

External Factors Affecting Project Delays: A Case Study on PETRONAS Refinery & Petrochemical Integrated Development (RAPID) Project

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Abstract- Project delay is a common problem in any construction project regardless of the industry. PETRONAS Refinery and Petrochemical Integrated Development (RAPID) project is a downstream oil and gas project in the southern part of Malaysia is also affected by this delay scenario. RAPID project was first scheduled for start-up in 2016 but due to several external factors, it has been postponed a few times since then. This paper presented the external factors that have caused the delay of the construction of RAPID project. This study conducted qualitative interviews to identify and examine the factors of delays in oil and gas downstream construction industry. The instrument used for the data collection is by literature review, semi-structured interview and documents review techniques. The results of this study revealed that social, economy, political and technology factors cause project delays. Findings from this study will help to change the way of project being handle when they are facing external factors throughout the project phase by considering the external factors identified in this study.

Keywords – Petronas, Project delays, RAPID, Oil and gas industry, External factors

I. INTRODUCTION

It is a critical concern to many nation relating to petroleum as it is important to many industries. There are various types of activities in oil and gas industries such as deepwater exploration, oil drilling, refining and retailing of a wide range of petroleum products, and these activities can be divided into two main groups which are upstream and downstream. Upstream in oil sector also known as exploration and production (E&P) sectors where the activities involved directly in exploring and production of crude oil (Hilyard,2012). Companies involved in this sector take the initial steps in searching for potential underground or underwater crude oil and natural gas field, drilling wells and set up the facilities for production. Downstream activities involved with refining of petroleum crude oil, processing of raw natural gas, marketing and distributing the finished products including diesel fuel and gasoline (Hilyard, 2012).

The processes in oil and gas construction industry includes engineering, procurement, contracting, construction commissioning and maintenance of upstream and downstream facilities. To archive production targets, several development and growth programs are predicted, which consist of projects for fabricating a new oil and gas facilities or upgrading of the existing facilities. This program has created an opportunity to the local and international Engineering, Procurement & Construction (EPC) companies to play an important roles and responsibilities in accomplishing these targets.

For every project stakeholder, whether they are a project owner, contractors or the consultant in public or private sectors, their ultimate goals is to successfully complete the project within planned budget, on schedule, and with the uppermost quality (Delgado-Hernandez & Aspinwall, 2008). However, this ultimate goal is difficult to achieve due to delays, which is a common issue faced all around the world in oil and gas construction industries. In oil and gas construction projects, the increasing safety and health regulation requirements, technological and quality aspects, project scope variations, changing in socio-economic environment, and increase in cost due to inflation and escalation have been a great deal of concern which have effects on project performance. Therefore, project team have to identify the causes and effect and effectively use relevant project management processes, tools and techniques in order to manage and control the projects.

However, delay is unavoidable. Delays in project can happen for many reasons due to political issue, law and regulations, environment and social economy (Akanni, Oke, and Akpomiemie, 2015). If these issues are not mitigating in the earlier stage of a project, the project may suffer losses. Therefore, this study aims to identify and examine the external factors that cause delay in oil and gas construction project delay by conducting a case study in PETRONAS Refinery and Petrochemical Integrated Development (RAPID) project.

The rest of the paper is organized as follows. Proposed embedding and extraction algorithms are explained in section II. Experimental results are presented in section III. Concluding remarks are given in section IV.

II. BACKGROUND

The oil and gas industry are an important sector in Malaysia due to its enormous contribution to the country's economic development. This is in terms of employment opportunities and also attraction of Foreign Direct Investments which grossly contributes to one-fifth of the national Malaysia Gross Domestic Product (GDP) (PEMANDU, 2014). Thus, delayed in delivery of the oil and gas facilities will hinder the oil and gas industry to achieve the business target as planned and it indirectly affects the Malaysian revenue in its portfolio as the petroleum industry is one of the most contributing sectors to Malaysian economics.

To avoid or minimize delays, risk management will be conducted to identify and mitigate all potential risk during planning phase of a project (Kendrick, 2013). Without knowing the risk and understand the factors that could contribute to delays, project managers are unprepared for the unexpected risk surroundings the project (Tan, 2010). Generally, it is much easier to identify and manage internal risk compared to external risk as it is more elusive. External risks are more difficult to predict and manage as it is beyond the control of the project and its parent organization (Tan, 2010).

