



**DEVELOPING AN IDEAL PROJECT MANAGEMENT MATURITY IN OIL
AND GAS INDUSTRY IN MALAYSIA**

By

MUHAMMAD ABDUL KARIM BIN ABDULLAH GEDANG

**Thesis Submitted to the School of Graduate Studies,
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July 2023

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DEDICATION

I dedicated this thesis to my family for their support and encouragement.



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in
fulfilment of the requirement for the Degree of Doctor of Philosophy

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July 2023

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The Malaysian oil and gas industry plays a key role in the country's economic growth. To sustain its continuous production, the industry requires more innovative and aggressive development projects, particularly megaprojects that can monetize natural reserves. These projects, however, involve high risks, huge investments, and various complexities that demand effective project management to ensure successful project delivery. Unfortunately, limited project management experience among relevant human resources is hindering project delivery performance, causing project delays, contractual disputes among stakeholders, and up to 10 percent of investment wastage. Notably, oil and gas organizations' poor project delivery capability due to these issues indicates a lack of effective project management maturity (PMM) models. Existing PMM models have been unable to assist oil and gas practitioners due to their inflexibility, rigid 'one-size-fits-all' framework, and complexity for adoption in different contexts. To address this limitation, this study aimed to develop a conceptual PMM framework for project management practitioners in the oil and gas industry. First, a preliminary framework was developed based on a review of the literature. Then, adopting a multiple case study approach, this study employed convenience and snowball sampling to identify informants from six oil and gas companies. Interviews and survey were conducted with them to obtain primary data, which was thematically analyzed. Based on the analysis results, the preliminary framework was refined using a two-way approach. The resulting PMM framework is the main contribution of this study, as it serves as a guide for oil and gas organizations to enhance their project management capabilities in conducting development projects. Specifically, the framework enables oil and gas practitioners to better understand what PMM is and how they can use it to build organizational capabilities in delivering a successful project. It also helps them identify key factors and contingencies during the selection of project management practices. Ultimately, this study's PMM framework facilitates oil

and gas practitioners in achieving an ideal project management approach for successful project delivery, thus enhancing organizations' project success rate.



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

MEMBENTUK KEMATANGAN PENGURUSAN PROJEK YANG IDEAL DALAM INDUSTRI MINYAK DAN GAS DI MALAYSIA

Oleh

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Industri minyak dan gas Malaysia memainkan peranan penting dalam perkembangan ekonomi negara. Untuk mengekalkan pengeluaran berterusan, industri ini memerlukan projek pembangunan yang lebih inovatif dan agresif, terutamanya projek mega yang boleh mengewangkan rizab asli. Projek-projek ini, walaubagaimanapun, melibatkan risiko tinggi, pelaburan besar, dan pelbagai kerumitan yang menuntut pengurusan projek efektif untuk memastikan penyerahan projek yang berjaya. Malangnya, pengalaman pengurusan projek terhad dalam kalangan sumber manusia relevan menurunkan prestasi penyerahan projek, lalu menyebabkan kelewatan projek, pertikaian kontrak antara pihak berkepentingan, dan sehingga 10 peratus pembaziran pelaburan. Utamanya, kelemahan keupayaan penyerahan projek oleh organisasi minyak dan gas disebabkan isu-isu ini menunjukkan ketiadaan model kematangan pengurusan projek (*PMM*) yang berkesan. Model *PMM* sedia ada tidak dapat membantu pengamal minyak dan gas kerana ketidakfleksibelannya, rangka kerja 'satu-saiz-muat-semua' yang tegar, dan kerumitan untuk diterima pakai dalam konteks berbeza. Untuk mengatasi limitasi ini, kajian ini bertujuan untuk membangunkan rangka kerja *PMM* konseptual untuk pengamal pengurusan projek dalam industri minyak dan gas. Pertama, rangka kerja awal telah dibangunkan berdasarkan tinjauan literatur. Kemudian, dengan menerima pakai pendekatan kajian pelbagai kes, kajian ini menggunakan teknik persampelan mudah dan bola salju untuk mengenalpasti informan daripada enam syarikat minyak dan gas. Temu bual dan kaji selidik telah dijalankan dengan mereka untuk mendapatkan data primer, yang dianalisis secara tematik. Berdasarkan keputusan analisis, rangka kerja awal telah diubahsuai menggunakan pendekatan dua hala. Rangka kerja *PMM* yang terhasil adalah sumbangan utama kajian ini, kerana ia berfungsi sebagai panduan kepada organisasi minyak dan gas untuk meningkatkan keupayaan pengurusan projek mereka dalam menjalankan projek pembangunan. Khususnya, rangka kerja tersebut membolehkan pengamal minyak dan gas memahami dengan lebih baik apa itu

PMM dan bagaimana mereka boleh menggunakannya untuk membina keupayaan organisasi dalam menyerahkan projek yang berjaya. Ia juga membantu mereka mengenal pasti faktor dan kontinjensi penting semasa pemilihan amalan pengurusan projek. Keseluruhannya, rangka kerja *PMM* kajian ini memudahkan pengamal minyak dan gas dalam mencapai pendekatan pengurusan projek ideal untuk penyerahan projek yang berjaya, justeru meningkatkan kadar kejayaan projek organisasi.



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

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LIST OF ABBREVIATIONS

BBOE	Billion barrel oil equivalent
CMM	Capability Maturity Model
CSF	Critical Success Factor
CT	Contingency Theory
EFQM	European Foundation for Quality Management
EOR	Enhanced Oil Recovery
EPCC	Engineering, Procurement, Construction and Commissioning
FIZ	Free Industrial Zone
FPSO	Floating, Production, Storage and Offloading
FST	Fuzzy Set Theory
GDP	Gross Domestic Product
HSE	Health, Safety, and Environment
IOC	International Oil Company
NOC	National Oil Company
PSC	Production Sharing Contract
PDCA	Plan, Do, Check, Act
PM	Project Management
PMBOK	Project Management Body of Knowledge
PMM	Project Management Maturity
PMMM	Project Management Maturity Model
PMO	Project Management Office
PMP	Project Management Professional

PSC	Production Sharing Contract
SDR	Success driver
SLR	Systematic Literature Review
SME	Subject Matter Expert
TQM	Total Quality Management
US	United State of America
USD	United State Dollar



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CHAPTER 1

INTRODUCTION

This chapter discusses the background of the study, the problem statement, research objectives and questions, the significance of the study, the scope, and the limitation of this study. Finally, this chapter presents the structure of this research.

