

Cost Overruns in Engineering Procurement Construction (EPC) Fabrication Oil and Gas Megaprojects in Malaysia: The Issues of Resource Allocation (5M)

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Abstract

Every project involved in oil and gas fabrication erected onshore usually experiences cost overruns. This cost overrun is closely related to the use of machines, manpower, methods, money, and materials (5M) in order in a project where all these resources require a good financial cycle. However, these cost overruns often occur due to improper management planned resource allocation. Therefore, this study was aimed to examine the issue on mismanaged resource allocation affected cost overruns specifically in oil and gas fabrication projects as a preliminary study. Semi structured interviews with ten (10) qualified specialists in the Engineering Procurement Construction (EPC) projects from the Oil and Gas industry were conducted for strengthening the assistance of the cost overruns issues. In accordance with the results of the expert's interview, there are several factors that contribute to project cost overruns, including inconsistent resource allocation to project activities, financial constraints, a lack of suitable resources, and difficulties obtaining resources that are compatible with project objectives. By using the ATLAS-ti to study the networks, it was revealed that money had a greater impact on the allocated resources and the issue of budget or money allocation that does not meet project requirements is a major issue which led to cost overruns. In conclusion, safety, time, quality, and cost are the key considerations for determining the success of the project performance for all projects that are managed by project management in conjunction with numerous phases that are involved from the project's beginning until it is successfully completed in accordance with contractual agreement. Cost or money is one of the most important aspects to pay attention on.

Keywords: Cost Overrun, Resource Allocation 5M, Engineering Procurement Construction (EPC), Oil and Gas Fabrication Megaprojects

Introduction

The oil and gas industry is one (1) of twelve (12) in the National Key Economic Area (NKEA) that Malaysians have identified as being globally competitive and serving as the primary driver of economic growth. The oil and gas industry is divided into upstream, midstream, and downstream (Ismail et al., 2014). The petroleum resources of Malaysia are managed by Petroliaam Nasional Berhad (PETRONAS) (PETRONAS, 2019). For Malaysian Assets, International Assets, and Centers of Excellence (CoE), Development and Production (D&P) combines development and production functions, resulting in the execution of world-class operations values (PETRONAS, 2019). Several structures are delivered as part of the Oil and Gas Fabrication project to meet the needs of customers all over the world. The Oil and Gas Project looks at the concept's definition, application, and stages of development.

There are various aspects that influence the entire cost of the project, regardless of the Oil & Gas fabrication project. Huge construction projects have drawn a lot of scholars due to their complexity and financial requirements which they address it as a major cost issue (Derakhshanalavijeh & Teixeira, 2017). Therefore, onshore fabrication projects for the oil and gas industry typically require a substantial capital investment. Direct activities are defined by discipline or scope, whereas indirect activities are determined by the construction phase's planning and execution stages (Suppramaniam & Ismail, 2019). According to Aldhaheri et al., fabricators manage the way they acquire materials and manpower to optimise project value while profiting from Engineering, Procurement, and Construction (EPC) project activities (Azadeh et al., 2016).

Lack of project management and cost monitoring of resource allocation currently during fabrication operations which contractor site management and financial management are considered separately. These issues must be improved to keep rising the under control construction costs (Rahman et al., 2013). Malaysia's economy grows and develops as a result of the country's construction industry. Despite this, projects in the sector frequently incur cost overruns, such as negative cost variances, in which the total cost of the project exceeds the agreed-upon amount (Shehu et al., 2014). According to Shah, improper contractor planning, poor site management, and poor contractor experience are the leading causes of Malaysian project delays and cost overruns (Shah, 2016).

The main contractors or fabricators in the Oil and Gas structure are also entitled to cost overruns and delays that negatively impact their profit, satisfaction, and reputation. Cost overruns are common in the construction industry, and the Oil and Gas fabrication project is no exception, suffering from cost overruns due to mismanagement of resource allocation. According to Suppramaniam and Ismail, cost overruns continue to be a major concern in Malaysian oil and gas megaprojects (Suppramaniam & Ismail, 2019). Then, through a variety of high-quality project fabrication activities, an integrated in-house service for Project Management, Procurement, Engineering, Construction/Fabrication (EPC) is provided. The various phases of oil and gas fabrication project processes are improved by emphasising planning, human resources, and performance monitoring (Suppramaniam & Ismail, 2019). The findings of this study can be used as guidelines for managing EPC projects, particularly Malaysian EPC projects in the oil and gas industry, in order to avoid and minimise cost overruns. The ATLAS.ti software was used to analyse qualitative data extracted from interview transcripts in gather the issue of the resource allocation in onshore Oil and Gas fabrication project.

