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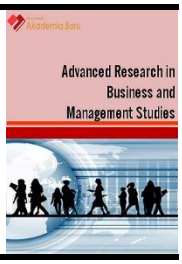

Effects of Delay in Construction Phase of Oil and Gas Projects in Malaysia

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ABSTRACT

Delay in project is a universal phenomenon and the effects of the delay can affect all involved stakeholders. Thus, most project management companies managing Engineering, Procurement, and Construction (EPC) contracts in oil and gas projects are optimising the activities to avoid any delays which can affect the entire project negatively. It is important to understand how the delay in the construction phase affects the oil and gas projects negatively and how bad the effects can be. This paper aims to investigate the effects of delay in the construction phase of the oil and gas projects in Malaysia. A systematic literature review (SLR) from various sources through books, conference proceedings, project management documents, and oil and gas industry journals were made to write this paper. Some effects of delays were categorised as the main effect and some as the sub effect. This initial study is based purely on literature review, comparison of similar cases, cross referencing, and critical judging. The effects of delay in the construction phase specific to the oil and gas projects in Malaysia should be further researched with focus only in the Malaysian projects and industry players in order to derive a good delay mitigation plan at later stage.

1. Introduction

Delay is a common occurrence in the construction industry, and it is not an exception for the oil and gas projects. Due to the complexity of the oil and gas projects with long construction cycle, huge financial commitments, and countless risks, it can greatly affect the completion of the project adversely. There is various causes of delay that affect the completions of oil and gas projects with the common ones being inadequate planning and ineffective project management and other uncommon examples which are specific to certain projects depending on project needs and geopolitical aspects [1,2].

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An information summary from world renowned Offshore Magazine, detailed that nearly USD 230 billion oil and gas projects in Nigeria, Kazakhstan, and Indonesia primarily and followed by Norway, Canada, Malaysia, Australia, Thailand, Ivory Coast and South Africa were deferred due to delays in decision making factors [1]. This clearly indicates that the delay in oil and gas projects affected projects not merely based on certain geographical location but worldwide. The oil and gas projects in Malaysia also experience delay due to late acceptance of agreements and financial constraints from the low oil price on upstream companies similar to oil and gas projects worldwide [1], changes in workflow or design of project at later stage of project cycle [3] and long waiting periods on critical decision due to formalities from governments [4].

2. Literature Review

A successful project can be managed with sufficient project control and the right personnel which will ensure the maximum output value from the project right from the beginning stages [5]. An unsuccessful oil and gas project affects all the personnel involved in the project or known as stakeholders and they are linked through contracts. Therefore, understanding the stakeholders in oil and gas projects and the types oil and gas project contracts are critical prior to going into the details of effects of delay in the construction phase to the oil and gas projects in Malaysia. The following sections briefs on the stakeholders who are involved, and the types of contracts used in the oil and gas projects to bind them.

2.1 Stakeholders in Oil and Gas Projects

The definition for project stakeholders given by The Project Management Institute (PMI) (2013) is individuals, groups, or organisations, who may affect, be affected by, or perceive themselves to be affected by a decision, activity, or outcome of a project. The stakeholders in a project may appear as numerous customer in the project and their interest may vary according to the levels of investment and interest [6]. The usual key stakeholders in oil and gas projects are the project owner or client, Project Management Team (PMT), Project Management Consultant (PMC), contractor, subcontractor, end-user which can be the client again for operations, equipment vendors and suppliers, insurance institute as well as financial institute [7,8]. Some of the stakeholders such as the financial institutes or insurance institutes may not be directly involved in the project but will support as external parties.

The project owner or client holds exclusive ownership rights to all oil and gas exploration and production projects and in this paper refers to PETRONAS in Malaysia [9]. It is important to note that the client may have a tendency to underestimate the cost of the project since they are responsible for securing the financial resources required for the capital investment [10]. It is critical that the competence and knowledge of the PMT is of high standards since they are responsible for managing the project on behalf of the client and entitled for ensuring project delivery [11]. The PMT ensures that the contractor carries out the work in accordance with both the agreed scope of work and the contract with the help of the PMC for specialist assistance when required [8]. Whether the services provided by PMC are adequate in ensuring that projects are completed accordingly within the budget is still debatable, even though PMC has become an important entity in the construction industry and the services have increased significantly in recent years [12].

The contractors are involved in the project as per the project client's requirements during the development stage giving inputs in the design, architecture and evaluation of the technology and hold the construction responsibilities during the implementation stage [13]. Meanwhile, the

subcontractors whom are specialised in the installation of the required systems as per the contract's specifications are involved in the implementation stage of the project [8]. In order to achieve successful results in the oil and gas project, both the contractors and subcontractor must commit to the quality process and have a productive attitude [14]. End user may vary in other industries, but in this paper for the oil and gas industry, it is the operators of the facility who focus on the running and maintenance of the facility. For the oil and gas industry, most of the time the client will become the operators but managed from another unit of the client's parent company, meaning there is one department to oversee projects and another to manage operations [15].

