

CHALLENGES IN RESOURCE ALLOCATION (5M) TOWARDS COST CONTROLLING IN ENGINEERING PROCUREMENT CONSTRUCTION (EPC) FABRICATION OIL AND GAS MEGAPROJECTS

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Abstract: *The resources contain a money cycle involving machinery, manpower, and materials aligned with a suitable method (5M) in a fabrication project. However, given the current economic climate, it is critical to keep costs under control and realign its mission. As a result, this study objectives and aims to use ATLAS-ti to analyze preliminary survey data on resource allocation management challenges in oil and gas EPC fabrication projects. The survey data was gathered through qualitative research involving interview techniques with ten (10) experts in Engineering, Procurement, and Construction (EPC). The results reveal that the factors affecting resource allocation (5M) are a lack of support from top management, poor resource utilization, and management in the EPC project. The atlas-ti network analysis revealed that money had a more significant impact on the allocated resources. The budget issue, in which the budget allocation does not meet the project requirements, is a significant source of procurement challenges. The challenges of resource allocation management, which control cost overrun in 5M of Oil and Gas Fabrication, are expected to be revealed in this study.*

Keywords: *Cost Controlling; Resource Allocation 5M; Engineering Procurement Construction (EPC); Oil and Gas Fabrication Megaprojects*

Introduction

There is a lack of project control and monitoring of the cost element in resource allocation during fabrication activities. Contractor/Fabricator site management and financial management are two of the factors. As a result, progress in this area is required to keep rising construction costs in check (Rahman et al., 2013). Malaysia's construction industry is a driving force behind the country's economic development. Despite this, it frequently has cost overruns, such as negative cost variance, in which the final project cost exceeds the contract sum (Shehu et al., 2014). Improper contractor planning, poor site management, and bad contractor experience, according to (Shah, 2016), are the leading causes of Malaysian project delays and high costs. Cost overruns occurred due to unpredictable material prices, contractors' cash flow issues, and management's poor site supervision, according to (Rahman et al., 2013). Cost overruns happen whereby part of it requires 5M to be allocated in a project. In the Oil and Gas fabrication project, the main contractor or fabricator is also entitled to cost overruns and delays that harm their profit, satisfaction, and reputation. Cost overruns are a common occurrence in the construction industry. According to (Suppramaniam & Ismail, 2019), cost overruns in oil and gas megaprojects remain a significant concern in Malaysia. Following that, an integrated in-house service for Project Management, Procurement, Engineering, Construction/Fabrication (EPC), Commissioning, and Installation is provided by a wide range of high-quality project fabrication activities. Oil and gas fabrication project processes improve the various phases by emphasizing planning, human resources, and performance monitoring (Suppramaniam & Ismail, 2019). The researchers assist both the direct and indirect aspects of the projects. As a result, there are challenges in identifying the activities involved in locating resources at each milestone, whether direct or indirect, which is the first step in project operations for early planning, monitoring, and part of project management functions (PMBOK., 2017).

Literature Review

Cost Controlling in Resource Allocation

Managers are expected to keep a close eye on the amount of money spent in every decision-making situation. The manager must, in particular, ensure that the cost of materials obtained is kept as low as possible. The amount of materials used in the fabrication process is not excessive. In contrast, the labour cost is proportional to the amount of output produced. In addition, employee-handled production rates will achieve the desired level of output (Thankgod C. Agwor., 2015). Money, manpower, material, machinery, and method are the 5M of resources required in a project to control costs. As a result, this research aims to look at several previous works of literature on oil and gas fabrication project management from around the world, with a focus on cost overrun. Then, conduct a preliminary survey with a more thorough investigation to determine whether any cost overruns, particularly in resource allocation, affect the performance of EPC projects in Malaysia. The findings of this study can be used as a strategic indication for managing EPC projects in the oil and gas industry in Malaysia. In qualitative research, Atlas-Ti was used to analyze preliminary survey data on resource allocation challenges (5M) at the EPC project.

Cost overrun in Oil and Gas projects across the globe from a literature search found that fabrication cost overruns are a common problem that degrades project performance. In Iran's, Gas-Oil construction projects are no exception (Derakhshanalavijeh & Teixeira, 2017). As a result, the issues stem from project management, which includes inaccurate cost estimates, poor planning, frequent design changes, insufficient labour/skill availability, and price inflation in machinery, labour, raw materials, and transportation. The cost overrun in Iran happened from part of 5M. Therefore, resource management requests manpower, materials, and machinery. The method starts with money, which will determine whether the project successfully controls considerations and strategies.

Malaysia's construction industry is a driving force behind the country's economic development. Cost overruns, defined as a negative cost variance in which the final project cost exceeds the contract sum, are unfortunately common in its projects (Shehu et al., 2014). On the other hand, in oil and gas projects, the main contractor or fabricator rationalizes to avoid cost overruns and delays that harm profit, customer satisfaction, and reputation. The following is a summary of the findings from the literature review on issues in managing oil and gas projects with a cost overrun focus:

- i) Mismanagement of the project schedule
- ii) The complexity regarding the scope of the project.
- iii) Concentrate on resources for the construction phase.