Literature Review - Study on Worldwide Cost Overruns in oil and gas EPC project

Cost overruns in projects have been extensively researched over the years. They are a significant issue for most Korean EPC contractors, who are currently suffering from massive deficits and losses due to implementing mega offshore EPC projects to fabricate oil and gas production facilities (Jo et al., 2018). As a result, issues such as project schedule mismanagement and applying the Theory of Constraints (TOC) have become essential in managing material procurement, resource competition, and buffer management. The interpretation can be as resource allocation being controlled to meet the project's deadline. As a result, effective decision-making was required to overcome all constraints.

Excess costs in fabrication projects are a common issue that harms project performance, and Iran's Gas-Oil construction projects are no exception (Derakhshanalavijeh & Teixeira, 2017). This problem is usually stemmed from project management that deals with these contributing factors: inaccurate cost estimates; poor planning; frequent design changes; insufficient labour/skill availability; and price inflation in machinery, labour, raw materials, and transportation. An efficient resource management, that deals with the request for manpower, material, machinery, method, and money, will determine the success of a project in terms of controlling considerations and strategies.

For example, Chevron, Woodside, BG, Santos, and Exxon Mobil experienced a total of \$25 billion in cost overruns in Australia alone in 2012 (Olaniran et al., 2015). It is evident that cost overruns in oil and gas megaprojects are a persistent issue. Thus, no matter the type, location, size, scope, time and costs, or critical concepts, the Chaos Theory in project management knowledge should be considered. Many researchers are interested in large construction projects with high complexity and capital requirements because they address fundamental cost issues. The problem contributes to sensitive reliance on initial conditions, positive feedback, and strange attractors in the mechanism. The issues and contributing factors depict project management chaos and resource allocation for each task.

Lorentzen reported an average cost overrun of 64% on global projects in the oil and gas industry. Megaprojects (> 1 billion USD) in the EPC industry, particularly in the petrochemical and oil and gas industries, have experienced issues with project size over the last decade, which have contributed to diversion, complexity, and priority (Lorentzen, 2017). These loads and delays frequently impressed the contractors. These variables represent some project characteristics under the control of clients, consultants, and contractors. As a result, project size and complexity necessitate all stakeholders' engineering expertise and dynamic management to achieve the success of a project.

Literature Review - Project Management in oil and gas EPC project

Due to material and labour shortages, bad weather conditions, unstable political settings, insufficient financial reserves, probable inflationary impacts on project costs, and the short-term nature of most construction projects, maintaining a solid project structure is increasingly difficult. Despite these insurmountable obstacles, it is nevertheless feasible for a project manager to regularly provide excellent project results. The chance of completing a project can be increased by adding project management feedback that is relevant to the success in the execution plan. Changing the focus of resources from one job to another can also be an alternative. Such decisions are frequently required at various stages of the project life cycle: (i) conceptual, when the project manager is concerned with the total cost and project feasibility, as well as tender appraisal; (ii) submission, when contractors are concerned with preparing reasonable and economical price estimates that must match with project resource

requirements; and (iii) operational, when site and contract managers must deal with the realities of daily operations. The resources provided to a project determine the construction method(s) (Ugwu & Tah, 2002)

Project management is precious in the oil and gas business in science, technology, and engineering (Al Subaih, 2015). In general, a project's life cycle defines the resources required in each phase, as well as the precise work that must be accomplished at each stage. (Kannimuthu et al., 2019) imply that various execution strategies are conceivable by varying production processes, materials, and crew numbers.

Research Methodology

The first phase entails reviewing previous literature reviews based on field of study. The purpose of a literature search is to obtain on the current cost issues in addition to identifying the problem and research gap. Thus, a comparable research area was conducted through synthesizing the outcome of literature search on identifying the issues in managing the oil and gas industry focus at onshore fabrication of oil and gas megaprojects in Malaysia. This stage extracts resource allocation issues and contributing factors related to managing oil and gas projects in fulfilling resource allocation. Secondary data sources for this study will include journals, articles, conference papers, annual reports, and books (Sveno Brinkmann, Steinar Kvale, 2018). The purpose of the comparable research area in identifying the resource management issue concluded by Farrah et.al asserted that the increase in costs mainly occurred due to a lack of managing resources and poor resource allocation, was identify occurred at the procurement level (Rina & Roshdi, 2022). Therefore, qualitative research methods via case study among the interpretive was chosen because it is detailed, rigorous, and systematic while still allowing for flexibility and freedom (Roshdi et al., 2021). The case study goes through four major stages in analysing the cost overrun issue, beginning with the creation of open-ended questions, and ending with the analysis of survey data (Brinkmann & Kvale, 2018)

Study on Malaysia oil and gas EPC Project

The following are some of the reasons why substantial investigation on Malaysia oil and gas EPC projects is required:

- Natural gas and petroleum EPC projects are large-scale EPC projects carried out in a complex and demanding international environment.
- EPC execution is expedited, taking anywhere from a few months to two or three years.
- The project management team is made up of individuals from various backgrounds, levels, and hierarchies.
- There are no rules or policies in place for the team or execution. Project management should be done in a variety of ways (Van Ban & Hadikusumo, 2017).