Numerous studies have been conducted to identify the external factors influence the causes of delays in the construction industry. However, limited studies focus on the examining the causes of delays in refinery and petrochemical projects in Malaysia. Therefore, the aim of this study is to fill the gap by addressing the factors of delays in the context of downstream oil and gas industry focusing on refinery and petrochemical projects in Malaysia. It is imperative that to conduct this study as external factors lies largely outside the company's control. By outlining clearly these external factors, project managers and organization can assess their potential impacts and figure out the appropriate strategies to reduce, eliminate or mitigate the effects before it adversely affect the project performance. Hence, by conducting this study, project managers and organization can use this case study as a lesson learned when conducting risk assessment related to external factors.

III. DELAYS IN OIL AND GAS PROJECT

Delay is defined as the original planned occur at a later time than it is expected to happen (Cambridge Dictionary, 2016). In another word, construction work cannot complete within the period which stated in the planning schedule. The oil and gas construction industry are viewed as a complex, fragmented, scheduled and resource-driven industry (Mohamed, 2015). A successful project can be defined as one that is completed within budget, on time and meets the specified quality standard that is satisfactory to the clients and all stakeholders involved (Chan and Kumaraswamy, 1993). One of the criteria to determine project success is project can be completed according to planned schedule.

Delays in any construction project have been huge effect on the satisfactory and performance delivery of the project (Acharya, et.al. 2016). Research shows the effect of delays as cost overrun, time overrun, arbitration, disputes, total abandonment of project and damaging the relationship between the project stakeholders (Aibinu & Jagboro, 2002; Acharya, et.al. 2016). Therefore, the causes of project delays should be identified in order to facilitate avoidance and minimize the construction project delays.

Oil and gas industry is different with construction industry, that is huge in size, involves complex designs and sophisticated technologies are applied (Dey, 2012). In oil and gas construction projects, complete defined scope is crucial to a success of design, construction and start up (Dumont, et.al. 1997). Poor scope definition can lead to changes later during construction stage, and the project may face cost overrun and delay besides disagreements between organizations involved (Dumont, et.al. 1997). Industrial construction projects with well-defined scope will have a better cost and time performance by 23.1% and 13.2% respectively compared to insufficient scope definition. Ralston (2015) highlighted that 14% of the failures due to external factors such as government intervention and environment-related mandates

IV. PROJECT EXTERNAL FACTORS

Delays can be categorized into two type of factors which are internal factors and external factors (Ahmed, 2003). These factors can either be a direct consequence to the projects, or completely unrelated and avoidable. Internal factors arise from the project, which can be occurred due to project stakeholders such as client, contractors, and consultants. External factors due to unforeseen factors where it arises not from the project team members. It arises outside the control of stakeholders such as the government's action, the changes from technologies, political, economy and social. They can also be from the act of God such as natural disasters and climate change (Ahmed, et.al. 2012).

In construction industry, the causes of delays are varied from one country or projects to another. According to Benett (1991), referring to the major review of project management theory, researcher recognized that planned progress of construction projects can be interfered by external factors. If the expectation of delays factors is less and the potential effects are large, managing the progress of construction projects must be taken more into account. It is challenging for project managers in managing the project external factors. These challenges arise from vital risks such as telecommunication system, transportation networks, political stability and lack of adequate infrastructure such as water and electricity supply, political instability and excessive bureaucratic contract procedure.

Previous studies have recommended that there is a need to develop appropriate management tools and techniques specifically design to fit the project environment (Faniran, et.al. 2010). The project external factors that have been generally identified included: legal, political, cultural, institutional, sociological technological resource, financial, economic, and physical infrastructure (Walker, 1991). According to Ajayi, et.al. (2010), the four most important external factors in decreasing order include community issues, economic situation (boom or meltdown), weather conditions and government policy. Akanni, et.al. (2015) have identified main external factors that impact on the project performance which are political, legal, construction technological and resources, economic and financial, socio-cultural and physical. As for Voiculet, et.al. (2010), external factors can be grouped into political-legislative factors, economic factors, social-cultural factors and technological factors.

