the Malaysian government for reformation in administration procedure, to develop good relationship with the government as well as environment authority and lastly to be familiar with the system by understanding the laws and regulations.

Whereas for the Malaysian government, the possible strategies that can be applied are including to form a working team which is aimed at cutting down bureaucracy and enhancing the quality of the delivery of public services to attract investments. This team has jobs to identify measures of improving procedures, rules and current laws and formulate an easier way for the companies to conduct their businesses in Malaysia according to the statement.

4.2.2. Design Changes (RF-18)

With average index score 3.524, "Design changes" risk factor is ranked 2 in term of likeliness of occurrence. Change or modification is always an expected component of any project's design and construction. There is no assurance for a project will be free from experiencing significance changes, not even the best well-designed plans or most detailed contract agreement. This risk of design changes is badly affecting the

project to an extent of delay in schedule and over budget cost. Moreover huge complex projects such as the construction projects in petroleum industry, are subjected to more risk of design changes due to different policies from the involvement of multi-national companies.

One of the ways that could reduce the impact as mentioned above is by implying the function of a Configuration Management (CM) methodology at the project stages of planning, designing, constructing, maintenance and operating (Steinberg & Otero, 2008). In their writing, Steinberg & Otero (2008) mentions that according to the American National Standards Institute, Configuration Management is "A process of organization for setting up and preserving steadiness of a product's performance, functional, and physical characteristics with its necessities, design, and functioning information during its life span". By applying so, it is expected that the partner company (e.g. contractor, consultant, etc) may generate more profit from the works and at the same time satisfying their client, thus can have a more successful project.

4.2.3. Late Internal Approval Process from the Owner (RF-25)

Together with "Design changes", the risk factor of "Late internal approval process from the owner" share the average index score of 3.524 and place rank 2 in the most often risk factor to occur in the industry. This risk is coming from the problems within the organization itself, thus it is considered an internal risk. It occurs either when the people who are drawn in the project are not giving enough dedication or when the manager of the project is structurally powerless in solving the problem or in other words he/she doesn't have the authority to do so but has to report to higher manager instead (Thuyet, Ogunlama, & Dey, 2007).

In their writing also, Thuyet, Ogunlama & Dey (2007) suggest possible mitigation strategies which include enhancing the manager's of the project empowerment. According to Egeland (2011) in his article, empowered teams are better than the ones which disempowered in term of effectiveness. An empowered team is more united in which the process of conclusion creation is moved downwards to the personnel, staff, or any division which management level is ranked lower, to allow them to employ more efficiently and openly their talent. A team which has been empowered will take more responsibility for the produced outcomes. Furthermore, in empowerment the

team may distribute the weight of the project's responsibility with the project leader as well (Egeland, 2011).

In the implementation of empowerment strategy, the project managers of Petronas' projects are advised to be aligned with the company's management objective and believe. Based on understanding, management's confidence and managers' reliability decisions can be more quickly decided thus any delay or late in approval process can be minimized.

4.2.4. Delay in Signing Contract (RF-15)

In rank 3 with average index score 3.333 there is risk of "Delay in signing contract". This delay happens if the operator companies (client) change their mind and are late in ordering the instruction or approving drawings. The fact that this risk is due to the client, does not make the contractor is unable to prevent it to happen. Coordination with client is necessary to at least try preventing this risk to take place. Furthermore there is always a possibility to reduce the impact affected by the risk upon occurring.

As mentioned, one of the reasons that this risk may occur is due to the design changes by client. A way to possibly prevent this to happen is by setting "Freeze Time" of design changes at a certain point to allow for procurement lead times, approvals. This fixed deadline allows the contractor to catch the target on-time. For instance, contractor of an oil rig fabrication has to finish their works on a certain date, and then there is a "Point of No More Changes" when upon the reaching of this point of time, client (e.g. Petronas) has to obey the agreement and not allowed or not advisable to issue more changes.

Besides, in most cases of which this risk is already happened, there are potential methods could be applied to reduce the negative impact of the risk. No matter what the root of the delay is, company must try and recover their position. One method is by accelerating the company work upon the risk to happen. It shall be faster than it should be as previously planned. If an essential timeline is missed, it may not matter whose fault it is. The most important thing is still how to reach the goal of the project in term of quality, budget and time frame. Secondly, Petronas is to supervise the jobs performed by the contractors carefully. To ensure recognising and documenting the delays are also advised, to control and further study the cause of the delays and try not to repeat the same mistake in the future.

4.2.5. Inadequate Coordination among Contractors (RF-24)

The risk factor number 4 in the rank is "Inadequate coordination among contractors". With average index score 3.286, this risk factor is also prone to exist in the construction projects in petroleum industry in Malaysia. When there is lack of coordination, there will always be a communication problem behind it. Steps-forward actions are necessary to be taken by big companies like Petronas to improve coordination between their partner contractor companies in hopes of resulting more economical and effective project development.

One of the actions to minimize the risk is by carrying out a series of constructors meetings to share ideas on what's being bought and what issues are running between them that decelerate the progress of the development project. It could be done also by delivering precise input from all the division involved to escalate probability of happening. Problems such as lack of mobility, relation to client/government and others that occur along the time of performing the project are to be discussed here in the meeting. Petronas as client can also attend the events and network with the contractor's program managers and contracting officers. An enhanced effective communication among the contractors and also between the contractor and the client are hopefully achieved. In the end, by strengthening project team relation and performing more comprehensive forecast, coordination among contractors in doing a project can be sufficient and more satisfactory.