Questionnaire Survey Draft

Open-ended question interviews were conducted with ten (10) randomly selected experts with experience in EPC projects (Van Ban & Hadikusumo, 2017). In order to support the data of the research problems and issues, there are three (3) Engineering experts, four (4) Procurement experts, and three (3) experts from the Construction phase for oil and gas fabrication projects. The interviews were carried out until saturation was achieved. The case study was used to strengthen the issues of cost overruns in the oil and gas industry in resource

allocation by analysing the data using open coding, axial coding, and selective coding (Roshdi et al., 2021; Flick, 2018)

The opening interview question were as follows

Q1.To identify the issues of resource allocation management (5M) under Project Management in EPC Onshore Fabrication projects.

The purpose of the study, as well as the significant effect(s) of common resource allocation issues that result in cost overruns on EPC project performance, were explained to the interviewees (Roshdi et al., 2021).

As displayed in Figure 1, the case study is processed through four main phases in analyzing the cost overrun issue, which covers from forming open-question until the analysis of the survey data.

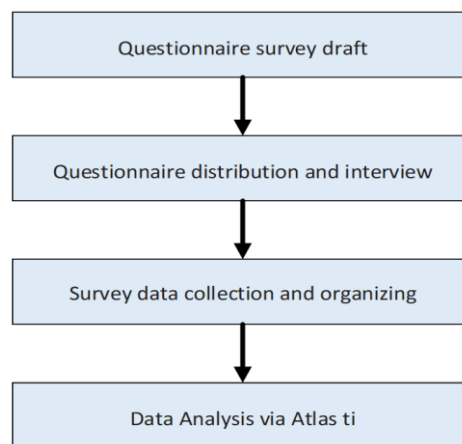


Figure 1: Data Collection Flowchart for EPC Onshore Fabrication Project

Semi-Structured Interview Form Distribution and Interview

Data was also gathered from a variety of sources, including engineering, procurement, and construction (EPC) experts via semi-structured interviews and a literature review (Uwe Flick, 2018), For this study, a questionnaire was developed that focused on respondents' ideas and opinions on resource allocation issues in EPC projects. Interviews with qualified people with EPC project experience were recorded.

The participants were selected based on the following criteria

- Project Team in Engineering, Procurement, and Construction (EPC) phase for fabrication projects.
- Individuals involved with Onshore Fabrication Projects which are operating on land areas, not offshore.
- Individuals involved in Engineering Procurement Construction (EPC) contracts

Survey Data Collection and Organising

All survey data (document number) were collected and gathered. The interviewees hand wrote the survey data that was collected. The data was then converted into text format for further data analysis. The survey data was transferred and organised into a formatted Excel spreadsheet with prefix headings in each column indicating the required variable to be highlighted in the research (Friese, 2019).

The Methodology, Findings, and Discussion sections were organised according to each step of the assessment process, enabling the readers to clearly understand how the data were processed and follow the implications of the process and results. The data analysis phase is shown in Figure 2.

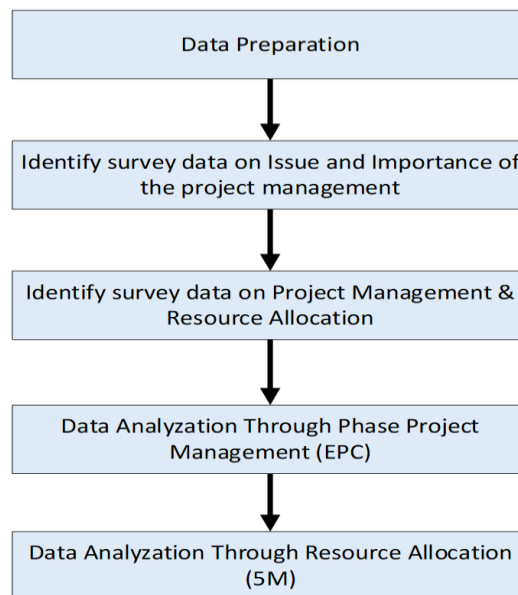


Figure 2: Data Analysis Flowchart for EPC Onshore Fabrication Project

Analysis and Findings

The ATLAS.ti software version 9 was used to perform thematic analysis on all of the formatted and organised survey data (Friese, 2019). The analysis of the information gathered from the interviewees included a coding process to determine the significant impact of resource allocation issues on EPC project performance (Roshdi et al., 2021).