4.1. Political Factor

Political factors can be defined as the activity related to government policy which has potential to influence a business. It can be included such as rules, regulations, and law legislated by states or federal government to safeguard the current and future generations from the possible harmful activities of other individuals or entities (Marmol, et.al., 2015). It is unavoidable that new or existing policies, laws or rules, and regulations can have a significant impact on projects implementation. Recent year, oil and gas projects have been exposed to political forces due to increased concern of the oil and gas activities to the environment. Therefore, it may cause delays and additional costs to the projects (Morris, 1998). When there is a change of government policy throughout the project period, the project team has to modify the project design in order to fulfil the revised policy which may cause difficulties to the project team. Therefore, the project owner and the management have to be extra attentive and alert with the new or revised regulation. as changes in the political environment, including changes in governments and political philosophies, projects can be significantly affected (Marmol, et.al. 2015).

4.2 Economic and Financial Factors

Projects are potentially exposed to financial risks from various aspects of the overall economy. The global economy is one of the vital external factors affecting the project. Bush (2016) mentioned that interest rates, recession, exchange rates, taxes, inflation, and demand and supply are among the economic factors involved in a business that will also affect the progress of the project. A challenging task for any project manager is to ensure that the project is viable financially in a variable economic environment (Odeh & Battaineh, 2002). Since the economic cycle often significantly affects the construction activities, specific predictions of global and local economic trends are important (Oladapo & Olotuah, 2007).

Microeconomic factors including user response that influence the demands and supply of products or services, which hence influences cost. Macroeconomic factors including the growth of a country's products and services and inflation also affect the demand and supply of products or services. For instance, the lack of demands can spur the economy of the country into recession. The slump of oil price, for an example, is a situation where it can affect a project.

4.3 Social Factors

Social factors refer to the changing of values and attitudes among the people who concerning with the wildlife, environment, native peoples, habitat, unions, and others (Halari, 2010). Sometimes these factors also created because of the inadequate education on the matters among the organizations and citizens that do not pay adequate attention to their corporate social responsibility (CSR). Though large companies, in recent years, has a special department to deal with these social forces. With internet technology nowadays, this turbulence can spread quickly, catching organization with unexpected ways.

4.4 Technology Factors

Technological factors can be considered as changes in work processes, engineering, or equipment, which generally improve the activity or function in terms of cost, efficiency, time and others. Incompatible technology is one of the causes for failed projects as highlighted by Morris (1998). Not all technology brings benefits to a project. Thus, it is

important to identify and eliminate non-compliant technology in the early stage of the project to avoid the inefficiency of production in long run. Sometimes, the selection of technology during planning phase will result in high overall project cost. In that situation, the project team needs assess other options that can be implemented with lower cost. Thus, it causes rework and could impact the project cost and schedule

V. PEST ANALYSIS

Understand the environment in which the project took place is crucial in implementation and identifying the development of strategy. It is necessary to identify the external threats and opportunities that may affect the project. After reviewing literature, external factors which has the possibility to affect the implementation and performance of project consists of political, economic, social, and technological factors (Taherkhani et.al. 2014). To deal with the impact of external factors issues in a project, PEST Analysis tool is a suitable and comprehensive method to be used. Therefore, in this study, PEST Analysis method will be used to identify the external factors during data collection as displayed in Figure 1

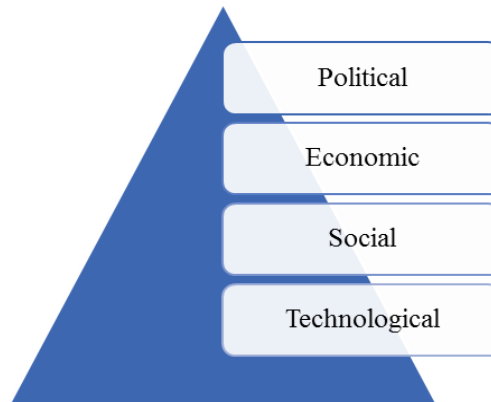


Figure 1. PEST Analysis

The PEST analysis framework will enable the researcher to identify the external factors by queries each of the factors and discuss the effect to the project. The purpose of PEST Analysis is to identify issues that comprise the criteria as below:

The factors will have some level of impact on the organization.

