

Conceptual framework of resource-based cost allocation at procurement phase for onshore fabrication oil and gas projects

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Abstract. Cost overruns are common in construction projects and Onshore Fabrication Oil and Gas projects in Malaysia are not an exception. The paper presents the strategies in controlling the cost in resource allocation management implemented at Procurement Phase. The data gathered from previous researchers' studies and literature reviews. The study revealed the primary relative importance in the conceptual framework; theory underpinned, procurement phase, activities identification, cost element attributes and resource-based cost allocation towards business profit. Hence, the procurement phase should establish effective project planning, management, and monitoring to improve project performance to control costs in resource allocation for onshore oil and gas fabrication projects.

1. Introduction

The Malaysian Construction Industry Development Board (CIDB) (2016) classifies Oil and Gas industry as part of the construction industry in Malaysia. The fabrication of the platform falls under the Development stage for production operations. The oil and gas sector are among twelve (12) sectors determined by Malaysians to be competitive worldwide and act as the main engine of economic growth under the National Key Economic Area (NKEA). The oil and gas sector is called "multibillion-dollar megaprojects" common in industry today [1].

Meanwhile, it is critically important to manage the transition proactively from planning to construction [2]. A large number of causes of cost increases are related to poor resource management [3]. The selection of construction methods influences the time duration of the activity, materials, and crew size. Cost overruns occur at each phase; however, the cause of project surplus usually occurs during the construction phase. One potential solution to reduce the impact of excess cost in fabrication projects is the insertion of adequate resources (i.e. money, manpower, method, machineries and material) management systems implement at the procurement phase to assist the construction phase. Therefore, this paper is limited to this phase.

Procurement functions in onshore fabrication projects' Engineering Procurement Construction (EPC) contract have experienced a considerable transition and now play a crucial role in determining revenues [4]. Thus, procurement refers to the procurement as well as the processes required to meet

the needs of the organisation [5]. Therefore, resource allocation management at this early stage, especially at the procurement stage, is crucial because it will smoothen the construction phase according to the contract. The engineering phase began with the creation of plans and specifications, followed by the acquisition of various elements in the fabrication or construction phase [7]. Starting with planning and scheduling, mobilising workers and equipment, and executing the job and managing resources through procurement, the fabrication phase of a project comprises of a variety of tasks [6]. Thus, the life cycle starts with initiating, planning, executing, monitoring, controlling, and closing. The engagement with people, processes and technological assets in science and engineering form the basis for carrying out organisational goals [6].

2. Literature review

2.1. Overview of cost overrun

Cost overruns are a common occurrence in the construction business for all types of projects. Malaysia's oil and gas industry is facing difficult times and challenging market conditions require reducing costs and restructuring an organisational business. However, megaprojects faced cost overruns due to fluctuation of material prices, contractors' cash flow difficulties, and inadequate site supervision in management [8]. Cost overruns persist as a significant concern within oil and gas megaprojects in Malaysia's overview [9]. The following issues related to the resource allocation process by procurement for the fabrication project are the lack of project control and the monitoring cost of resource allocation from construction or fabrication activities towards project value. Factors fall into two categories, namely, contractor site management and financial management category. Therefore, improvements in this category are essential to control rising costs in construction projects [10]. The construction industry drives economic growth and development in Malaysia. Therefore, lack of coordination and misunderstanding on the cost incurred in the fabrication activities of resource allocation. The oil and gas business has an average cost overrun of 64% on global projects [11]. Because the oil and gas business is interdisciplinary in nature, many challenges arise throughout the project life cycle. The most common causes of project delays and budget overrun are poor contractor planning, poor site management, and insufficient contractor experience [20]. Due to cost and time overruns, many variation works, poor workmanship, quality, and delay [12]. Oil and Gas enhance financial and strategic performance [1] and an approach to the criteria decision-making approach for supplier selection [13]. All this study will help strengthen Oil and Gas for better management in terms of financial performance. Therefore, systematic project management is a flexible process that varies according to the size and complexity of the project. While budgeting is often not a controlling factor in handling projects well, ultimately, the allocations and expenses are addressed [6]. Megaprojects (> 1 billion USD) requiring EPC (Engineering, Procurement, and Construction) require the essence of planning to guarantee that the activity required to meet project objectives in terms of time, cost, and quality is completed.