The methodology presented in the manuscript illustrates one approach to using qualitative analysis of survey data. The sections Methodology, Findings, and Discussion were organised according to each step of the assessment process, allowing readers to clearly understand how the data was processed and follow the implications of the process and results (Roshdi et al., 2021).

The survey data were gathered via semi-structured questionnaire, which involved participants among the experts of EPC. The participants answered all questions which focus on the issues of resource allocation in the Oil and Gas onshore fabrication project. Then, the answers were converted into the text type structure using an Excel spreadsheet. The Excel file was subsequently imported to the ATLAS.ti software for qualitative analysis. Figure 3 exemplifies the required significant data of phase project management involved and the affected resource allocation as processed by the software.

Prefix heading

IPARTICIPANT	DESIGNATION	EXPERIENCES ON OIL & GAS CONSTRUCTION PROJECT	EXPERIENCES IN RESOURCE ALLOCATION EPC CONTRACT	PHASE-Critical Phase on resource allocation management throughout lifecycle of Onshore Fabrication project	REASONS	ISSUES-Issues encountered during managing resource allocation involving Project Team request towards Project Value	IMPORTANCE-Importance of managing resource allocation in Onshore Fabrication projects in meeting Project Value/ Contract Amount	CHALLENGE-Challenges of managing resource allocation for Onshore Fabrication projects in meeting Project Value/ Contract Amount
Participant 1	Cost Controller	6-10 years	6-10 years	Construction / Fabrication	Fabrication depends on DDE and Procurement. Changes in DDE and Procurement , delay to construction progress, method of construction and delivery of final product.	Changes of currency. Delivery material upon priority. Rate Fluctuation. Unforeseen event happened (Pandemic) shipping activity stopped, cause material delay.	To ensure projects able spending within budget. Maximize profit. Avoid losses.	The gap of bidding period too far from the contract award. The project may experience the fluctuation of FOREX and market rate
Participant 2	Facilities Manager	6-10 years	Less than 5 years	DDE. Procurement. Construction/ Fabrication.	Wrong DDE can contribute to project delay and wrong purchase material. Long Procurement process that require proper early planning.	Budget issues. Long Procurement process. Late request from Project Team	Able to complete project in time. Able to meet budget allocated. Make Profit	Low control budget release from top management after project award
Participant 3	Project Manager	More than 20 years	6-10 years	DDE. Procurement. Construction/ Fabrication.	DDE completed in advance prior Procurement stage to start. Otherwise material quantities always changes and delay in delivery at site. This can effect Construction/ Fabrication activity to meet progress schedule and completion date.	Delay on approval of DDE. Pending Procurement to finalised order. Late delivery of material ,delay at work to increase manpower and other resources will increase cost of the project. Lack of manpower on site mobilised due to less material available and some resources need to standby time to time.	Time is the essence of every project. Need to manage drawings readiness in advance. Material delivery on time as per specifications. Experience and enough manpower. Enough equipments and consumables. All resources to ensure meeting the Project	Material received not as per specifications. Need to reorder and delay in delivery. Manpower allocation need to plan their mobilisation and demobilize according to project schedule. Due to late and delay in drawing issues and materials availability it will affect the planning and unnecessary cost incurred.
Participant 4	Procurement Manager	15-20 years	15-20 years	DDE	Budget refined, overakk schedule clearer, identify risk management, critical path identify, contracts & insurance. Good DDE will make construction stage easier.	Major issue derive from Procurement perspectives , insufficient budget and no budget. create delay in finalize award when time spend on analyze situation. Reduce estimate revenue. Unclear scope of work. Vendors might quote higher on contingency. create future change order.	To achieve efficiency and saving opportunities when comprehensive accurate scope is established.	Big mis. Change of work sequence. lack of capital. insufficient manpower.

Figure 3: Prefix heading for data organization and identification for EPC Onshore Fabrication Project

For the open-ended questionnaire, the questions revolve around issue, reasons, importance, and challenges. The participants’ responses of the questions were tabulated (see Figure 2) to identify the actual resources and project phase that contribute to the cost overrun in oil and gas EPC projects. However, only the responses on Issues of resource allocation management were highlighted and coded in this research. This is because the researchers aim to identify the most significant and affected resources (5M) and phase (EPC) of the fabrication which could impact the cost overrun of a project. Figure 4 illustrates the issues based on the survey data that were coded into a quotation for further data identification and analysis of phase project and resource allocation.