Providing materials and equipment as per the project specifications is the responsibility of the equipment vendors and suppliers whom are selected in the early stages of the project to ensure the suppliers are able to support the project initially and continue through with supply chain and operations [16].

Additional costs incurred due to incidents that may occur to either project personnel or equipment during project implementation falls under the responsibility of the insurance institutes [8]. Prior to engaging the insurance institute and selecting the coverage, the costs are usually estimated based on rigorous risks management analysis that takes into consideration the project type, size and complexity of the project by identifying all the relevant risks involved in the project and to cover all stakeholders in case of any issues [17].

The loans that aid in covering the huge financial commitments of projects are provided by the financial institute and estimating the amounts of these loans based on the risk associated with the projects as well as defining the policies that secure the lending terms based on projects feasibility, market conditions and securities are the scopes of the financial risk consultant [18]. The financial institute will be very analytical in the selection of projects, identifying the risks and understanding who the key stakeholders are prior to facilitating the finance since their main aim is to invest and generate returns [19].

Since the number of stakeholders on a given project varies based on the project type, size and complexity of execution, it is substantial to identify project stakeholders at an early stage, analyse their level of interests, level of involvement and possible influence on project completion, regularly review and update this early assessment and properly manage the relationships between them to avoid unexpected mistakes and ensure smooth project progress [20]. The concept of stakeholders and their input in the project management is still a fundamental part of project management, however studies show that there is still room for improvement in the stakeholder theory and management practices [14,15,21]. Figure 1 depicts the professional interaction between the stakeholder based on the understanding of the stakeholder management for the oil and gas projects observed by this paper.

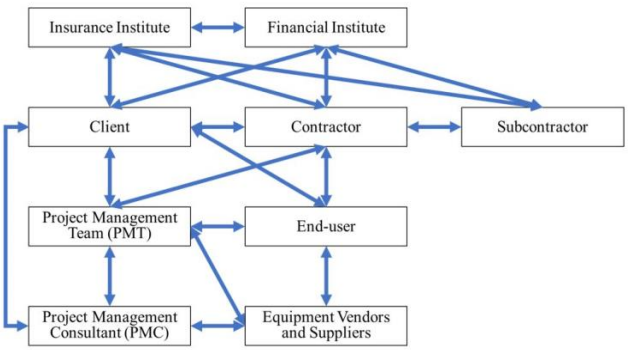

Fig. 1. Stakeholder professional interactions for the oil and gas projects

2.2 Oil and Gas Project Contracts

Oil and gas projects worldwide are managed through various types of contracts which includes Engineering, Procurement and Construction (EPC), Engineering, Procurement, Construction and Management (EPCM), Engineering, Procurement, Construction and Installation (EPCI), Engineering Procurement Installation and Commissioning (EPIC) and Lump Sum Turn Key (LSTK) [5,13,22]. Work Breakdown Structures (WBS) are used for some of the oil and gas mega projects with extensive scope of work, such as onshore, offshore, subsea and topsides, where the contracts issued based on the work scope and area which means that the project will have multiple contracts [23-25].

The EPC contract is the most common type of contract used to manage construction works on complex and large-scale oil and gas projects where the contractor agrees as per the EPC contract to deliver a complete facility with an agreed costing, within schedule and according to the specification set in the contract with the developer [26]. According to the EPC contract, the EPC contractor will deliver the keys of the commissioned plant to the owner for the agreed amount signed in the contract similar to a house builder, handing over the keys to the house owner after completion. It is an accepted practice in the industry that both scope of installation and commissioning in a project are covered in the EPC contract even though both the terms are not included in the definition. The contract covers all aspects from the point of the client deciding on the location for the facility and the requirements for the project in terms of scope and the specifications of the facility, quality, project duration and cost, and finally with a law binding agreement between the client and the contractor [26,27].

Some of the advantages of using the EPC contracts are manging the schedule with a fixed completion date, focal point of responsibility, contractor's liability issues, as a form of security if the contractor breaches the contract or does not comply, giving the contractor the right to order variations agreed by the client [8, 26, 28]. The EPC contract can also include for the contractor's obligation to repair defects that occur in the 12 to 24 months following completion of the performance testing, giving the owner full authority over all the intellectual property used in the execution of the works and as an insurance to the performance specification that details the performance criteria that the contractor must meet, but does not dictate how they must be met [8,26,28].