1.1 Background

In today's competitive and challenging environment, many organizations use project management (PM) as a strategic tool to accomplish their business objectives (Anantatmula & Rad, 2018). Organizations rely on their project management capability to achieve their business objectives through successful projects (PMI, 2019). Deriving from the need to improve the project success rate, project management maturity (PMM) has become an important concept in project management (Kerzner, 2019). PMM is defined as the state of an organization's current PM practices, processes, and effectiveness at performing certain tasks, and eventually being able to deliver a successful project (Li, Yang, Pasian, & Zhang, 2020).

Therefore, according to Anantatmula and Rad (2018), it is important for an organization to achieve its intended level of PMM. Projects are mainly driven by the performance of project management practitioners (Li et al., 2020), hence it is important that practitioners understand the concept of PMM, and how their selection of the project management approach and practices could contribute to the development of an organization's intended maturity level, eventually achieving the capability to deliver projects successfully.

However, to achieve the organization's intended PMM level, practitioners need to understand the external and internal factors that influence organization's PMM. Previous studies had indicated that project environments such as the location of the project, technology involvement, stakeholders, and the governing body are part of the external factors (Albrecht & Spang, 2016; Kerzner, 2019). These factors could influence practitioners' project management approach and practice in managing their projects. Meanwhile, internal factors include organizational structure and management oversight (Crawford, 2021). Both can influence practitioners' adoption of the project management methodology.

With advancement going on in today's project management processes, the PMM concept and its models need to also improve so as to maintain their value to organizations. The one-size-fits-all idea may no longer be relevant. It is possible

that the need for organizations to strive for the highest maturity level in project management may no longer be relevant. Anantatmula and Rad (2018) had mentioned that organizations should only strive to achieve the highest maturity level when it provides organizations with sufficient capability to deliver a successful project. Naturally, this highest level can only be acquired through the project managers who are equipped with the ability to customize the approach to suit the project by focusing and prioritizing on the project management areas that are important for them to fulfil the delivery of a successful project.

Practitioners clearly play an important role in determining organizations' level of PMM. As suggested by the Contingency Theory (CT), an alignment between practitioners' approach and practice with external and internal factors could lead to the existence of a fit condition. Through this, organizations can aspire to achieve their intended performance, hence their ability to deliver a successful project (Anantatmula & Rad, 2018; Donaldson, 2001).

This study aims to understand how practitioners align their project management approach and practices with internal factors such as organization's business objectives, organization's existing structure, and external factors such as project contingencies (for e.g., project complexity). To be able to do this, the oil and gas industry of Malaysia is given special focus and in this context, the practitioners' responses to how they assessed their own PMM level based on the development projects were captured and analysed.

1.2 Background to the study

The oil and gas industry of Malaysia plays an important role in the economy of the country. Although comparatively young when compared to other worldwide practices, this industry has enabled the nation to flourish and to survive many crises. Over the years, the industry has also conducted and completed several development projects, albeit with local and foreign support and collaborations.

Global Project Performance Issue

Despite the development and advancements of project management and the PMM to improve project performance, poor project performance is still a global issue impacting nation's progress (Anantatmula and Rad (2018). This is evidenced in the poor project performance leading to many projects failing despite the advancement of project management. A global survey based on 365 megaprojects conducted by EY's Oil and Gas Centre (EY, 2015) found that 64% of the projects faced cost overruns, and 73% reported experiencing schedule delays. EY (2015) then concluded that project delivery success in megaprojects is on the decline, with many organizations affected. Undoubtedly, whenever projects missed their target, there is a significant implication on companies'

financial performance due to the loss of revenue caused by missed production dates.

Another global survey done by the Project Management Institute (PMI, 2018) measured project performance based on dollars wasted over dollars invested in the project. This survey made a comparison of the various countries' project performance. Table 1.1 showed that Australia had the highest of 13.9% of dollars wasted or \$139 million on \$1 billion invested. Meanwhile, China had the lowest percentage of dollars of 7.6%, or 76 million dollars wasted on every \$1 billion invested in projects. On average, 9.9% of dollars are wasted on every 1 billion dollars invested.

Table 1.1: Project performance based on countries

Region	Average of wasted due to poor project performance (Comparison to the global average of 9.9%)
Australia	13.9% (Dollars wasted \$139M on \$1B invested)
Europe	12.7% (Dollars wasted \$127M on \$1B invested)
Brazil	12.2% (Dollars wasted \$122M on \$1B invested)
EMEA	11.7% (Dollars wasted \$117M on \$1B invested)
UK	10.8% (Dollars wasted \$108M on \$1B invested)
Latin America	10.2% (Dollars wasted \$102M on \$1B invested)
North America	9.6% (Dollars wasted \$96M on \$1B invested)
Asia Pacific	8.6% (Dollars wasted \$89M on \$1B invested)
Middle East	8.5% (Dollars wasted \$85M on \$1B invested)
India	8.1% (Dollars wasted \$81M on \$1B invested)
Canada	7.7% (Dollars wasted \$77M on \$1B invested)
China	7.6% (Dollars wasted \$76M on \$1B invested)

(Source: PMI, 2018)

Based on its results, the PMI proposed that high-performance organizations invest in a proven project management practice to improve performance level. It was apparent that the PMI was against poor project management performance causing so much loss in money in multi-billion megaprojects. The two studies of EY (2015) and PMI (2018) indicate poor project performance has become an uncommon global issue that directly contributes to a significant waste of invested capital funds. Poor project performance clearly affects company business performance (EY, 2015; PMI, 2018; PwC, 2016).

“Champion: Organizations with 80% or more of projects being completed on time, on budget, meeting business intent, and having high benefits realization maturity”. Meanwhile “Underperformers: Organization with 60% or fewer projects being completed on time, on budget, meeting business intent, and having low benefits realization maturity”.