2.2. Resource allocation

Developing a better understanding of the origins of cost increases in the Procurement phase is the first step to overcoming this recurring problem in practice. This research potentially assists in raising profitability margins for fabricators. Procurement organises cost estimates and controls the complex context where onshore erection operates in contracting and sub-contracting philosophies [14]. Resource allocation is a challenging process regarding the management of scarce resources. Resources include money, machineries, materials, manpower, and method within time management. Build up a new offshore oil platform or rebuilding an existing one is a complex type of procurement involving several contractors, subcontractors and vendors [15]. Resource allocation will reflect the cost element in each resource needed in the projects in line with controlling cost to avoid task unsuccessful in terms of price.

2.2.1. Material

Procurement Department shall ensure that they obtain the best prices for the best materials and assets, check with various suppliers to find the best prices and materials via tenders and based on Procurement Management Plan. All suppliers should be invited to open meetings with the procurement manager, and all queries should be treated equally. Ineffective vendors may purposefully provide lower bidding costs to win the contract if appropriate and correct specification information is not provided. They realise that by submitting modifications or purchase orders, the contract price will be altered. And as a result of this move, the expenses of such a multibillion-dollar project will rise.

2.2.2. Manpower

Petroleum Company or Contractor that perform and handle multibillion projects should know their employees' strengths, weaknesses, and skills, determine suitable training for them, schedule them for the positions that allow Company to make optimum use of their abilities. After materials/assets and services costs, labour costs account for a large portion of total costs in oil and gas companies. Although services costs include materials and labour costs, it is not practical to determine such costs from service contractors' invoices, with the exception of consultancy services, which do not include materials costs.

2.2.3. Machinery

Project-related, client-related, design team-related, contractor-related, materials, labour, plant/equipment, and external variables are the eight primary types of delay causes that apply to most projects. Plant or machinery used for a project must be either owned or rent. The decision should be wisely and strategies to decide the best value for money of machinery for the usage of the machinery and rental or leasing so that the cost is still within the budgetary schedule.

2.2.4. Method

The application of project management in the Oil and Gas industry is incredibly high in science, technology, and engineering [16]. In general, the life cycle of a project determines the resources that need in each phase and specific work to be completed in each stage of the project life cycle. Various combinations of manufacturing processes, materials, and crew numbers can be used to create a variety of activity execution plans [17].

2.2.5 Money

Resource allocation starts from money or capital in Oil and Gas project development, including distribution of Machinery, Manpower and Materials [6]. Efficient allocation of resources for fabrication activities requires planning to determine a cost-effective basis [15]. But on the contrary, inefficient allocation of resources can result in delays and high costs of money. Factors that cause lost project implementation are additional expenses for equipment or machinery, materials, and recruitment and loss of time for contractors [16].

3. The framework of Resource Allocation at Procurement Phase

3.1. Procurement Phase

Procurement is an essential element of all projects and can provide practical ways to execute projects. Approximately 35% of the oil & gas project's costs reported spent on procuring equipment and materials [18]. The procurement effectiveness predicts the contract strategies used with the respective vendors, suppliers, and contractors. The most critical area for consideration on contracts relates to risk and ascertaining which party is best able to handle it.

Table 1. Strategies on cost elements identification for controlling the cost of 5M; Resource Allocation (Money, Material, Manpower, Machinery and Method) in construction activities.

Money	Material	Manpower	Machinery	Method
From project value, wrong time and cost estimates. [8]	Fluctuation price [8]	Labour supply[20]	Equipment availability and failure [8]	Regular meetings with subcontractors and supplier [8] Ensure safety and health[16]
Poor financial control at site[8]	Shortage in material[8]	Problems with subcontractors [20]	Late delivery of equipment [8]	Slow information flow between parties [16] Established appropriate communication with all parties via Traffic light tracking[12]
Financial difficulties by the owner [3] Ensure labour and contractors paid on time[8]	Time variation could change the material price [8] Material price check irregularly before purchase [13]	A project manager is someone who has worked in a comparable sector and can predict potential problems from the start to finish of a project. [16]		Don't underestimate the project's complexity. [8] Frequent design changes[8] Used effective methods to visualise the overall project view such as BIM technology, Oil and Gas used traffic light tracking[12]
Delay in progress payment [8]	Inaccurate quantity take off [8]	Labour productivity [8]		Control mistakes during the construction stage and errors and errors in design [8]
Inaccurate of time and cost estimates[8]	Cost and design estimation should not be treated lightly. [16]	Labour absenteeism [8]		Delay in drawing approval [8] Incomplete design at the time during tender (FEED) [12]
Contractual claims[8]		Shortage of technical personnel[8]		