Some disadvantages to the EPC contract are that it can result in a higher contract price than alternative contractual structures, mainly due to the construction risk to the contractor, building contingencies into the contract price for events that are unforeseeable or unlikely to occur and extra risk assessment from the client to ensure the unlikely risks are not included [29,30].

2.3 Effects of Delay at the Construction Phase to the Oil and Gas Projects

Effects of delay at the construction phase are the impact that it causes to the project, such as failure to achieve targeted time, budgeted cost and specified quality [31]. Usually, when the projects are delayed, the schedule are either extended from the initial plan or accelerated and therefore, incur additional cost [31,32]. From previous studies that were conducted, it is common understanding that time overrun, cost overrun, disputes, arbitration, litigation, and total abandonment were the main effects of delay at the construction phase [31-36] . Most of the studies conducted by others also stated the similar effects as per mentioned but the only variance is on the ranking of each effects.

Some studies showed a minor difference in the effect of construction delay, which included additional points, namely reduction in profit for the contractor, non-productivity loss for the owner, distrust with contractor, delay in the progress payment and loss of market value of the contractor

[32,33]. Based on these findings, the frequency, and the ranking of the effects of construction delays are shown in Table 1.

Table 1
Frequency of the effects of construction delays

Delay Effects	Sambasivan and Soon [31]	Kikwasi [33]	Amoatey *et al.* [34]	Divya and Ramya [35]	Khattri *et al.* [36]	Kumar [28]	Highest Frequency	**Ranking**
Abandonment	x			x	x	x	4	**3**
Arbitration	x	x	x	x		x	5	**2**
Bankruptcy		x					1	
Cost overrun		x	x	x	x		4	**3**
Delay in the progress payment						x	1	
Delaying by the client to return the loans		x					1	
Delaying in getting profit by clients		x					1	
Disputes	x	x		x	x	x	5	**2**
Distrust with contractor						x	1	
Idling resources		x					1	
Lack of continuity by client			x				1	
Lawsuit					x		1	
Litigation	x		x	x	x	x	5	**2**
Loss of market value of the contractor						x	1	
Negative social impact		x					1	
Negotiation					x		1	
Non-productivity loss for the owner						x	1	
Poor quality of work due to hurry		x					1	
Reduction in profit for the contractor						x	1	
Time overrun	x	x	x	x	x	x	6	**1**

3. Results and Discussion

The method of content analysis via a systematic literature review (SLR) was conducted to identify and classify the list of critical activities by combining results from relevant sources [37]. This initial study is based purely on literature review, cross referencing, and critical judging which does not require primary and complex data collection via survey method. A content analysis was conducted by conceptual analysis, focusing on specific code in the literature review and collecting them to be tabulated [38], where for the purpose of this study, delay effects of the construction phase to the oil and gas project is selected as the code.

From Table 1, it can be concluded that the highest effect of delay in construction is time overrun, followed by arbitration, disputes, litigation, abandonment, and cost overrun. Other effects of delay

that record low frequency are further grouped by this study as delay consequences for client (namely delaying by the client to return the loans, delaying in getting profit by clients, lack of continuity by client and non-productivity loss for the owner), delay consequences for contractor (namely delay in the progress payment, distrust with contractor, loss of market value of the contractor and reduction in profit for the contractor), delay consequences for project (bankruptcy, idling resources, lawsuit, negative social impact, negotiation and poor quality of work due to hurry) which are depicted in Table 2 and will be used for the purpose of this paper in developing the questionnaire survey.

Table 2
List of effects of delay of the construction phase, DE – Delay effects

	Delay effects of the construction phase
DE1	Abandonment
DE2	Arbitration
DE3	Cost overrun
DE4	Disputes
DE5	Litigation
DE6	Time overrun
DE7	Delay consequences for client
DE8	Delay consequences for contractor
DE9	Delay consequences for project

4. Conclusion

This paper is based purely on literature review, comparison of similar cases, cross referencing, and critical judging via a systematic literature review (SLR). The initial findings concluded that the effects of delay at construction phase to the oil and gas project as abandonment, arbitration, cost overrun, disputes, litigation, and time overrun as the main effects and delay consequences for client, delay consequences for contractor, and delay consequences for project as the secondary effects. None of the effects of delay at construction phase to the oil and gas project has been identified as critical at this point of the research of this study and will be further reviewed with questionnaire survey. The delay effects of the construction phase to the oil and gas projects specific to the oil and gas projects in Malaysia should be further researched with focus only in the Malaysian projects and industry players. The understanding from this paper will assist in researching the mitigation plan on the delay effects of the construction phase to the oil and gas project in Malaysia.

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