(PMI, 2018)

1.3 Problem Statement

Despite the oil and gas industry making huge contributions to the nation's economy, the Malaysian government still looks to this industry for its revenue expectations. There are several internal and external factors that currently affect the oil and gas industry (Bhattacharya & Hutchinson, 2022; MIDA, 2018; PETRONAS, 2018). For instance, the industry faces a significant decline in its oil production since 2016 (Bhattacharya & Hutchinson, 2022; EIA, 2017). Other experts (Rahim & Liwan, 2012) estimated the country's reserve depletion by 2035. Through the government's new Economic Transformation Plan (ETP), the Malaysian oil and gas industry is aggressively moving towards tapping into unconventional reserves such as deep-water segments (MIDA, 2018). This is taken as a measure to monetize the country's underdeveloped oil and gas reserves. Indeed a positive step forward, but this practice would involve a number of megaprojects that also come with high risks, high technology demand, huge investments, and a longer period of time for project delivery (BMI, 2018). The delivering of successful megaprojects is in line with the government's vision, but this industry would require a high level of performance of the country's project management.

Malaysia has had so far, three completed deep-water megaprojects since 2007. The second deep-water megaproject was completed in 2014, but it was plagued with several issues including a schedule delay of more than a year leading to a massive cost overrun of USD245.45 million (Raj, 2017). Even though two out of the three completed megaprojects in 2017 were successful as perceived by many parties (Aramanadka, Yong, Kota, Jamal, & Yeap, 2018; Chai, 2017; TheStar, 2016), by the definition of the PMI given in 2018, megaprojects managed in Malaysia had been below the adequate level of performance.

Additionally, the underperformance of project management in megaprojects has caused the industry to face a significant increase in project costs (BMI, 2018), especially in the deep-water sector (Bhattacharya & Hutchinson, 2022). To deliver successful megaprojects involving huge investment costs would require demand an effective project management system (Arto, Gemünden, Walker, & Peippo-Lavikka, 2017). To date, the industry and academic research has shown that poor project management performance is attributed to ineffective organizational project management (PMI, 2018). This may be due to non-technical issues, management processes (EY, 2015), or low level organizational

PMM (Bhattacharya & Hutchinson, 2022). Needless to say, ineffective project management could turn a megaproject into a failed project, thereby disrupting the organization's progress in achieving the government's vision.

A successful project has a significant relationship with organizational PMM level (Anantatmula & Rad, 2018). This is because organizations that carry a high level of PMM were more likely to increase project success rates whereas organizations with low level PMM were more inclined to experience project delivery issues, such as cost overruns and delays in achieving product attainment date. Since the Malaysian megaprojects' success has been rated by the PMI's benchmark as below performance, this study seeks to explore PMM within the industry. It further aims to understand how project management practitioners' approach their projects. In that regard, this study hopes to unravel the situation and to gather some evidence which can show that the industry is adopting the PMM concept and its models.

This topic of research is important and timely because the oil and gas industry of Malaysia is moving into megaprojects as a way to sustain and increase its contributions towards the country's revenues. The outcome of this study can then be used to demonstrate the readiness of the industry's players in executing megaprojects in the country in the near future.

There is ongoing research to find out why the PMM fails to provide a consistent result to project success while previous studies tend to attribute the cause to the structure of the PMMM which focuses more on the narrow process-based view (Kostalova & Tetreva, 2018). The structure is deficient in taking a broader approach; it lacks the consideration of looking at organizational level determinants as well as other contextual factors that shaped organizational PMM. Kerzner (2019) also accentuates this observation saying that the PMMM structure ignores organizational factors which could influence the PMM (Kerzner, 2019). It seems that most PMMM were developed in two dimensions as originated from the CMMI (Kostalova & Tetreva, 2018).

The first dimension was based on the PMI's recommendation - nine project management knowledge areas. The second dimension was on stepwise maturity level, adopted from the CMMI. In contrast to its current narrow process-based view, the ideal outlook is that the PMMM be more flexible in structure. It should be more adaptable in its application, and more responsive in its interpretations so as to keep it PMMM relevant for industries to use (Kostalova & Tetreva, 2018).

Besides its narrow process-based view, Seelhofer and Graf (2018) noted its overly complex structure. It appears that for organizations to acquire a complete assessment of the PMM level, many PMMM models require a lot of information from the organization. For the organizations to expedite a complete assessment,

they would need to have more time and cost, such as for engaging consultants to conduct the assessment. Too much information could also lead to difficulties in the interpretation of the result (Anantamula & Rad, 2018). These issues highlighted above made the PMMM a burden to be implemented. Consequently, its usage became lesser and lesser within the industry (Pells, 2020).

In response to the ongoing issue of the PMM, previous studies have said that an organization may not necessarily strive for the highest maturity level so as to achieve its intended capability in order to deliver a successful project (Albrecht & Spang, 2014a, 2016; Anantamula & Rad, 2018). Albrecht and Spang (2016) proposed that the concept of an ideal PMM level should be based on the contingency theory (CT). This is because an organization needs to customize its project management approach in order to suit its environment. The CT states that a fit between the project management approach with the project environment and organizational structure could enhance project performance. This fit condition is the ideal maturity level that provides organizations with sufficient capability to deliver a successful project. Further to the above, other factors, including environmental factors also contribute to an ideal PMM. Thus, to develop the ideal PMM for organizations, this study explores the project management approach and practices of organizations so that organizations' capability to deliver successful projects can be increased and further improved.

Knowledge gap

Although the term, project success, may carry different values for different organizations, the term embraces the value of making improvements to project success, such as completing projects without any schedule delay and not incurring any cost overruns.

According to Ernst and Young's (2015) global survey which was based on 365 megaprojects, 64% of the projects faced cost overruns while 73% experienced schedule delays (EY, 2015). Despite increased risks and management support, projects had exceeded budgets and deadlines. This demonstrates a negative perspective of megaproject management.

Meanwhile, Merrow (2011) stated that 78% of 318 samples of megaprojects in the oil and gas industry failed to meet the deadline, hence incurring cost overruns. The delay in meeting the deadline led to the late meeting of product attainment, thus delaying the oil company's return on investment (ROI). Merrow (2011) concluded that poor project performance is mainly due to low project management capability.

Two additional global surveys were by PricewaterhouseCoopers (PwC) and Project Management Institute (PMI). The outcome indicated that poor project success rate was due to poor project management capability (PMI, 2018; PwC,

2007). Both surveys also concluded that poor project management capability was derived from low PMM.