IPARTICIPANT	DESIGNATION	EXPERIENCES ON OIL & GAS CONSTRUCTION PROJECT	EXPERIENCES IN RESOURCE ALLOCATION EPC CONTRACT	PHASE-Critical Phase on resource allocation management throughout lifecycle of Onshore Fabrication project	REASONS	Issues	Importance	Challenge
						ISSUES-Issues encountered during managing resource allocation involving Project Team request towards Project Value	IMPORTANCE-Importance of managing resource allocation in Onshore Fabrication projects in meeting Project Value/ Contract Amount	CHALLENGE-Challenges of managing resource allocation for Onshore Fabrication projects in meeting Project Value/ Contract Amount
Participant 1	Cost Controller	6-10 years	6-10 years	Construction / Fabrication	Fabrication depends on DDE and Procurement. Changes in DDE and Procurement , delay to construction progress, method of construction and delivery of final product.	Changes of currency. Delivery material upon priority. Rate Fluctuation. Unforeseen event happened (Pandemic) shipping activity stopped, cause material delay.	To ensure projects able spending within budget. Maximize profit. Avoid losses.	The gap of bidding period too far from the contract award. The project may experience the fluctuation of FOREX and market rate
Participant 2	Facilities Manager	6-10 years	Less than 5 years	DDE. Procurement. Construction/ Fabrication.	Wrong DDE can contribute to project delay and wrong purchase material. Long Procurement process that require proper early planning.	Budget issues. Long Procurement process. Late request from Project Team	Able to complete project in time. Able to meet budget allocated. Make Profit	Low control budget release from top management after project award
Participant 3	Project Manager	More than 20 years	6-10 years	DDE. Procurement. Construction/ Fabrication.	DDE completed in advance prior Procurement stage to start. Otherwise material quantities always changes and delay in delivery at site. This can effect Construction/ Fabrication activity to meet progress schedule and completion date.	Delay on approval of DDE. Pending Procurement to finalised order. Late delivery of material ,delay at work to increase manpower and other resources will increase cost of the project. Lack of manpower on site mobilised due to less material available and some resources need to standby time to time.	Time is the essence of every project. Need to manage drawings readiness in advance. Material delivery on time as per specifications. Experience and enough manpower. Enough equipments and consumables. All resources to ensure meeting the Project	Material received not as per specifications. Need to reorder and delay in delivery. Manpower allocation need to plan their mobilisation and demobilize according to project schedule. Due to late and delay in drawing issues and materials availability it will affect the planning and unnecessary cost incurred.
Participant 4	Procurement Manager	15-20 years	15-20 years	DDE	Budget refined, overakk schedule clearer, identify risk management, critical path identify, contracts & insurance. Good DDE will make construction stage easier.	Major issue derive from Procurement perspectives , insufficient budget and no budget. create delay in finalize award when time spend on analyze situation. Reduce estimate revenue. Unclear scope of work. Vendors might quote higher on contingency. create future change order.	To achieve efficiency and saving opportunities when comprehensive accurate scope is established.	Big mis. Change of work sequence. lack of capital. insufficient manpower.

Figure 4: Data Selection of Constructs for EPC Onshore Fabrication Project

Identify survey data- Project Management in Resource Allocation

On the issues quotation of each survey data, the identification in the Phase Management of the Engineering, Procurement, and Construction (EPC) was executed through a single-layer open coding of the related word(s) and sentence(s) of the text quotation. The resource allocation, i.e., method, machine, manpower, material, and money, that is involved in each quote was also coded to identify the most affected factor in the fabrication project. The coding sample of project management and resource allocation is shown in Figure 5.

Issues encountered during managing resource allocation involving Project Team request towards Project Value

Changes of currency.
 Delivery material upon priority.
 Rate Fluctuation.
 Unforeseen event happened (Pandemic) shipping activity stopped, cause material delay.

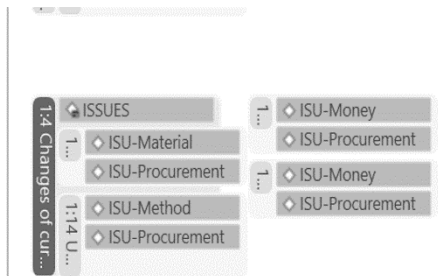


Figure 5: Data Coding for Resource Allocation for EPC Onshore Fabrication Project

Data Analysis through Resource Allocation

Each coded quotation that is relevant to the Resource Allocation (5M) was then analyzed by forming a relation resource allocation network of the issues and importance of the fabrication project. The forming resource allocation network of the Issue and Importance is displayed in Figure 6.

