Factors Influencing Project Delay: A Case Study of the Vale Malaysia Minerals Project (VMMP)

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***Abstract*— Delays are one of the biggest problems faced by the construction industry. Delays in construction projects have significant financial and social impact to parties involved in the projects. The main objective of this study is to explore the causes of delay in the Vale Malaysia Minerals Project (VMMP) in Lumut, Perak. This study was conducted by using a qualitative approach. A series of face to face interviews were conducted with an expert from the construction organization and VMMP staff. Responses were analysed qualitatively using content analysis. The results revealed that several factors contribute to the delay in VMMP completion, i.e. poor communication, delays in material delivery, and poor management on site, etc. Time and cost overrun were the effect of delays in the construction project. The findings of this study will help project managers and/ or the client to take necessary actions and to use of supply chain management techniques to avoid further delays in future project completion on construction projects.**

***Keywords*—** *Delays, construction, Vale Malaysia Mineral Project, supply chain management, Case Study*

1. Introduction

The construction project is a complex task which requires the full commitment of the project team, comprising from different disciplines, to carry out the multiple task and interrelated functions of planning, design, costing, engineering and production [22]. The project team are namely, architect, engineers, quantity surveyors, main contractors, sub-contractors and suppliers commissioned on a project and often sometimes are unaccustomed to working with one another and thus, project activity imposes a special demand on team building and motivation. Hence, completing projects on time is an indicator of an efficient and successful planning and to the specified quality standard [7].

Further, the construction industry is a key participant in the economy, generating both employment and wealth. Nevertheless, many construction projects experience extensive delays and thereby exceed the budgeted time. Unfortunately, it is common for projects not to be accomplished on time and within the original project budget. Delays on construction projects are a universal phenomenon which occurs in the majority of construction projects, the magnitude of which varies considerably from project to project. Project delays are a common problem not only with an immeasurable cost to society, but also with debilitating effects to the contracting parties [30]. Project delays are a reoccurring problem and have negative impacts on project success in terms of time, cost, quality and safety [3]. To minimize these impacts, identifying the most significant factors influencing project delay is vital.

2. Construction Delays

Construction delays can be defined as the late completion of work compared to the planned schedule or contract schedule [32]. Assaf and Al-Heiji (2006) [4] in their studies defined delay as the

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time over run either beyond the completion date specified in a contract or beyond the date that the parties agree upon delivery of a project.

Numerous numbers of literature investigated the causes of construction delays. Alaghbari et al., (2007) highlighted that the construction delays are the most common, complex, costly and risky problem encountered in construction project. The owner and the contractor both have different main objectives in a project. The owner largely insists to complete the project within the stipulated time and cost, whilst the contractor needs to complete the project in time to maintain their profit margin. The lawsuit is the final result when disputes persits and claims cannot be settled. Common delays factors caused by the client is continuing change of drawings and specifications, change of orders, claims conflict which may lead to a court battle and consumes a lot of money and cause financial problems to the client and the contractor. Meanwhile, on the contractor side, delays are generally caused by lack of management skills, poor planning and managerial skills, failure to understand accounting and financial principles which have led to bad reputation and performance of the contractors.

A study by Majid (2006), reveals that delays in construction projects can be minimized when the causes are identified. He defines delays as a situation the construction players, i.e. the contractor, consultant, and the client jointly or severally, contributed to non-completion of the project within the original agreed contract period.

Many researchers and practitioners have recognised the potential of Supply Chain Management (SCM) as a way forward for the construction industry [15], [16] & [24]. Existing research also supports the fact that the SCM benefits client and contractor organisations [23] & [5] and SCM appears to have the potential for achieving better project time performance [26].

3. Supply Chain Management (SCM) in Construction

SCM is a concept that originated and flourished within the automotive manufacturing industry and has gained the attention of the construction industry. It emerged in the late 1990‟s [23] and has been the focus of construction industry ever since. SCM has been defined by [8] as, “The management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole”. Contrasting traditional practice, SCM promotes competition between supply chains, not merely single entities [17], which motivates all parties to be competitive and productive [19].

SCM prescribes organizational restructuring and extending achievement throughout organizations. It is a philosophy that proposes improvement in the organization’s operation by including the elements of integration [36], coordination [35], communication [13], information [12] and control systems to create more value out of every process. SCM is said to be better than traditional practice in various aspects, such as reduced inventories, sustained improvement, cost efficiency, speedier operation, improved information flow, higher coordination and shared risks and rewards.

In Malaysia, SCM has a great potential for the local construction industry, especially for public sector projects which experience the most delays. In light of the success of its application within the UK‟s Ministry of Defence (Pearson, 1999), there is some optimism that SCM could similarly benefit the Malaysian construction industry.