In brief, this means that even though huge investments were required in the oil and gas projects, the industry is still experiencing low PMM. This implies that the implementation of PMM concept and its models (PMMMs) needs to be explored.

Past studies (Derenskaya, 2017; Mustaqeem, Khalid, & Nabi, 2020; Žurga, 2018) had also mentioned the need to explore the relevancy of PMM and PMMMs in the oil and gas industry. These studies looking at the PMM had focused on the IT industry as it was the origin for the PMM and PMMM concept (Anantatmula & Rad, 2018). Nonetheless, several studies (Gareeb & Rwelamila, 2021; Shan & Lu, 2020; Yazici, 2020) had also explored the adoption and implementation of the PMM and PMMM in the oil and gas industry. These studies offered multiple opinions though.

First, ideal PMM is more appropriate when compared to the need to strive for the highest PMM. Albrecht and Spang (2014a) examined the German energy companies PMM and they concluded that there were insignificant adoption and implementation of the PMM and PMMM. The study observed that practitioners in the industry were more inclined towards seeking for an ideal PMM level that is a fit to their project demands. In this regard, the degree of project management knowledge areas implemented by these companies was based on selective needs only. There was no attempt to strive for the highest maturity level.

Secondly, there was a deficiency in PMM within the energy industry. Thus, it is critical that this be improved since the national energy security depends heavily on success projects in order to realize its vision. A study by Mihic, Petrovic, Obradovic, and Vuckovic (2015) on the Serbian oil and gas industry was driven by the need to assess the readiness of the industry's capability to deliver multiple oil and gas development projects successfully. The said study detected poor project management among the oil and gas players in the country. In brief, this means that the oil and gas industry is facing a deficiency in this aspect. Therefore, there is a need to improve the industry's project management and PMM level so as to ensure its readiness to deliver their national aspiration. As a developing country, Malaysia is also facing a similar situation.

Thirdly, the PMM and PMMM in the Malaysian oil and gas industry has been neglected for a while since the last two studies conducted by Abdullah, Rahman, and Awang (2011) and Rasid, Ismail, Mohammad, and Long (2014). Even though both studies did not directly investigate the PMM and PMMM of the said industry, the outcome derived from these studies provide some clues on the existence of the PMM and PMMM in the oil and gas industry of this country. Abdullah et al. (2011) noted that the oil and gas industry was similar to other industries throughout the world where the major concern of any organization is

its project success rate. This is typically measured by certain criteria such as the organization's ability to meet the scope of the project, the deadline, and customer satisfaction. Meanwhile, the project owners who are mainly international oil companies (IOC) that perform the exploration and development aspect would measure project success through other criteria such as meeting product attainment and schedule, increased company revenue, increased shareholders' value, and also company sustainability (De Wit, 1988; Shuen, Feiler, & Teece, 2014). In the oil and gas industry, poor project delivery is frowned upon. Thus Abdullah et al. (2011) proposed that future studies be conducted on a larger scale so that project management issues within the Malaysian oil and gas industry can be better gauged and improved on.

Fourthly, there is a lack of comparison data which offer better insights into the areas that are strong and those which are weak. A study by Rasid et al. (2014) which assessed the PMM of the public sector found that there was no similar data available on other industries and their PMM. Thus there is a need to explore the PMM within the Malaysian oil and gas industry.

1.4 Research Objectives

To establish the framework which can guide practitioners in reaching for an ideal project management approach in order to deliver a successful project, the following research objectives were developed:

- To examine the perceived organizational PMM level.
- To explore and understand how project management practitioners align their approach and practices to business objectives and project contingencies.
- To develop a conceptual framework of the ideal PMM.

1.5 Research Questions

To achieve the research objectives noted above, four research questions were formulated. They include:

- 1) What is the perceived PMM level in the organization?
- 2) How do project management practitioners align project management approach to the project environment?
- 3) How do project management practitioners align project management approach to organizational structure?
- 4) How do project management practitioners measure organizational project management capability?

1.6 The Malaysian oil and gas industry

Understanding the industry's environment is essential because any change in condition within the broader environment may influence how the industry responds to the economy (Hill, Schilling, & Jones, 2018). Based on this, the current study seeks to identify the possible contingent factors that could affect the industry's interest (Rahimi, Kenworthy, & Balakrishnan, 2018).

A review of the industry has disclosed that it faces several challenges such as the need to:

- Support the country's economic growth,
- Monitor the country's petroleum reserves and depletion issues,
- Accommodate global changes and demands.

Support the country's economic growth

Since its inception in 1974, the NOC has propelled Malaysia's oil and gas industry to become the world's third-largest exporter of liquified natural gas (LNG), after Qatar and Australia. Malaysia is also the second largest oil exporter within Southeast Asia (Bhattacharya & Hutchinson, 2022; MIDA, 2018). The industry contributes to government revenues through tax, royalty, export duties, and dividends. In 2020, total revenue in the nation had increased to RM50.9 billion, 25% of the total country gross domestic product (GDP) compared to RM43.69 billion in 2015 (Bhattacharya & Hutchinson, 2022). With a steady revenue received from the industry since 1975, Malaysia has developed to what it is today. Nonetheless, as the Malaysian economy expands, contribution from the industry has become smaller in proportion (Bhattacharya & Hutchinson, 2022). To continuously support the country's economic expansion, this industry needs to grow through production increase. This can be achieved through new exploration and development of the oil field, but many projects need to be acquired.

Monitor the country's petroleum reserves and depletion issues

The country's oil and gas business prospects very much depends on the amount the petroleum reserves the country has. Satter and Iqbal (2015) defined a petroleum reserve as a "...proven or proved...accumulations of oil and gas that are producible in commercial quantities...". Investors and IOCs are only attracted to invest if the reserve is profitable (Shuen et al., 2014). Thus, Malaysia must have a massive number of proven reserves to convince investors and IOCs to participate in the country's exploration and production activities.

Fortunately, the Malaysian Investment Development Authority (MIDA, 2018) reported that the current country's petroleum reserve stands at 12.94 billion

barrels of oil equivalent (BBOE). This amount is eleven percent of the total reserves in Southeast Asia, and the third-highest petroleum reserve by country, after Indonesia and Vietnam.