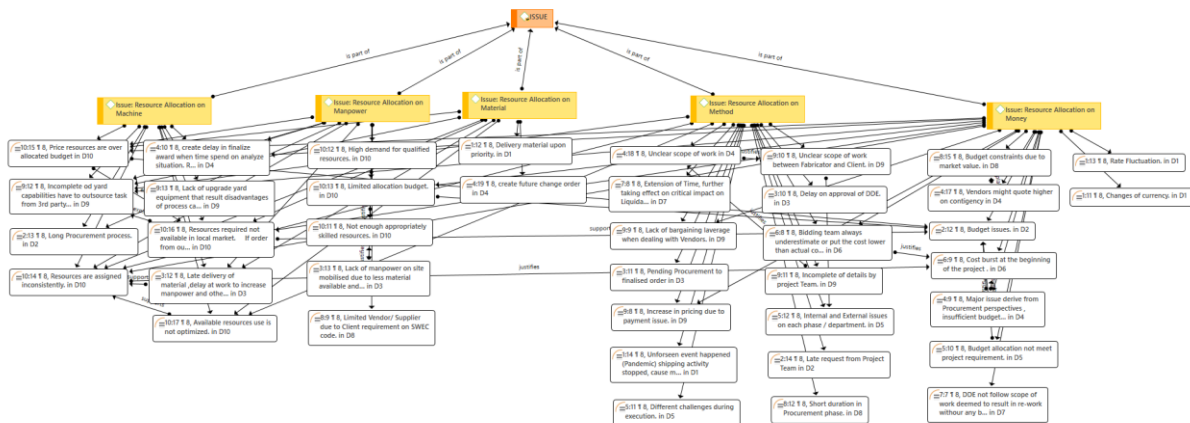


Figure 6: Resource Allocation Network for Issues and Importance for EPC Onshore Fabrication Project

Data Analysis through Project Management

Each coded quotation that is relevant to the Phase project management (EPC) was then analyzed by forming a relation project management network of the issues of the fabrication project. The project management network of the issues is presented in Figure 7.

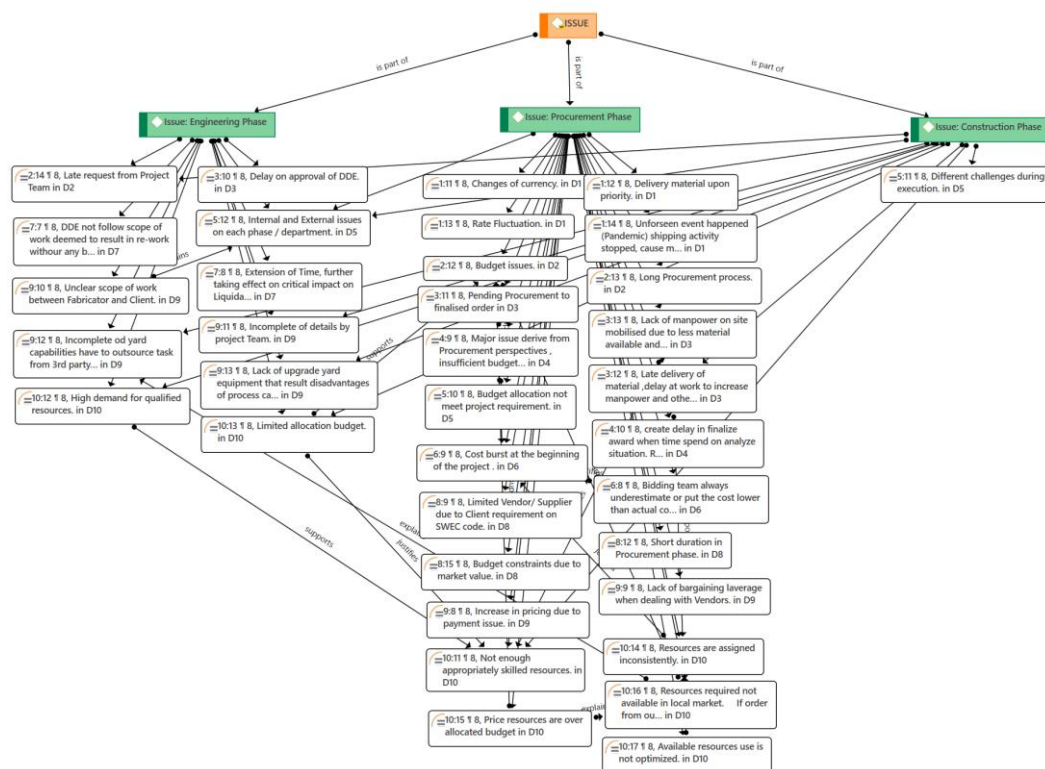


Figure 7: Project Management Network for issues for EPC Onshore Fabrication Project