The issues mentioned above necessitate a particular project cost monitoring and control strategy and focus. As a result, cost overrun contributing factors has been identified. The findings on contributing factors are as follows (PMBOK., 2017):

- i) Material procurement management that isn't up to par
- ii) Cost estimates that aren't accurate
- iii) Insufficient planning
- iv) Changes in design are standard.
- v) Inadequate labour/skills availability
- vi) Costs of machinery and labour have risen as a result of inflation.

Material, Manpower, Machinery, Method and Money (5M).

Material

The Procurement Department is responsible for ensuring that the best prices are obtained for the best materials and assets and checking with various suppliers to find the best prices and materials through tenders and based on the Procurement Management Plan. All suppliers should be invited to open meetings with the procurement manager, and all inquiries should be given equal consideration. If appropriate and correct specification information is not provided, ineffective vendors may purposefully provide lower bidding costs to win the contract. They understand that submitting modifications or purchase orders will change the contract price. As a result of this decision, the costs of a multibillion-dollar project will increase (Roshdi et al., 2021).

Manpower

Petroleum companies and contractors who perform and manage multibillion-dollar projects should be aware of their employees' strengths, weaknesses, and skills, determine appropriate training for them, and assign them to positions that allow the company to make the most of their abilities. Labour costs account for a large portion of total costs in oil and gas companies after

costs for materials/assets and services. Although materials and labour costs are included in service costs, determining these costs from service contractors' invoices is not practical, except for consultancy services, which do not include materials costs (Roshdi et al., 2021).

Machinery

The eight primary types of delay that apply to most projects are project-related, client-related, design team-related, contractor-related, materials, labour, plant/equipment, and external variables. A project's plant and machinery must be either owned or rented. The decision and strategies to determine the best value for money of machinery for usage and rental or leasing should be wisely made so that the cost remains within the budgetary schedule.

Method

In science, technology, and engineering, project management in the Oil and Gas industry is exceptionally high (Badiru & Osisanya, 2016). In general, a project's life cycle determines the resources required in each phase and the specific work that must be completed at each stage. Various activity execution plans can be created using various combinations of manufacturing processes, materials, and crew numbers (Kannimuthu et al., 2019).

Money

In the development of oil and gas projects, resource allocation begins with money or capital and includes the distribution of machinery, manpower, and materials (Badiru & Osisanya, 2016). Planning to determine a cost-effective basis is required to efficiently allocate resources for fabrication activities (Olsen et al., 2005). On the other hand, inefficient resource allocation can result in delays and high costs. Additional costs for equipment or machinery, materials, recruitment, and lost time for contractors are all factors that contribute to project failure using various combinations of manufacturing processes, materials, and crew numbers (Badiru & Osisanya, 2016).

Engineering, Procurement and Construction (EPC) project

Procurement functions in the Engineering Procurement Construction (EPC) contract for onshore fabrication projects have undergone a significant transformation and now play a critical role in determining revenues (Chavan et al., 2020). As a result, procurement refers to both the procurement and the processes required to meet the organization's needs (Andersson & Norrman, 2002). As a result, resource allocation management at this early stage, particularly during the procurement stage, is critical because it will ensure that the construction phase runs smoothly and follows the contract.

The engineering phase began with creating plans and specifications, and the fabrication or construction phase began with the acquisition of various elements (Olsen et al., 2005). The fabrication phase of a project entails some tasks, including planning and scheduling, mobilizing workers and equipment, executing the job, and managing resources through procurement (Badiru & Osisanya, 2016). The life cycle steps are initiating, planning, executing, monitoring, controlling, and closing. Engagement with people, processes, and technological assets is the foundation for achieving organizational goals (Shah, 2016).

Some of the reasons why in-depth research on Malaysia oil and gas EPC projects is necessary are as follows (Van Ban & Hadikusumo, 2017):

- i. Oil and natural gas Large-scale projects with EPC characteristics carried out in a complex and demanding international environment are known as EPC projects.

- ii. EPC implementation is accelerated, taking a few months to two to three years.
- iii. People from various backgrounds, levels, and hierarchies comprise the project management team.
- iv. There are no set rules or policies for the team or execution. Project management can be done in a variety of ways.

Methods, Material, Result and Discussion

In determining which resource allocation significantly affect performance in oil and gas EPC projects, a qualitative approach (interviews) was used to identify the data that needed to be collected and processed according to the coding steps in the case study. The first phase entails reviewing previous literature reviews in the field of study in question. Conducting a literature search is important for learning about current challenges as well as determining the problem and research gap. As a result, a similar research area is needed to identify the issues with managing the oil and gas industry with various megaprojects. This stage extracts resource allocation issues and contributing factors related to managing oil and gas projects to fulfil resource allocation. Journals, articles, conference papers, annual reports, and books will be used as secondary data sources in this study. Ten randomly selected experts with experience in EPC projects were interviewed with open-ended questions. The interviews provided answers to the how and why questions common in qualitative research.