Forecasts showed that Rahim and Liwan (2012) had noted that the Malaysian petroleum reserve will deplete by 2030, if there is no appropriate control and balance between oil extraction, production, and consumption. They suggested that the country embarks on long-term planning to sustain its daily oil productions. The country must seriously consider discoveries to replenish its depleting petroleum reserves.

The country's petroleum reserves come from conventional oil fields, such as matured fields and deep-water segments (EIA, 2021). Most matured fields are located in shallow waters. There is, at the moment, a deep-water segment located further from the country's shoreline, with a water depth of between 200 to 1200 meters (Salleh & Sainal, 2010). The deeper the water depth, the more complex the facility which has to be built to extract the oil from the seabed. This, undoubtedly would require advanced technology, huge costs, and longer time to complete.

Majority of the oil and gas activities are within shallow waters. There are 353 offshore facilities or platforms. Only three are located in deep-water segments (PETRONAS, 2018). Despite their easy development access, most of Malaysian matured fields are presently experiencing production decline due to reserve depletion which occurs after 30 years of production (EIA, 2017). To mitigate reserve depletion using innovative solutions would require huge investments. For instance, the industry has applied innovative solutions such as enhanced oil recovery (EOR) technology to prolong its production life. The application of the EOR has successfully increased production by as much as 50% of the country's daily production (MIDA, 2018). However, the EOR carries a huge project cost. To date, Malaysia has spent about USD14 billion on ten EOR projects as compared to 200 matured fields currently available (Bhattacharya & Hutchinson, 2022)

The Business Monitor International (BMI, 2018) had reported that the deep-water sector is the country's promising source of petroleum reserves, with approximately seven (7) billion barrels of oil equivalent (BBOE) to be discovered. The existing production coming from deep-water fields amount to about 31 percent of the country's daily oil production. This is a significant contribution. This was also noted by the Energy Information Administration (EIA, 2017) which mentioned that the average production coming from two deep water oil fields amounted to around 120,000 barrels per day

The third deep-water megaproject which was completed in 2016 contributed another 60,000 barrels per day to the country's total daily oil production. Yet,

despite its significant contributions, deep-water oil and gas fields have been under-explored. The reason is because it requires complicated and high technology and huge investments (BMI, 2018).

Deep-water fields require huge investments which are used to support the construction of massive interfaces, expensive technologies, and the high risks involved. Bhattacharya and Hutchinson (2022) noted that an average of USD 1 billion is required to deliver a facility in deep-water fields. In addition, raising this huge capital fund is also a challenge, especially for small E&P oil and gas companies. Due to this, deep-water exploration and production activities in Malaysia is still dominated by several supermajor IOCs, achieved through a strategic joint venture with the NOC. For example, two OICs collaborated with the NOC to develop one of Malaysia's deep-water field by sharing a percentage of Shell shares at 35%, ConocoPhillips Sabah at 35%, and PETRONAS Carigali at 30% (WOGNEWS, 2016).

With a promising reserve and the high potential of contributions made to the national daily oil production, delving into deep-water megaprojects is a critical resource (MIDA, 2018). Although the Malaysian oil and gas industry may seem to have a long future, it would require a strategic plan to exploit the potentials of its deep-water fields. This industry needs a high level of organizational project management capability in order to deliver such complex megaprojects.

Accommodate global changes and demands

The era of “easy oil” has approached its end. Oil and gas companies must diversify their portfolios in order to sustain themselves in the industry. EY's Oil and Gas Centre (EY, 2015) had emphasized that E&P oil and gas companies must tap into emerging opportunities in unconventional oil and gas reserves, such as shale, ultra-deep-waters, coal-seams, and the Arctic. Unconventional oil and gas reserves require new technology, new processes, new opportunities the need for ubiquitous learning due to their diverse geography (BMI, 2018). These are some challenges which the oil and gas industry needs to accommodate and adjust so as to raise its own capability to deliver a successful development project within a more complex environment.

Despite the pervasiveness of renewable energy and the popularity of electric vehicles, economists and strategists from the oil and gas industry had forecasted that energy demand will grow by 37% by the year 2040 – comprising four almost equal supply mixes of oil, gas, coal, and low-carbon sources (BP, 2019). These energy demands can inflict danger on the global energy system.

In addition, E&P oil and gas companies must take steps to venture into unconventional roles and be prepared to undertake a long-term quasi-irreversible commitment of huge investments so as to ensure their share in global

energy demands besides offsetting reserves depletion. For countries to meet this substantial global oil demands, the U.S Energy Information Administration (EIA) estimated that by 2030, around US\$900 billion is needed to invest in the oil and gas upstream developments (EIA, 2021). Meanwhile, through the Economic Transformative Plan (ETP), the country is committed to the deep-waters old and gas exploration and development projects in order to meet growth in its aggregate production capacity by five (5) percent per annum (MIDA, 2018).

Observations show that Malaysia is moving in the right direction; it is outing in efforts to spur exploration and development in its potential deep-water sector. To fulfil its need to obtain a huge investment fund for its long-term production sustainability, It is necessary for the government to increase various initiatives that can attract supermajor OICs to participate collaboratively. This initiative was started not very long ago and it is visibly noted in current government policies. Based on this, it is clear that the oil and gas industry would need the support of strong and effective project management practitioners to realize its vision.

1.7 Justification for choosing this industry

The above section has already highlighted the importance of the oil and gas industry and the significant contributions it made towards the country's economic growth. The following are noted as justifications:

- It has an aggressive development portfolio
- It uses development projects with high complexity and huge investments to expand the industry.
- The industry is supported by the involvement of the NOC as a regulator in the development projects.
- There are differences in interest between the NOC, the IOCs and local players – this creates a challenging scenario in project management
- It is experiencing a talent experience gap.

Aggressive development portfolio

The expansion of the oil and gas industry in Malaysia is done through development projects under MIDA. Due to this, project management approach and practices are expected to happen heavily. Moreover, the country is experiencing the evolvement of continuous projects, moving from small to megaprojects. Report showed that there are 10 upcoming projects in the world, and as the top 10 projects, nine oil and gas fields are expected to be developed. These projects are anticipated to unlock 1.7billion barrels of oil equivalent (Nick, 2023). To oversee such megaprojects, a good project management is needed to help practitioners execute these projects. For instance, one single field development could involve a multiple of projects, depending on the field development plan. Due to this, there is a need to fill in the many gaps noted above. Figure 1.1 illustrates the future vision of the oil and gas industry.