The conceptual framework in this paper derived from exploratory research via literature search by previous scholars, as in Table 1. From that, the continuity shall link to the area of this research concept as Table 2. The decision-making theory applies to the procurement phase to develop the resource allocation standard. Thus, the primary study focuses on resource allocation strategy as the cost element requires each activity involved in construction or fabrication. For this study's context at Onshore Fabrication projects, the cost element factor for controlling and decision-making is control at the procurement phase. Another concern is the cost element indicating the resource allocation within budget towards the original project value. The project success is as per Iron Triangle; Time, Cost and Quality [19]. This study will focus on cost controlling until achieving one of the criteria for project success. The theory that relies on project success is the Resource-based View (RBV) theory, which also involves the roles and responsibilities of stakeholders, decision-making, and communication by every stakeholder involved in the projects.

Table 2. Researcher's Study on Conceptual Framework.

Oil and Gas Industry(casestudies)	Scope of Study	Causes	Impact
EPC Fabrication projects	Procurement in Resource Allocation Management in Cost Element	Lack of monitoring on cost element in resource allocation (5M)	Cost Overrun Poor performance Reputation None on ROI

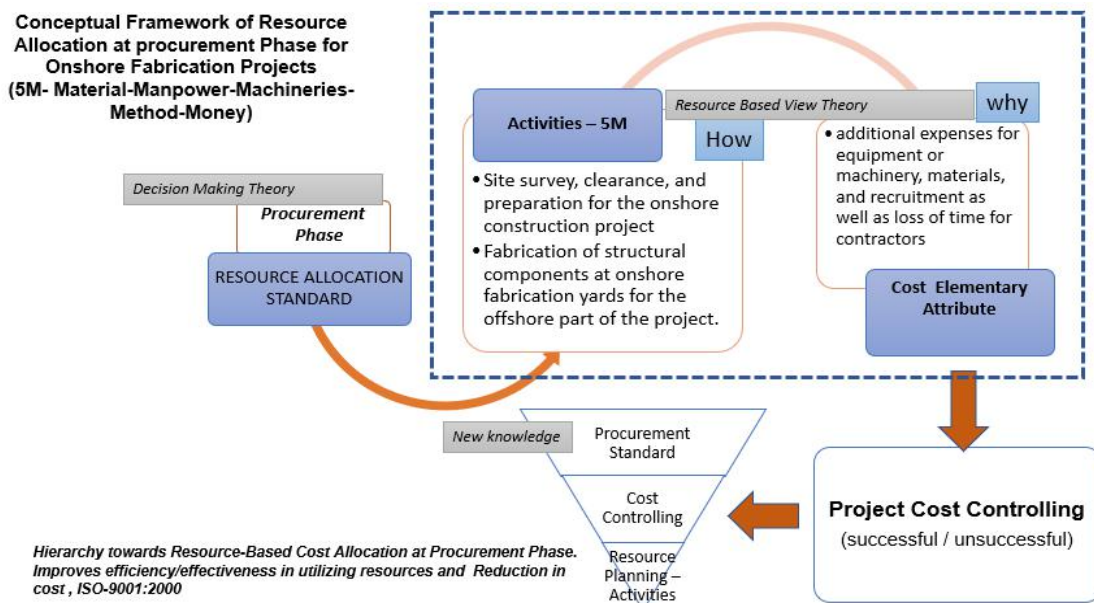


Figure 1. Conceptual Framework Resource-based Cost Allocation at Procurement Phase for Onshore Fabrication Projects.

4. Conclusions

From this review, the procurement phase plays an important role to improve efficiency and effectiveness in utilising resources in controlling cost. Beyond this review paper, the author's future research will develop a Procurement Standard on Resource Allocation for Onshore Fabrication Projects from Figure 1. The study hopes that this framework assists the relevant stakeholders and discusses various issues mentioned above for project cost control. Resource allocation is a cost element handle at Procurement Phase that reflects from construction activity. Procurement shall act efficiently and detail the project team's inquiry in considering cost elements in 5M, requirements, and contract value as benchmarks. However, decisions on what resources are requested to meet project activities and process the resources to control project cost part of Procurement responsibilities. Furthermore, a conceptual framework for the Procurement phase on resource allocation considers the cost-management elements expected from the case studies method of an onshore fabrication project.

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