4. An Overview Of Vale Malaysia Minerals Project (VMMP)

The Vale Malaysia Minerals Project (VMMP) is a mega project located in Lumut, Perak which started construction in November 2011 and has been successfully completed in September 2014 albeit many problems it faced during the processes. VMMP is basically a stockyard facility for iron mineral for Vale SA Inc. which is a Brazil-based company and one of the largest mining companies in the world. Vale has decided to open up a stockade and distribution centre in Malaysia to cater for the demands of the Asian market. This is a strategic move by the company to strengthen its market position in the Asian region. The project is divided into two main components, which are onshore and offshore. For offshore construction, the works include the construction of 2 km jetty, erection of transfer towers, conveyors, ship unloaders, ship loader machine as well as one substation. For onshore construction, the works include the construction of main substation, transfer towers, conveyors, stacker and re-claimer

machines, lifting stations, warehouses, pump houses as well as ponds. This case study will focus on the onshore construction only.

The budget allocated for the whole project was around USD 1.4 billion, which is approximately RM5.89 billion based on the current exchange rate. However, for the onshore mechanical erection package, the contractual sum was RM 94 million initially, but rose to RM124 million figure as a result of extension of time and variation orders in the contract amendment.

4.1 Project Timeline

The project started in March 2011 with the engineering works followed by the construction of Material Handling Quay (MHQ) in July 2011 and was successfully completed in September 2014. Overall duration of the project was around 3 years and 3 months. For Onshore Mechanical Erection Package, the mobilization of resources was supposed to be completed by end of December 2012 while completion of erection works should be on 15th February 2014 as per the original contractual agreement. However, the actual completion date for this package only occurred in September 2014, seven months later than the original contractual date.

5. Methodology

To meet the aim of this study, getting help from experienced people in the field of construction was essential. The sample for this study was selected using purposive sampling technique targeting individuals with specific experience, criteria, characteristics or knowledge that would allow the underlying themes, or phenomena, be best understood [1], [11] & [9].

5.1 Research design

A series of face-to-face interviews with experts have been selected for this research. The target population will consists of main contractor and staff of VMPP. The unit of analysis [6] & [10] of the sample was the individual who was a senior manager in the organization. The number of respondents to be interviewed can be derived once data saturation is achieved [18] & [2]. This can be determined by observing the situation whereby the data collected from the respondents do not provide any new information, but just repetitive information. Thus, once this stage is reached, the number of respondents required for the interview is sufficient.

The interview protocol was designed using an open-ended questionnaire to achieve the objective of this study, and it is classified into 2 sections:

- Respondent background - We are trying to obtain the respondents' background information such as their organization, position and years of experience.

- Cause of construction delays - This section will evaluate the delay factor listed in the interview protocol derived from a literature review. There are seven groups in total, of causes for delay in a construction project:
  - Communication
  - Material
  - Contractor
  - Labour
  - Project Management Consultant (PMC)
  - Equipment & manpower
  - Management interface

5.2 Data Processing and analysis

Data collected were analyses using the content analysis, where the researchers went through the whole text to make a sense out of the scripts. This was done manually since the sample of ten (10) respondents was a small number to manage. In this study, theoretical saturation was established in the tenth interview.

6. Results & Discussion

Based on the findings from content analysis, seven delay factors were discussed in the following section. The findings also reveal that no new factors discover from the interview conducted.

6.1 Delay Factor 1: Communication

One of the major causes of the problem is the communication amongst the multi-cultural project team. The project team consisted of members from countries like India, Germany, Brazil as well as Malaysia. The design team for the whole project, Essar, is based in India, with only a small amount of the engineers were stationed on site to assist the contractors. The erection contractor, PLOG, is also from India. The design team for the conveyor system, Beumer, is based in Germany with small amount of engineers mobilized to site to clarify any

issues raised during the construction works. The client is originally from Brazil while most of the managers in the project management team (PMC), namely Arcadis, where Brazilians as well.

As the project team members operated in different part of the world, virtual communication (i.e. E-mail and tele-conferences) was chosen as the communication medium while on site team usually meet face-to-face for discussions and progress meeting. Due to the virtual communication medium, the response time lag is quite high from both Essar and Beumer due to the time zone difference while it was found out that the frequency and response time from team in India was quite poor indicating communication barrier among the project team. The trend towards steadily expanding utilization of technology to assist communication can be productive and unmistakably spares costs, however, comes with a price with face-to-face communication is proving to be the most effective and preferred way of communicating [28].

6.2 Delay factor 2: Material

Delayed material delivery to site is definitely one of the major contributing causes for the delay. As part of their contracting strategy, the procurement team had split the supply package into two suppliers in order to mitigate or reduce project risks. For pipe and cable rack structure, a Malaysia-based Company, Eversendai was contracted to fabricate and supply the 5,768 tons of the structure. Although Eversendai is a local company operating in Rawang, Selangor, the delivery of the fabricated structures to the site still suffered significant delay due to their limited operating capacity, lacks of commitment and inability to paint the structures in time for delivery. As for conveyors and transfer tower structure, the contract was awarded to Beumer, a Germany-based Company, with the 16,764 tons of steel structure was being fabricated in China while the mechanical parts for the conveyors are being supplied from Germany itself. As the production location for the this contract were both overseas, the steel structure from China and mechanical parts from Germany were being shipped by sea-freight by the suppliers contributing to further delay to the work package.