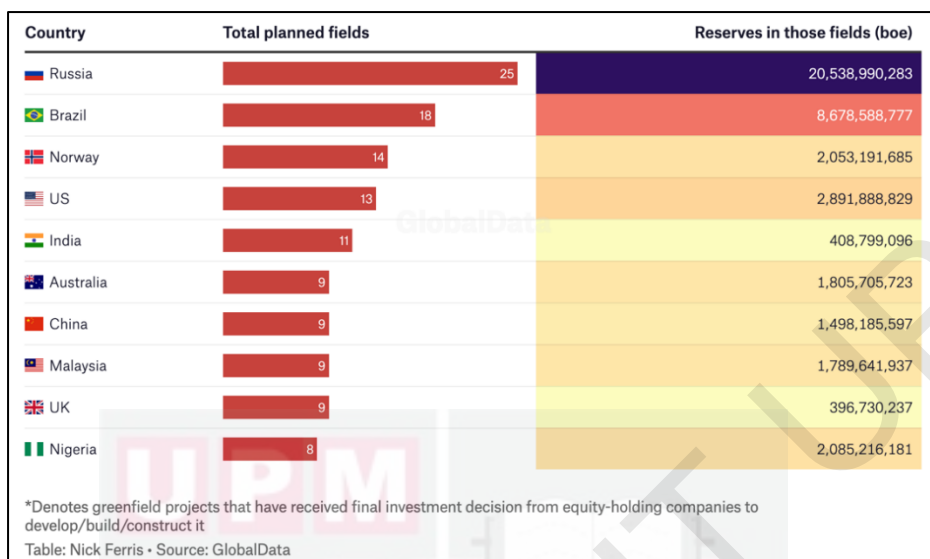


Figure 1.1: Future development of the oil and gas industry
(Source: Nick, 2023)

Since projects are to be managed by competent and good practitioner and project team, their ability to handle projects are critical. Projects also involve many stakeholders whose involvement is equally critical for the smooth management of projects by practitioners. Figure 1.2 below shows the line-up projects in Malaysia under the Projection of Development Portfolio 2019 to 2021 (PETRONAS, 2018). The figure illustrates a total of 20 line up projects of new offshore facilities for the engineering and construction companies. Each new offshore facility would require several OICs to operate in Malaysia.

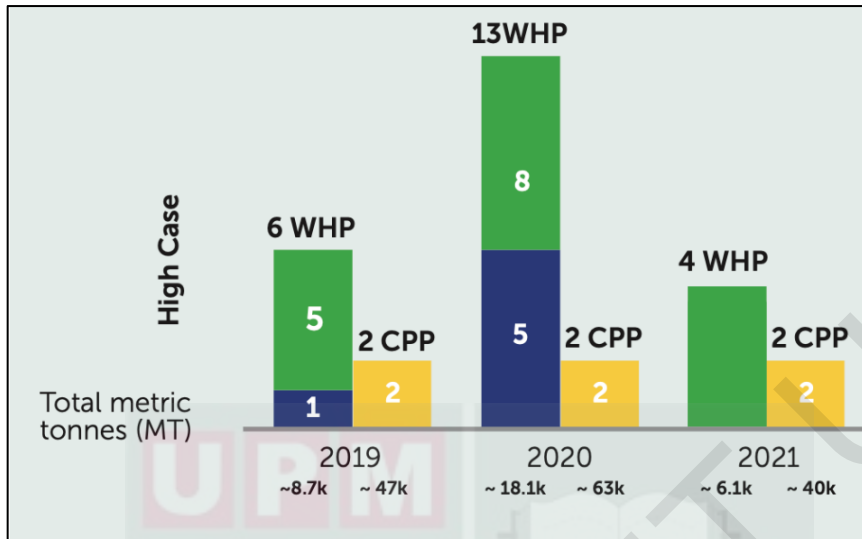


Figure 1.2: Development projects in Malaysia
(Source: PETRONAS, 2018)

High complexity and huge investments

HHP and CCP refer to the types of offshore facilities classified according to size and complexity. The CPP (Central Processing Platform) involves productions that are complex. Its accommodation could take between three to five years for the engineering and construction phase. Meanwhile the WHP (Wellhead Platform) is simpler and smaller. It does not have any production facility, and it has no accommodation. It could take between two to three years for the engineering and construction phase to complete.

Regardless of size, the project would still require a high capability of project management team to execute the process of the development projects. Moreover, the more complex the projects, the more the investment, the more the stakeholders, the more the bureaucracy, the more the technology, and the more the documentation process. All of these are critical to the organization for organizational sustainability (Bhattacharya & Hutchinson, 2022; BMI, 2018; Yacob, 2021).

Overall, it can be said that aggressive development projects have been happening in this country for years, and with time, more is to be expected. This implies that the projects not only need to be supported by advanced technology, but also competent human talents, and high level project management capabilities. Without these, the practitioners would be unable to deliver projects successfully.

Involvement of the NOC and the differences of the players

As a regulator, the NOC is involved with many project owners some of which are international oil companies (IOCs). This means that how they interact among each other is of utmost importance since the channel is supposed to carry, convey and provide a rich set of information to all concerned on how the projects will be conducted. This interaction involved the project practitioners, the project owners, the regulator – the NOC, various stakeholders and possibly even the government.

Talent gap

Based on the expansion of megaprojects, the need to oversee contractors' skills and competence, the need to communicate with various stakeholders, and the regulator, it would appear that the practitioners themselves must be well equipped and experienced to manage the projects. In other words, there is a need to fill in the talent gap because Malaysia is a small country that is expanding fast in the oil and gas industry. Although its human factor in this industry is also growing, there is still a talent gap in terms of the practitioners' project management capability and organization's ability to deliver projects successfully. If this gap is not filled in at the most opportune of time, Malaysia will lose its human talents in the oil and gas industry due to the unattractive nature of the work, low expertise, inadequate experience, and possibly unappealing work environment. With the current skilled practitioners reaching their retirement age, it is possible that this country will lose the human talent so required for this industry due to retirement. The current young generation may likewise have lesser interest in this aspect due to the accessibility of other professional openings. (KPMG, 2022). Figure 1.3 and Figure 1.4 below illustrate the future workforce of the oil and gas industry globally.