The factors are outside the control of the organization

This analysis tool can be used to understand and know the political, economic, socio-cultural and technological project in which it operates. It can be used to evaluate the market condition to know the position, potential, and direction of the project. The government's actions are beyond the control of the organization. Therefore, how political change can directly affect project must be understand. By using PEST Analysis, political factors, for example, government supports, political stability, standards, and regulations, taxes and policies effecting the project will be identified. To plan the development of the project in the future, economic factors that have potential to affect the project will be analysed. This will help the project team to define and estimated the cost of capital, transportation, and operation. Furthermore, economic factors including the rate of inflation, taxes, and exchange rates and the price of diesel fuel and other social factors related to aspects of society such as ethical, religious, historical issues and social and cultural conventions. Safety, health, and quality of life were also considered as it will be the face of the organization. Technological factors will continue to change time to time. The techniques, material, and various other aspects of the business will change with technologies. The factors as said above is the key factors to identify if the project will be successful or otherwise.

VI. RESEARCH METHODOLOGY

This research selected RAPID project as a case study to determine the external factors that causing delays in oil and gas projects. The main data collection for this research is semi-structured interviews. The four main factors that identified from the literature review will be discussed in detail with the target interviewees. This research adopted purposive sampling and the criteria for selected target interviewees are i) have at least 3 years of experience in oil and gas industry and ii) involved in RAPID project for more than 2 years. This is to ensure that the selected target interviewees have sufficient working experience and knowledge in the oil and gas construction industry. Thus, ten interviewees were identified but the findings achieved saturation after seven interviews.

The interview was conducted with the personnel involved directly in the RAPID project from various departments in order to obtain various views and information. This is to ensure that all possible external factors affecting each area of the project were obtained. In addition, it can avoid any bias resulted from the study. Different departments have various interests in this project. Thus, different delay factors could be investigated from various perspectives. Thus, the key personnel from various department were selected based on their involvement in the project and their year of experiences. Table 1 summaries the background of the interviewees.

The interview protocol as recommended by Stake (1995) was followed where the participants were briefed about the background and objectives of the study by highlighting their contribution to this research. The conversations were recorded after seeking permission from the interviewees. All the information and identity from the interviewees will be treated confidentially.

Table -1 Summary of interviewees' background

Respondent (R)	Department	Position	Years of experience	Brief background
R1	Chemical Engineering	Senior Engineer	10	R1 involved in more than 12 refinery turnaround activities.
R2	Chemical Engineering	Manager	15	R2 involved in deliberation of RAPID project from the earliest stage of the project.
R3	Civil Engineering	Civil Engineer	10	R3 involved in various kinds of oil and gas projects from upstream to downstream and had worked in several countries.
R4	Health and Safety Department	Health and Safety officer	3	R4 poses experience in term of health and safety matters.
R5	Project Management	Senior Project Manager	17	R5 is an expert in managing projects
R6	Project Governance	Procurement Governance Executive	8	R6 involved in procurement process and involved more than 5 oil and gas projects.
R7	Sourcing Department	Sourcing Executive	4	R7 involved from upstream to downstream procurement process.

VII. ANALYSIS AND DISCUSSION

All interviews were recorded, transcribed and analyse by using content analysis. A number of delay factors were identified and listed as shown in Table 2.

Table -2 Delay factors highlighted by respondents

Respondent	Factors	Issues
R1	Infrastructure	Insufficient water supply to support the project
	Geographical setting	The soft ground area is unexpectedly vast
		The terrain cause difficulty to the logistic
		Site clearing duration extended due to monsoon season which has cause flood
	Slump in oil price	Work order was delayed a few times
	Incompetent contractor	Local contractor has no experience in refinery and petrochemical process
Government support	Relocation of local resident and cemetery was delayed	
R2	Very large machinery	Access road need to be develop in order to support the movement of very large machinery
	Multicultural	Difficult to manage as different contractors has different ways on doing works
	Government support	Relocation of local resident and cemetery was