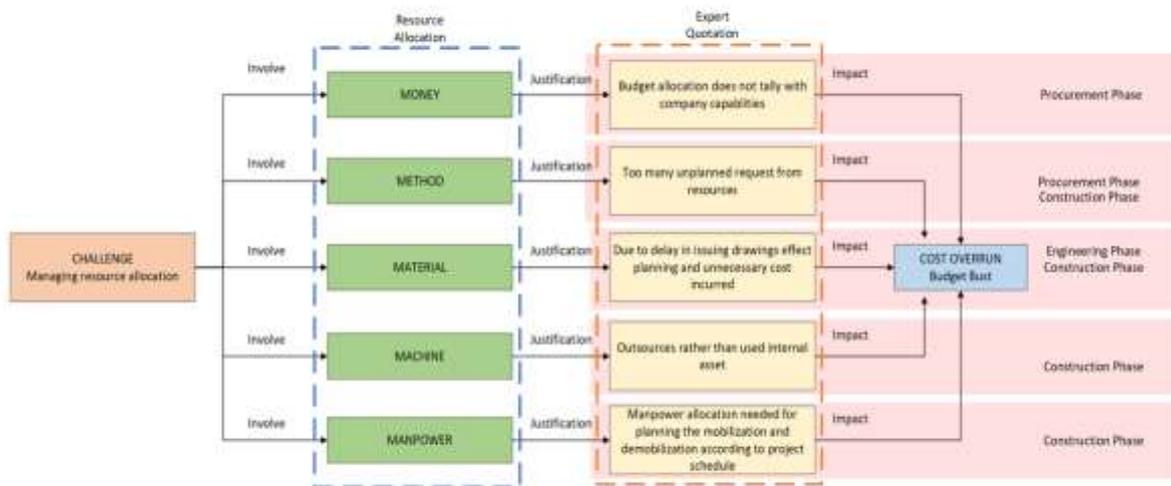


Figure 1: Analysis Challenges of Resource Allocation

Method, money, machine, manpower, and material are the five resources identified against the EPC project phase based on the atlas ti analysis. Figure 1 depicts the challenges and their significance because of the data. According to the analysis of the challenges with the EPC onshore fabrication project’s resource allocation, each resource impacted the project’s cost overrun. According to the management, the unplanned and too many requests of resources are under challenges in the resource allocation method. Manpower allocation needed for planning the mobilization and demobilization according to project schedule is the challenge in manpower management, and the cost of other resources rises simultaneously. Aside from that, the project cost was affected by material resources due to delay in issuing drawings, effective planning and unnecessary cost incurred. The challenges and cost overrun will be influenced by outsourced machinery rather than internal assets. Money had a more significant impact on the allocated resources in all the discussed and analyzed networks via the atlas-ti. There is a problem with

budget allocation when it comes to the budget, and the challenge does not tally with company capabilities.

Table 1: Challenges of Resource Allocation (5m) Against EPC Project Phase

Co-Occurrence Resources	Project Management Phase		
	Construction	Engineering	Procurement
Machine	0	0	3
Manpower	3	0	4
Material	1	2	7
Method	6	0	3
Money	2	0	8

The expert's analysis of the challenges of resource allocation management, as shown in Table 1, revealed that the most common occurrences highlighted by the expert were allocation of funds, which involved the procurement phase management, being the most affected in the fabrication project than engineering and construction. As mentioned by the expert, it is critical to ensure that the project can spend within budget to achieve efficiency and meet the budgetary allocation while minimizing profit and illuminating cost overruns. Procurement functions in Engineering Procurement Construction (EPC) projects have changed dramatically, according to (Chavan et al., 2020), after summarizing the literature review. They now have a significant impact on profit margins. Procurement is the process of obtaining goods and services and the processes necessary to meet an organization's needs (Loch et al., 2007).

Conclusion

After overcoming these recurring challenges in practice, it is necessary to better understand the causes of cost increases during the procurement phase. Fabricators may benefit from this study because it may help them boost their profit margins. Procurement focuses on cost estimates and control in a complex environment, while onshore erection follows contracting and subcontracting philosophies (Ajator., 2014). Project management is the process of effectively managing, allocating, and timing resources to achieve specific goals. In the oil and gas industry, project management is precious in science, technology, and engineering (Al Subaih, 2015). The project life cycle, in general, determines the resources needed in each phase and the specific work that will be completed in each phase. According to (Kannimuthu et al., 2019), various execution plans are possible by varying fabrication methods, materials, and crew sizes. Each project has activities that set it apart from others (Badiru & Osisanya, 2016). According to (Loch et al., 2007), preliminary requirements costs are usually determined using project management plans, charters, the enterprise's environmental factors, and organizational process assets. The goal of planning is to ensure that all of the activities necessary to meet the project's objectives are completed on time, on budget, and to a high standard. It is critical to identify these challenges in oil and gas project management to achieve project success, particularly in resource planning, monitoring allocated project resources, and cost control (Aldhaheri et al., 2018).

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