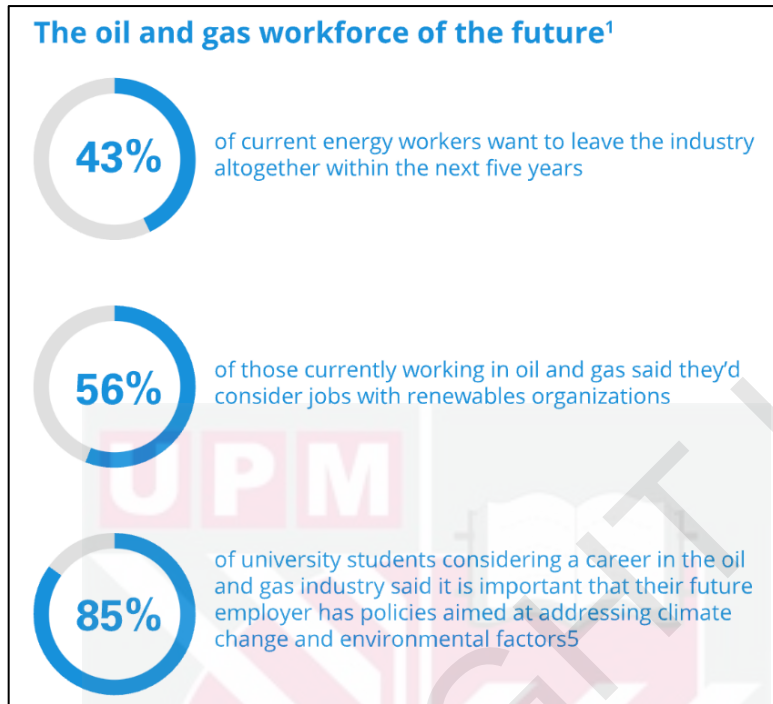


Figure 1.3: The oil and gas workforce of the future in Malaysia
(Source: KPMG, 2022)

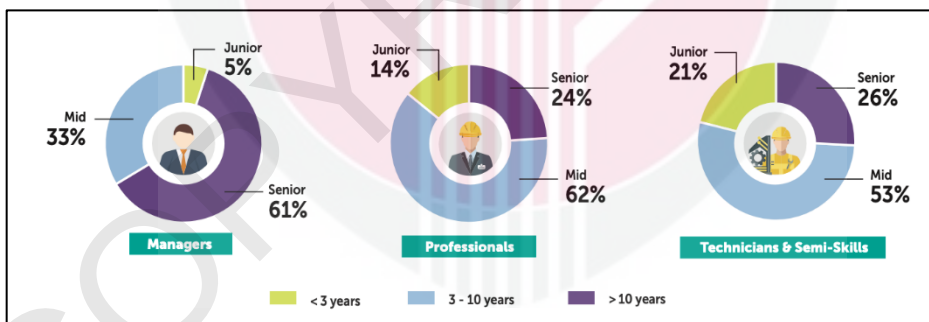


Figure 1.4: Workforce demarcation in the Malaysian oil and gas industry
(Source: PETRONAS, 2018)

Despite its significant contributions to the country's economic growth, the Malaysian oil and gas industry is challenged by reserve depletion. It has no choice but to embark on more complex and bigger projects to mitigate this issue (Bhattacharya & Hutchinson, 2022; Yacob, 2021). This step is necessary to sustain the country's oil production and to make economic contributions to the nation's aspirations. Nevertheless, there are challenges which the country needs to address.

1.8 Significance of Study

This topic of research is important and timely because the country is presently pursuing complex and high-risk projects to offset the country's petroleum reserve depletion issue. The oil and gas industry is still a significant "engine" of the Malaysian economy's growth and development. To enhance its growth and expansion as well as to sustain national oil production, the industry has to rely on more development projects (MIDA, 2018). In the next few years, Malaysia will be listed as one of the top countries with a high number of oil and gas development projects (Nick, 2023). In this regard, the project management practitioners and the project organizations need to be ready and well equipped with sufficient capability to undertake such projects.

The contribution of this study is linked to the conceptual framework that is developed. The framework will serve as a guide to all parties. It can be used to explain to project management practitioners and organizations on what the ideal project management app is like since the framework also highlights project contingencies and industry background in the country. The ideal PMM conceptual framework enables the practitioners to conduct better project management to projects, hence they could consider using its adoption for their daily project management approach and practices.

1.9 Scope and Research Limitation

The Malaysian oil and gas industry overview

The oil and gas industry in Malaysia started from British colonial days. The Malaysian government, however, managed to obtain full control of this industry after the inception of its national oil company, Petroleum Nasional Berhad (PETRONAS) in 1974 (Yacob, 2021). PETRONAS was mandated by the Malaysian government to manage and develop natural resources both onshore and offshore (BMI, 2018). This establishment further monetizes the national reserves, and it soon, became one of the major contributors to the country's economy and development (Yacob, 2021).

PETRONAS needs to work with established international oil companies (IOCs). The Shell Dutch company was the first IOC that partnered with PETRONAS through the Production Agreement Contract (PAC) in 1974 (Yacob, 2021). Shell started exploration on the offshore reserves of Sarawak, Sabah and Peninsular Malaysia, and subsequently, on the economical natural reserves. Shell started the development and production phase which includes building a new offshore facility. This includes a steel structure platform, subsea pipelines, and an onshore process plant. This progress was followed by IOCs which today, accounted for the 100 active IOCs.

Unlike the public sector, development projects in Malaysia were regulated by PETRONAS who enforces its in-house project guidelines. The involvement of PETRONAS in IOC's development projects starts from the economic evaluation, engineering front end loading, construction, production until the abandonment of the facility. The stage gate system and decision stage were also introduced by PETRONAS as a means to assess and evaluate the IOC's development projects. Here, PETRONAS acts as a gate keeper for the critical stage gate (DBS, 2018). The downside of its aggressiveness in regulating projects, especially in trimming project costs, could cause the IOCs to either delay or cancel any of the projects (BMI, 2016).