		delayed
R3	Incompetent contractor	Local contractor unable to deliver jobs as requested Lack of experience and knowledge
	Standardization of materials	Short of supplier to deliver newest technology of products
	Government support	Relocation of local resident and cemetery was delayed Securing water supply
	Infrastructure	Insufficient water supply to support the project
R4	Safety culture	Contractors' unfamiliarity to the Legal Compliance and PETRONAS standards presented a challenge for the HSE team
	Training	All workers lack of training in HSE
	Infrastructure	Insufficient water supply to support the project Existing road unable to support very large machinery
	External body requirement	Department of Environment set a new requirement
	State government initiative	Community well-being
R5	Incompetent contractor	Local contractors do not have experience in constructing refinery and petrochemical facilities
	Locality issues	Difficulty to find capable Johor players
	Government initiative	Local citizen not been given job to work in the project
	Local training	Have to manage training for local citizen in order for them to involved in the project
	Exchange rate fluctuation	Cost of product and services increase
	Slump in oil price	Review and rebid some contracts in order to get a better price Investor decision
R 6	Locality	Johor government request to have more Johor company to involved in the project
	Repeating procurement process	Procurement process need to be done again due to the new requirement request by Johor Government
	Insufficient player from Johor	Johor is new with oil and gas business
R7	Slump in oil price	Review and rebid some contracts Rephrase some petrochemical project
	Locality issues	Re-bid some of the contracts
	Government support	Delay of relocating Pengerang resident and cemetery has cause the contract to extend.
	Good and Service Tax (GST)	Revising contract Late payment to supplier & contractors

The delay factors highlighted by the respondents were related with the issues arise in the case study project. During interview process, respondents presented a few management documents related to difficulties during this project. The interview and review of documented materials revealed several delay factors that contributed to late delivery of the case study project. Delays factors identified during this study were group into four big categories which are Political, Economy, Social and Technology. Although the respondents are from different expertise, but it was found that some of their opinions are similar and matched. Section following discuss the results obtained from the interviews.

7.1. Political Factors

The political factors affecting RAPID project can be classified in three main categories, which are government support, government initiative and taxation as tabulated in Table 3.

Table -3 Political Factors affecting RAPID project

No	Political Factors	Description
1	Government support	Government action to relocate Pengerang resident and cemeteries, the construction of housing scheme to the affected villages and water supply.
2	Government Initiative	To increase local company involved in oil and gas industry, constructions and operation business.
3	Good and Service Tax	GST implementation on April 1, 2015

The government support refers to government action in relocation of Pengerang resident, relocation of cemetery, construction of housing scheme and water supply. During the interview, two of the interviewees mentioned that site clearing that should complete on 1st quarter of 2014 with about 1,000 people working during this phase were delayed. The respondents mentioned:

“...The delay in relocating the cemetery has caused the site preparation activities extended. The activities that should be done once off for the area need to be done later after all resident has been moved. This is in itself a gargantuan task as it involves large machineries, people, tackling environmental conditions and logistical challenges...”

(Respondent 1)

“...Site preparation involved few contracts, as the project has been rescheduled due to delays in government action, we have to revisit or extend the duration of current contract. Government action do impact on this project and cause delay. The budget we set to complete site clearing also burst because of this. Obviously, project team has to reschedule their planned...”

(Respondent 7)

The state government has offered the villages with housing scheme. The houses are build in 387 acre resettlement area known as Taman Bayu Damai. However, state government is unable to finish the housing construction on schedule. The delays in the government housing scheme construction also causing delays in relocating Pengerang resident. According to Bernama (2012), six villages has been effected by this project which are Kg Sungai Kapal, Kg Langkah Baik, Kg Teluk Empang, Kg Jawa, Kg Batu Mas and Kg Seborg.

In addition to this, state government are also unable to relocate eleven Muslim cemeteries and seven Chinese cemeteries on time. Total about 3000 graves were involved including Muslim and Chinese cemeteries. Relocation of the cemeteries was handled with utmost care and attention as it involved community sensitivities. Therefore, it required a proper management. Relocation of Pengerang villages and cemeteries at the earlier stage of the project is the first delays factors which has caused the project to delay twice. The project is unable to proceed to the construction phase until the issue has been solved by the state government.

The second factor is state government’s initiative to increase local involvement in oil and gas industry. For example, some contracts need to be revise and re-bid in order to follow the state’s requirement. As highlighted by the respondent:

“...Government has requested to have certain work category to be done by Johor company. Only if insufficient local player to execute the work, then it will be open to other stage company. The issues come when almost every work category has none to 4 Johor licenses or register player. Johor is considered new in oil and gas business and we need to educate and expose them with PETRONAS requirement. This initiative has affected some work packages to be delay...”

(Respondent 6)

“...We have issues in identifying capable local company to be award with some contracts. The number of bidders is insufficient and the bidding is not competitive... It was easy to attract local company to license or register with PETRONAS but it wasn’t easy to identify vendors with experience and capability which meet PETRONAS’s requirements...”