6.3 Delay factor 3: Contractor

In PLOG's context, their commercial proposal for the project had the lowest price among the two other bidders which then eventually accepted and PLOG then contracted to carry out the onshore mechanical erection package. The thing is, lowest cost usually does not translate to performance. A selection of contractor based on cost may cause future problems to project performance [29]. A single attribute, in this case, the bidding price, cannot give the full picture of the goals that the stakeholders are trying to achieve [37]. Along with the bid price [37] suggested some other criteria to assist the selection process in their proposed model such as contract duration, guarantee period, experiences of contractor, total of works performed by contractor, communication as well as quality of works. These criteria should have been used by the procurement team to determine which bidders deserve to be contracted to carry out the works even though their bid might not be the lowest. Instead, for VMMP, the procurement team opted with PLOG who submit the lowest bid, which of course in the end backfired as the contractor failed to deliver the onshore mechanical erection package on time.

6.4 Delay factor 4: Labour

The essence of formulating productivity is very straight forward, a ratio of the level of output over level of input [27]. Productivity is a very important factor to be considered especially for labour intensive industry such as construction [34].

Additionally, the workmanship of the foreign workers was generally poor if compared to the acceptable workmanship standards due to their poor skill levels, hence producing poor quality of the works [14]. Poor workmanship leads to low productivity as the workers needed a much longer duration to perform the tasks as executed tasks needed to be repeated in order to rectify the poor workmanship issue. Similarly, lacks of supervision by the site engineers also lead to low productivity as the gang of workers inclined to take as much time as possible to execute given tasks. Due to these influencing factors, the main conveyor structures were not ready in time, which contributed to the delay of the package.

6.5 Delay factor 5: Project management consultant (PMC)

In PLOG's case, poor site management was evident with the project managers appointed proved to be incapable and incompetent in managing the site activities. The project managers from the company

were requested and demanded to be replaced a total of three times by the project management consultant (PMC) due to their incapability and incompetency. The reasons were the incapability to meet the datelines, poor HSE management on site, poor coordination within the site management team as well as the slow progress on site. Agreed datelines in the progress meeting kept on being re-scheduled by the project managers from one week to another due to the slow progress of works on site while some of the site engineers were not even aware at all with the datelines indicating poor coordination within the site management team.

6.6 Delay factor 6: Equipment and manpower

Mobilization of manpower and equipment is also identified as one of contributing causes to the delay. As PLOG is originally from India, they have chosen to mobilize the manpower of their home country for this project as part of their project execution strategy. Unfortunately, the full mobilization process took longer than anticipated, three months after the project has started, due to the tedious immigration procedures which the company was unaware of.

As for the equipment, the company also faced great difficulty to obtain the supplies from the local market (i.e. Lumut) as the local suppliers do not have the capability of supplying a large amount of mobile cranes, skylifts and 40-feet trailers which are required to meet the project's demand. In order to solve the problem, the company had to look for suppliers from Kuala Lumpur to supply the equipment which then further contributed to the delay of the mobilization processes.

6.7 Delay factor 7: Interface management

Interface among contractors during the construction phase is very common as the project team cannot afford to wait for the other contractor to finish their work in order for them to start with theirs. In PLOG case, the interface was with the civil contractor where they require the release of civil foundations in order to commence the erection works. At the same time, there are still ongoing civil works in the same area due to the partial handover. Additionally, there was also interfaced with the electrical contractor in which the cable tray installation and cable pulling activities take place concurrently. In the end, the intensified interface was poorly handled which then resulted in the delay.

7. Conclusion

Delays in construction projects may have different reasons that should be studied by taking different approaches. The aim of this study was to identify causes of delays in the Vale Malaysia Minerals Project (VMMP). Qualitative interpretation enhances understanding of delay causes associated with project management, logistics, and technology issues. Managers have a significant role in dealing with delays. Their management styles may contribute or mitigate delays in projects. Managers should distribute responsibilities evenly among team members and give them a level of authority to increase the agility of the firms against unpredicted matters that may cause delays. Planning an effective schedule based on actual data is a key in identifying delays and mitigating their impacts. Without a correct schedule, firms are not able to distinguish delays and this will lead to a long time-overrun in projects. This paper argues that, although utilising new technologies and methods of construction may help to reduce the overall time of construction, without adequate training, they can cause delays for projects. Customer service support and availability of the skilled labourers are key issues that should be considered before utilising new technologies and methods of construction. Findings therefore, support the necessity for the client or owner of the project to initiate SCM implementations towards revolutionizing current practices and shifting away from the inefficient conventional working traditions.

In conclusion, there are many causes of the problem identified in the Vale Malaysia Minerals Project (VMMP). This paper suggests that special attention paid to factors identified in this study will help industry practitioners in minimising the risk of delays in projects. Some of the causes could have been mitigated with extensive and careful planning and control processes while some might require a systematic approach to the issues and proposing an SCM to facilitate improvements in future projects. Future work on the matter can be on how the SCM concept can help to assist the project teams in dealing with the problem and its causes.

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