However, to support this development phase, IOCs need a reliable local ecosystem which can support the above activities. IOCs particularly require a local capability to build a new offshore facility (MIDA, 2018). In this regard, engineering companies, consultants, construction contractors, and other services are crucial in enabling the ecosystem to become accessible to all.

Over the years, PETRONAS has not only nurtured the industry, it has also been the main player in the progress seen today, especially through the infrastructure and social developments of Malaysia (Yacob, 2021). With more than 40 years of experience in the oil and gas industry, more reliable infrastructure, service contracts, and human resources have also been established in the industry (MIDA, 2018).

To date, there has been a lot of improvements made to increase the capability of local contractors to deliver projects successfully (MIDA, 2018). The only setback uncovered by PETRONAS was the issue of a lack of experienced human resource to continue the activities (PETRONAS, 2018). This talent gap involving human skills and knowledge and experiences in project is still pending. It was discussed earlier in Section 1.7 above.

Overall, even though the oil and gas industry in Malaysia appears to be booming, it is more complex in structure when compared to other industries such as public development projects. The reason is because the oil and gas industry is fully regulated through the PAC mechanism by the NOC. In this regard, IOCs need to understand the background of the industry, and to learn to adapt themselves to the unique role of the country's NOC in managing all the oil and gas activities. This helped the industry to achieve more success in their oil and gas ventures.

Scope of the study

This study focuses on the oil and gas industry of the country. Informants were confined to actual practitioners involved in project management with projects that were already completed or still ongoing. Although the industry consists of several local and foreign companies, the scope is confined to only project management

capabilities, ideal PMM level, and how the practitioners aligned their approach and practices to their organizational structure. As a qualitative study, the informants were also small in total, numbering only 12 representatives of six organizations. Data were also captured via online interviews, and the thematic analysis provided some insights into the industry's current practices. As a result, the conceptual framework was developed. However, generalisation of findings is restricted to the context of this study only.

1.10 Definition of Terms

This study uses specific terms that are linked to project management in the oil and gas industry, hence some of the operational terms used are further defined.

Project management system – It include standards, practices, project classifications, and tools (PMI, 2017).

Project management maturity (PMM) – The PMM is defined as the state of an organization's effectiveness at performing certain tasks, and the pursuit for continuous improvement (Kerzner, 2019).

Project Management Maturity Model (PMMM) – The PMMM is a conceptual structure that defines the maturity of the area of interest; it has the ability to quantify organization capability so as to allow it to manage projects successfully. It describes the processes that the organization will need to develop so as to reach a desired future state (Kostalova & Tetreva, 2018).

“Ideal” PMM – Albrecht and Konrad (2014) defined the idea of organization-specific's “ideal” level of maturity as the professional concern brought about due to efficiency reasons; it involves taking into consideration the environmental or circumstantial influences.

Project management practitioner – This refers to the community of practice in project management such as the project manager and other members of the project management team (Kerzner, 2019).

Project environment – This refers to the intra and extra-organizational environment that determines the ideal level of PMM (Albrecht & Spang, 2014a). It includes the influence of stakeholders, the organization structure, project typology and the region where the project is located (Aubry & Lavoie-Tremblay, 2018).

Exploration & Production (E&P) oil and gas company – Exploration and production is associated with upstream oil and gas activities that also includes the searching and extracting of oil and natural gas from underwater or underground. Surface facility development involves massive engineering and high technologies with the support of many contractors involved in the

engineering process, such as procurement, construction and commissioning, (EPCC) and contract (Petropedia, 2019).

1.11 Chapter Summary

This chapter has outlined the background to the oil and gas industry of Malaysia, the problem statement, the research objectives and research question, the justification for looking at this industry, the past and current situation of the oil and gas industry as well as the definition of terms used. The idea of the conceptual framework was discussed and the scope and limitations were also mentioned. The remainder of this thesis will be organized in the following manner. Figure 1.5 illustrates.

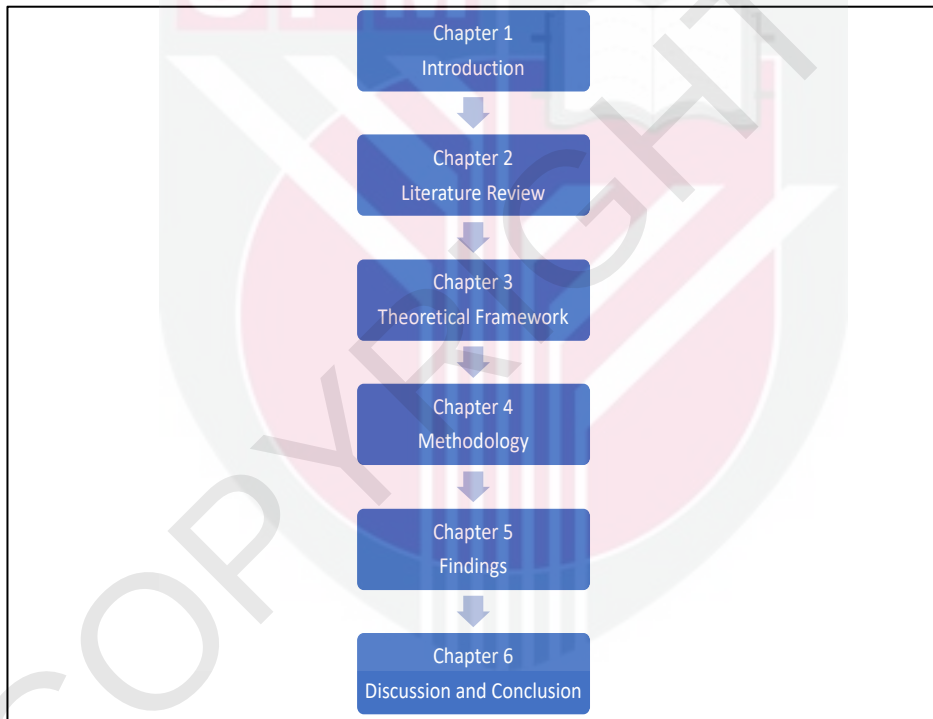


Figure 1.5: The organization of thesis

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