Result and Discussion

The construction industry in Malaysia pushes the country's economic growth and development. Cost overruns are unfortunately common in industry projects. Cost overruns are defined as a negative cost variance in which the total cost of the project exceeds the contract sum (Shehu et al., 2014). Analyzing prior literature on the chosen topic is necessary in order to further investigate this issue. These identified issues necessitate the development of a distinct strategy with a focus on project cost monitoring and control. In addition to the problems, factors that contribute to cost overruns were identified. The findings on contributing factors are as follows

- Inadequate material procurement management
- Inaccurate cost estimates
- Inadequate planning
- Frequent design changes
- Insufficient labour/skill availability,
- Inflation of machinery and labour costs

Meanwhile, Rahman et al. claimed that cost overruns occur as a result of unpredictable material prices, cash flow issues with contractors, and poor site supervision by management (Rahman et al., 2013). Resource planning, resource monitoring, and cost control are all critical aspects of oil and gas project management in order to complete a project successfully. As a result, qualitative data from interviews was analysed in accordance with the coding stages of the case study to identify the resource factors that have a significant impact on project performance in oil and gas EPC projects. The insights obtained from the interviews which addressed the how and why questions of a typical qualitative study.

Finding analysis Issue encountered during managing resource allocation involving Project Team

The five resources: method, money, machine, manpower, and material, were identified on each issue quoted via the ATLAS.ti analysis. The finding of the issues and significance is shown in Figure 8.

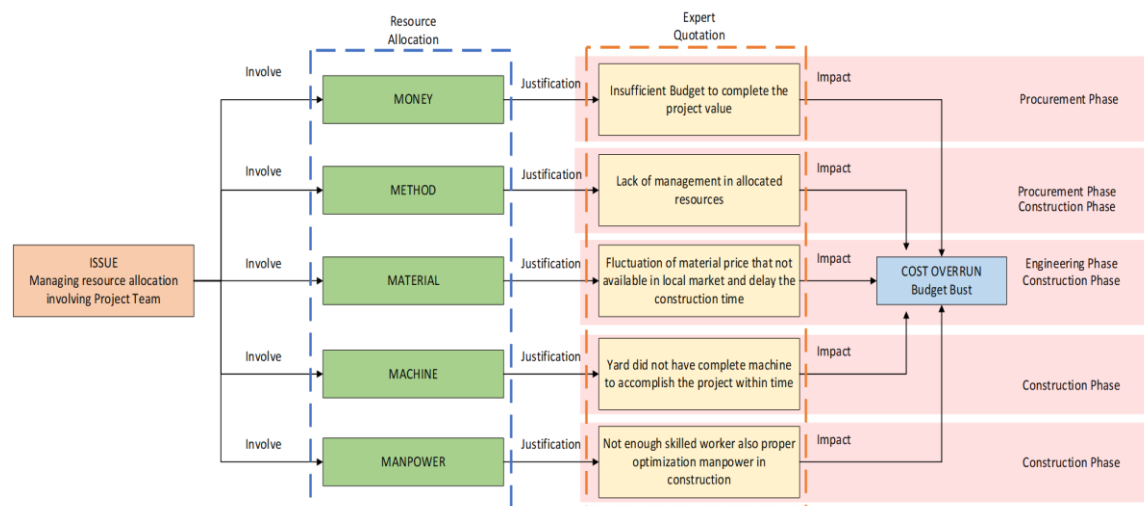


Figure 8: Resource Allocation Issue network on onshore fabrication project.

Based on the analysis of the Issues on the Resource Allocation of the EPC Onshore Fabrication Project, it is possible to conclude that every resource influences a project's cost overrun. The resource allocation method's management discussed how the available resource allocation was not optimised because it was not assigned consistently by the construction management. Another consequence is that the delivery period increased the time work and manpower hours as the cost of other resources increased concurrently. Aside from that, material resources that were not available in the local market had an impact on the project cost, as the price of the resources exceeded the allocated budget. In addition, there was a high demand for highly skilled workers due to a lack of appropriate skilled resources in completing the fabrication project, which would also have an impact on the cost overrun. The discussed and analysed networks, as processed by the ATLAS.ti software, revealed that money had a greater impact on the allocated resources. The issue of budget allocation that does not meet project requirements is a major issue that drives from the procurement perspective, resulting in cost burst and fabrication project cost overrun. Table 1 presents the analysis of the co-occurrence of issues on resource allocation.