(Respondent 7)

From the documents shared during the interview, the State Government Initiative were implement to help generate income and stimulate economy to local Pengerang resident as they have lost their small-scale and home business. As this causes is closely related to Social Factors and this will be deliberate in detail in Table 5.

The third political factors are GST implementation on April 1st, 2015. All companies with the annual sales turnover exceed RM 500,000 is mandatory for GST registration. This implementation of GST is part of the Government's tax reform program, aimed at enhancing efficiency and effectiveness of the existing taxation system. The changes to

PETRONAS is in large scale, encompassing aspects of people, processes, technology and data. This implementation resulted in revising of contract, overall project procurement process, revising of billing, invoice, customs process, payment and much more. Due to the implementation, procurement process was affected. However, this taxation is not a major reason of RAPID project delays as the implementation not effecting people on site. During the interview, only one interviewee highlighted that the GST implementation causes of delay to RAPID project.

7.2. Economic Factors

The economic factors affecting RAPID project can be classified in three main categories, which are slump of global oil price, investment decision and exchange rate fluctuation as shown in Table 4

Table -4 Political Factors affecting RAPID project

No	Economic Factors	Description
1	Slump of global oil price	PETRONAS reduces RM50 billion in spending over four years which affected project progress Renegotiation with contractors on product and services prices
2	Investment decision	Due to slump in oil price and weaker ringgit, investor holding back their decision to invest
3	Exchange rate fluctuation	Affect project costs, increase in the cost of materials and services

Due to the effect of a slump in oil price, PETRONAS has conducted rebidding to some of the tenders to secure better prices. In addition, PETRONAS have to reschedule some of its petrochemical project involving phenolic chains. This factor has highlighted by all interviewees. As stated by Respondent 7:

“... we believe it is due to the slump in oil price. There are also contracts that almost awarded were reviewed again...”

Project costs have been affected by the exchange rate fluctuation in local currency exchange rates. The increase of Malaysia Ringgit against US dollar has been a contributing factor to the increase of project cost and require revision of existing contracts. Inflation and price increase in the cost of goods and services has caused disputes between contractors and client. Although escalation clauses are usually foreseen in the contracts, however, to reach an agreement between contractors and client will take times which will affect the project duration. This issues also can happen between contractor and material suppliers who provide long delivery items. When the project team, contractor, subcontractor and material suppliers are financially stable and can withstand the changes in prices and continue their work while discussing the issues with project owner. However, if they are not financially stable and unable to tolerate with the price change, they have no choice except to stop work. International investors turning from Malaysia due to the dropping of oil price. When Ringgit Malaysia slumping in year 2015, it is an advantage for companies who sold their product internationally, however, it is otherwise for companies who buying products outside of Malaysia. This is what happened to RAPID project where most products and services were from an international company. PETRONAS has planned to delay some facilities construction due to financing issues.

The reversal in the price will happen whether it will happen in two years, four years or six years' time. Even the oil price is low, it is important for oil and gas companies to continue investing. RAPID is expected to be completed in 2019 and it will require around 3000 employees. If investments were held back when the demand is rising up, the facilities owner may find difficult or unready in meeting the demands. Therefore, it is wise for project owner and other companies to have a contingency plan for an extended period of low oil price.

Usually, oil and gas projects are large in size, requires incentive capital investment and longer period of construction. When the oil price is low, the return on investment is also low and the payback period is relatively longer than before. Upon completion of the project, RAPID is estimated to generate RM18.3 billion Gross National Income (GNI) by the year 2020 and created 8600 highly skilled and high-income jobs (Kumar, 2016). Thus, any delay to the RAPID project would be a significant impact to PETRONAS and Malaysia GDP.

PETRONAS has officially announced the postponed of the completion date of the project for more than 3 times, from late 2016 to mid of 2019. The initial delay in RFSU (ready-for-start-up) was due to PETRONAS decision to revise the final investment decision (FID) from June 2013 to March 2014 where the completion date was a drag to 2016. In addition, the early delay is attributed to difficulty in securing water supply, Johor state government's housing scheme, issues with land acquisition and relocation of the villagers' settlement due to land and compensation issues (Mohd Isa, 2013).