4.2.6. Inefficient and Poor Performance of Constructors (RF-28)

With the same average index score of 3.286, risk factor "Inefficient and poor performance of constructors" is also ranked 4 in the survey. Poor performance of the constructor may be due to lack of capabilities of the leader in the contractor partner companies who are directly managing the project. This problem can possibly be solved by registering the root causes to some mitigation approach performed by the client towards the organization partners.

A scheme or an initiative that possibly has ability to boost constructor performance in technical and management throughout the project development is by putting some reinforcement in Petronas to sanction outperforming contractors and reward the ones which are doing excellent works. Petronas is advised to have an authority that is able to perform take away a contract manager from constructor partner who is not

performing well. It also includes an annual review by the Petronas to put some considerations whether to keep the same contractors for the next projects.

4.2.7. Increase of Equipment Cost (RF-34)

Lastly, in number 5 of the rank and with average index score of 3.238 is the risk factor of "Increase of equipment". The price of equipment in Malaysia is considered prone to raise might not only due to world economic growth but also to higher demand of the equipments for the same project of petroleum industry in this country than any neighbouring countries. The necessary equipment's price has direct effects on the budget of project development and rehabilitation. Petronas as the project's owner, the equipment manufacturers, consulting engineers and related partner companies share strategies to diminish the risks affect created by this increasing cost of equipment. One of the strategies is including "risk-sharing techniques".

According to Odd Ystgaard vice president of Norconsult AS in Norway, the crucial objective of implementing "risk-sharing" system is to distribute risk to the group of owner/developer, contractor and supplier so that it can be easier and better measured and minimized (World, 2008). The means of mitigating this risk is by allocating the proper risk. For example if there is an increasing equipment cost allocated to the supplier, then the project owner must also subjected to the risk by paying a premium to help the supplier cover this risk.

Besides the method as mentioned above, according to one of the engineers from the survey performed, other strategies that are advised to be implemented in the body of Petronas are by performing big procurement contracts of the equipment near the beginning of the project which subject to international competition and also by estimating budgets which are able to accommodate even the most unpredictable increases. This means it is advisable for Petronas to source for better contractor, not only limited to local contractor to improve the efficiency in doing construction projects, as well as to be most cautious in providing approximate financial fees.

CHAPTER V

CONCLUSION AND RECOMMENDATION

5.1. Conclusion

From the results of surveys as presented above, it can be concluded that the most occurring risk factors in the oil & gas construction projects owned by Petronas in Malaysia from rank 1 to 5 respectively are "Bureaucratic in government system and long project approval procedure". Besides that, risks such as "Design changes", "Late internal approval process from the owner", "Delay in signing contract", "Inadequate coordination among contractors", "Inefficient and poor performance of constructors" and "Increase of equipment cost" are also occurring to be some of the highest top factors.

Besides risk types of "governmental and policy" and "economic" risks, the fact that three out of top-five risk factors are categorized under "project management and engineering risks", show that there is sense of importance to improve these sectors in construction project activities in Malaysia petroleum industry.

Some mitigation strategies have been developed to possibly be implemented by Petronas and its partner companies in the project. The strategies are built not to diminish the risk 100%, but instead it is developed to minimize the chance of its occurrence and reduce the impact resulted if problems due to such risks are experienced by Petronas and its partner companies. In summary the strategies for addressing the major project risks in petroleum industry in Malaysia, are as shown in table below.

Rank	Main Risk Factor	Strategies
1.	Bureaucratic government system and long project approval procedure (Risk Factor, RF-9)	• Reformation in the government's administration procedure; • For Petronas and its partners to develop good relationship with the government authorities; and • To be familiar with the system by understanding the laws and regulations.
2.	Design changes (RF-18)	• Utilizing a method of Configuration. Management (CM) for various project stages.
	Late internal approval process from the owner (RF-25)	• Enhancing the empowerment of Petronas' manager in its projects.
3.	Delay in signing contract (RF-15)	• Coordination with client; and • Setting "Freeze Time" of design changes at a certain point.
4.	Inadequate coordination among contractors (RF-24)	• Carrying out constructors meetings to share ideas, what issues are running between them and how to overcome those problems.
	Inefficient and poor performance of constructors (RF-28)	• Petronas to give sanction the underperformed contractors and prize to the excellent.
5.	Increase of equipment cost (RF-34)	• Implementing the "risk-sharing techniques".

Table 10: Summary of Main Risks Mitigation Strategies

5.2. Recommendation

5.2.1. Accuracy Increment in Targeting Respondents

To obtain more accurate result in the future, it is recommended to expand the target respondents' scope by having people from various company and perspective of working field or area. To achieve such, as mentioned in the project's scope of study, questionnaires are to be distributed more vastly also to Petronas Chemicals Group Bergad (PCG) and also to contractor and consultant which are partners of Petronas Carigali Sdn Bhd (PCSB). Moreover, other companies such as MLNG and Project Management Delivery of Petronas Technology & Engineering Division (T&E) are also targeted as respondents as they also represent as client of the construction project in Malaysia. In addition to make the future research more accurate, survey should be conducted towards projects which are owned by other major operator petroleum companies in Malaysia such as Shell or Exxon Mobil.

5.2.2. Deeper Analysis

Further and deeper analysis is to be done on how to mitigate the risk factor to occur. This can be done by conducting extensive interview with selected respondent who are willing to share their knowledge and experience. Besides that a more advanced and widespread research is to be conducted in the future to obtain more specific result. The fact that this research is considered "too general" can be recovered by performing potential research with the smaller and more specific scope of a currently completed project, example of such research may be entitled "Risk Management in SAMUR Project". Respondent target are the all the people who are working for the project and still have fresh memory in conducting the project. From the top management of superintendant officer and design manager until the sub-contractor workers and surveyor are all targeted as respondents for this future study.

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