Table 1
Issues on Resource Allocation (5M)

Co-Occurance (Issue)	Resource Allocation				
	Machine	Manpower	Material	Method	Money
Construction Phase	3	5	2	5	2
Engineering Phase	2	3	1	8	3
Procurement Phase	7	8	7	9	15

From Table 1, it is evident that the most occurring issue highlighted by the experts for resource allocation in the fabrication project is money.

Meanwhile, the major issues in the procurement phase in managing other resources are method, manpower and the less occurring issue are machine and material. As mentioned by the experts, the cost bursts at the beginning of a project created major issues in the procurement phase to process required resources due to insufficient budget and not meeting the project requirement.

According to Alnoor Akberali Halari's study, money would burst the cost overrun (Halari, 2010). He further said that the money spent on purchasing equipment and materials accounts for roughly 35% of the total cost of an oil and gas project (Halari, 2010). Meanwhile, construction accounts for roughly half of total spending, making cost-cutting efforts critical (Halari, 2010).

After overcoming these recurring issues in practice, the next step for this research is to better understand the impacts of cost increases during the procurement phase. This research could benefit fabricators by helping them increase their profit margins. Onshore erection follows contracting and subcontracting principles, whereas procurement is concerned with cost estimation and control in a complex environment (Ajator, 2014). Project management entails effectively managing, allocating, and scheduling resources to achieve specific goals. Project management in the oil and gas industry is extremely valuable in science, technology, and engineering (Al Subaih, 2015). The project life cycle, in general, determines the resources needed in each phase as well as the specific work that will be completed in each phase. Kannimuthu et al. imply that by varying fabrication methods, materials, and crew sizes, various execution plans are possible (Kannimuthu et al., 2019). In terms of project characteristics, each project has activities that set it apart from others (Badiru & Osisanya, 2016). According to Loch et al., preliminary requirements costs are typically determined using information provided by project management plans, charters, the enterprise's environmental factors, and organisational process assets (Loch et al., 2007). Planning's goal is to ensure that all activities required to meet project goals are completed on time, on budget, and with high quality.

Conclusion

The significance of this study has contributed to a better understanding and fresh knowledge about cost overruns that happen during resource allocation. The knowledge gap will be filled by an exploratory analysis of the resource allocation process for onshore fabrication for oil and gas, which will pinpoint the contributing solutions in protecting the project from cost overrun with the application of decision making theory. Therefore, it is crucial that future studies investigate the cost components of resource allocation. This research will help practitioners, organisations, and stakeholders in the Engineering, Procurement, and Construction (EPC) fields achieve success according to resource-based view theory, which represents the organisational performance focus in controlling cost overruns related to return on investment. Qualitative methodologies and data analysis were used to identify all significant cost overrun issues. To confirm the issues that arise during the coding process to arrive at the final results, semi-structured interviews were undertaken. These qualitative findings can be used by EPC management and this research further to create a resource-based framework for enhancing EPC project performance, particularly in cost control. The data analysis using ATLAS.ti qualitative software showed that every resource influences a project's cost overrun. The interviews with 10 specialists that work on EPC projects reveal that managing money and maximising all resources is the most significant resource allocation. The major findings for the cost increase were insufficient resource management and allocation,

which were not assigned consistently by the construction management. Furthermore, it is well understood that money resource management has an impact on all the allocated resources. The following areas of potential future investigation are noted in light of the study's limitations. The effects of variances in other nations were not discussed because this research exclusively focuses on EPC projects in Malaysia's oil and gas sector. Considering the present problems with cost overrun in managing resource allocation in the context of 5M, this study advises more research on project methodologies. The study suggested for making strategies based on the issues found can help EPC projects manage resources more effectively. Financial matters and capitalization methods are considered critical and vital. Indeed, in today's market conditions, raising the asset for capitalization is regarded as one of any economic activity's most critical strategic aims. According to Badiru and Osisanya (2016), allocating resources in developing an oil and gas project begins with money or capital and then moves on to machinery, manpower, and materials. The most efficient deployment of resources for fabrication processes necessitates cost-effective planning (Olsen et al., 2005b). On the other hand, inefficient resource allocation can result in delays and costly expenses. Al-Subaih (2015) asserted that among the factors that can cause money loss in the project implementation are additional expenses for equipment or machinery, materials, recruitment, and time loss for contractors. Any oil and gas project requires careful planning and efficient management of resource allocation to ensure a secured project. Aljohani (2017) revealed that the most contributing factor for rising costs is poor resource management. Another contributing factor for the cost increment is the length of the activity that is determined by the construction methods, materials, and crew size used (Kannimuthu et al., 2019). These factors will have an impact on a project's implementation. Thus, incorporating adequate resource management systems during the procurement phase of construction projects is one of the potential solutions in reducing the effect of excess cost in fabrication projects.

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