7.3. Social Factors

From the literature review, interview session and reviewed documents shared during the interview session, it has been identified that social factors have contributed to the project delays at the earlier stage of the project. Table 5 showed the results in terms of social factors influence RAPID project implementation to delay

Table – 5 Social Factors Affecting RAPID Project

No	Social Factors	Description
1	Relocation of local resident and cemetery	Pengerang resident protest from being moved to new location
2	Loss of employment due to relocation of resident	Loss of small-scale and home business, jetties/ launch sites and agricultural land

The Final Investment Decision (FID) is a critical stage in PETRONAS decision-making process. PETRONAS undertook a review of the project, including independent third-party assessments to ensure it meets PETRONAS criteria for long-term profitable and sustainable growth. Therefore, PETRONAS need to postpone their FID until the social issues in Pengerang were solved. Respondent 1 explained:

“...Final Investment Decision (FID) kept postponing because there are still unresolved problems faced by the Pengerang resident where the project is to be built. One of it is some fishermen in the area still protesting and they don't want to move because they can get a better catch in that area...”

The reason for the delay included unresolved community problems over land access in Pengerang and the proposed relocation of cemeteries in the area as explained by both Respondent 2 and Respondent 1.

“... In addition to this, most of the villagers in the area reluctant to move too. Then there is also question on the relocation of Muslim and Chinese cemeteries in the area which was highly objected by the community. Even this issue needs to be managed by the state government, we cannot just sit down and wait for state government to settle the issues. We need to take action or RAPID project will further delays. We cannot take this risk...”

(Respondent 1)

“...The relocation of villages and Chinese and Muslim cemeteries should be done by the state government; however, PETRONAS have to facilitate the relocation of the resident. We need to manage social impacts in Pengerang. We need to get “social license” to operate. We have established Social Impact Assessment (SIA) and Social Impact Management Plan (SIMP) to manage the social impact...” (Respondent 2)

PETRONAS needs the “social license” to operate. Therefore, they need to create awareness among internal stakeholders on the importance of managing social impacts. In addition, they have proactively and continually engaged with the affected communities to mitigate any negative reputation risk and project disruption. Base on the documents shared during the interview, Figure 2 showed the social impact of the project. Because to the sheer size of the project, the social impacts are indeed significant.



Figure 2. Significant Social Impact in Pengerang

When PETRONAS get involved in the relocation of Pengerang resident, they have formed a committee to investigate the social impact on the project. Therefore, Social Impact Management Plan (SIMP) were developed to handle Community Health, Safety & Security, Stakeholder Management & Resettlement & Cultural Heritage as mentioned by Respondent 4:

“... We started our engagements, especially with affected communities at the early stage of the project. This includes Pengerang resident, government, media and also our internal staffs. We have to engage with them to brief about our plan, what can benefit them etc. It was not easy to convince Pengerang resident but we have to do our best...”

Because of social impact, PETRONAS has postponed the completion deadline of the project from late 2016 to early 2017. The FID was supposed to have been approved in mid-2013 have to postpone until first quarter on 2014. Ideally, the construction and engineering work for RAPID should start between 2015 and 2016 so that the project can be completed by 2018. It was noted that the power of the environmental group, local communities, and other interested parties has a big influence and even can disrupt the approval of mega projects (Taherkhani, et.al, 2014). Therefore, project owner has to take additional measure on the social cultural issues and has followed the Human Right Policy implemented to the company to ensure fairness to all individual.

The contractors recruited locals from the surrounding villages who were previously farmers and fishermen, as the construction labour. With more than 30% of labour constituted by locals, the use of unskilled manpower could potentially cause delays and affect project cost and quality of construction. To overcome this issue, PETRONAS invested substantial time and money in developing the capability of the local workforce as explained by Respondent 5.

7.4. Technological Factors

In developing strategic plans, technology is an aspect that should be considered (Adejoke & Olukayode 2007). An appropriate construction technology can be measured by the availability of locally made plant and equipment, skilled manpower resources, extent of local material resources and the degree of utilization of such local construction resources.

The technological factors affecting RAPID project can be classified in three main categories, which are inadequate infrastructure, skilled manpower resources, and local product resources as tabulated in Table 6.

Table – 6 Technological Factors Affecting RAPID Project

No	Technological Factors	Description
1	Inadequate infrastructure	Insufficient roadway Water management problem
2	Lack of skilled manpower	Contractor competency and knowledge
3	Quality of parts and end product	Insufficient local product that meets international standard.

The inadequate infrastructure mentioned at Table 4.5 is referring to provision by government in supplying water resources and the road access. Two of the interviewees mentioned that water resources are not sufficient at the early stage of the project and state government has not completed the water resources project. As articulated by Respondent 3

“... We cannot construct the plant at the full speed because of the water problem. Therefore, PETRONAS take over the water project in Pengerang and we do not rely on the government to run the project...”

The delay in securing water supply for the project forces PETRONAS to take over the water supply project from the Johor state government. A new dam with 88 km of pipelines has been constructed to provide raw water for the project. This dam will supply the project with enough water as well as provide additional raw water resources for general use to the community. This will benefit to 100,000 residents in Pengerang and Bandar Penawar. The Raw Water Supply Project for RAPID or better known as PAMER is under the development of PETRONAS Refinery & Petrochemical Corporation Water (PRPC Water). Respondent 1 mentioned:

“... The reason we take over the water project from the government not only because we want to expedite the construction of the project. This is also the decision made by management to manage the social impact to Pengerang resident...”

The infrastructure at the project location has to be set up from scratch and approximately about 32 separated infrastructure and public amenities project being implemented, including the upgrading of the existing dual lane single carriageway to dual lane and new construction of dual lane carriage. This was mention by Respondent 2 during the interview.

“... We cannot move our large machinery such as excavators, bulldozer, trucks and compactors for soil movement as well as transportation into the site. The current road needs to be upgraded from single carriageway with two lanes to dual carriageway with two lanes in each direction.... During that time, the temporary road has been constructed to facilitate project development....”

Limited existing infrastructure has caused PETRONAS to invest in the development of infrastructure to gain access to resources and also has slow down the project progress. The respondents mentioned that some contractors did not have the capability and knowledge in technologies related to oil and gas. Respondent 3 mentioned that the incompetent contractor has caused some package of the project delays and construction did not follow the specification as per drawing.

“...We tried to help this contractor in every single way that possible. PETRONAS welcome their participation by giving them a contract with the very minimum requirement. For me, this is best possible way to help this local contractor gain experience and knowledge when they involved in this mega project. The challenges are that they require time to be familiar with oil and gas technologies. This what makes the construction process counters difficulties. The current engineering and technology they were not familiar. Safety standard in oil and gas construction is much higher than the normal construction. We have brief them with all this requirement, technologies, etc before they join this project...”

This was supported by the Monthly Management Report shown during the interview. The construction progress for few contracts was fall behind the others. And some construction did not follow the PETRONAS Technical Standards (PTS). Respondent 2 stressed that:

“...We really particular when it comes to technical standard. We want them to meet our requirement. For your information, PTS is PETRONAS internal technical standards developed based on relevant national and international codes and standards. This includes our internal knowledge and experience to ensure fit-for-purpose application within PETRONAS facilities. But some contractor did not follow our PTS so they have received our “warning letter” ... and we asked them to stop work when we court them did not follow our PTS...”

VIII. CONCLUSION

The study has revealed several factors of delay that made the project fail to meet the delivery date. Four main groups have been identified which are political factors such as government support, GST, local content; economy factors such as slump in oil price and fluctuation in exchange rate; social factors such as cultural, ethics and religion, employment, multicultural environment; and technologies factors such as knowledge management system, inadequate infrastructure, production efficiency and geographical setting.

Social Factor was identified as the main contributing factors which make the RAPID project delay. RAPID project has been delays for three times due to the social issues related to Pengerang resident and this problem was not solved by the state government. The second factors affecting RAPID project is Economical Factors. It has been confirmed by the respondents that many infrastructure construction works were postponed or rescheduled to be developed later due to economic factors. The third delays factor in RAPID project is Technologies Factors as at the early stage of the project, many infrastructures needs to be built prior to commencement of the project.

Delay in oil and gas construction is a common problem in Malaysia. However, there is limited literature available discussed the external delay factors in oil and gas construction in Malaysia. This study has revealed several external delay factors. To avoid construction delays, it is imperative for project participants to identify the possible external factors that can cause delay. Once these factors have been identified, suitable preventive measures can be to countered the negative effects that may arise as a result of their occurrence. The project management team should improve the management of the project, especially as shown in RAPID project. Besides, delay related to external factors need to be identified in depth focus on specific country as each country has their own unique environment. Thus, future researchers can opt to do similar studies with quantitative approach focusing on external factors causes delay in oil and gas project.

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