# THE IMPORTANCE OF THE PROCUREMENT PHASE IN SUPPLY CHAIN MANAGEMENT FOR RESOURCES (5M) PURCHASE; CASE STUDY OF ENGINEERING PROCUREMENT CONSTRUCTION (EPC) PROJECT

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Received Date: 13 January 2022
Accepted Date: 8 March 2023

## ABSTRACT

*The procurement phase and project management phase are typically dealt with in every construction project. The procurement responsibilities are to purchase following the project's requirement aligned with contractual agreement involved in the project. The use of machinery, manpower,method ,money, and materials (5M) to complete the job necessitates all of these resources at once in to set up a stable financial cycle. The importance of 5M as resources in procurement to support organisational policy is thus discovered by this study. The literature search on the procurement flow and responsibilities digest from scholars and generates the conceptual framework of Engineering Procurement Construction (EPC) project's procurement's responsibilities and workflow. Hence, this study was aimed to examine the value of procurement responsibilities for resources purchasing in supply chain management's perspectives specifically in oil and gas fabrication EPC projects as a theoretical framework study. The term procurement appeared in the EPC contract to emphasise that the phase participated not only stages but also the contractual of the project applied. Spending within budget, financial control meeting project value, optimising material usage, and sufficiently matching project goals within contract as for EPC projects as a case study involved million-dollar contract value at different currencies from varies country are important procurement duties that contribute to project control.*

**Keywords**: *cost control, procurement, resources 5M, supply chain*

## 1.0 INTRODUCTION

Procurement is an important element of all projects and can provide practical methods for project execution. According to Alnoor Akberali Halari, (2010), approximately 35% of the costs of an oil and gas project are spent on acquiring equipment and materials. Construction accounts for roughly half of all expenditures, making it a critical area of focus for cost-effectiveness. Procurement effectiveness is primarily determined by the contract strategies used with the respective vendors, suppliers, and contractors. The most important aspect of contract consideration is risk and determining which party is best suited to handle it. Most owners prefer to minimise risk by transferring it to third parties, but this comes at a high cost. As a result, involving the procurement group early in the project is critical for planning and having a realistic schedule, resulting in timely material, manpower and machinery deliveries, and method of ordering ahead of schedule also provides an additional buffer to the schedule and the potential for cost savings in term of money(Rina & Roshdi, 2022). Failure to collect long-lead items early in the project results in materials and machinery not being available at

the construction site when required. As a result, construction tradesmen frequently have no work fronts open, causing project delays and possibly cost overruns. Thus, this study is to examine the value of procurement responsibilities for resources purchasing in supply chain management's perspectives specifically in oil and gas fabrication EPC projects. The respective fields of global supply chain management, procurement management, and dynamic capabilities all use several definitions for the same terms. In order to understand the research, the researcher and reader must be of the same understanding (ZDEL et al., 2001 ; Cooper-Rooney, 2018). The following terms and concepts are used in this paper.

### 1.1 Procurement effectiveness

Procurement planning refers to one obtaining goods and or services within timeline and control budget and the processes thereof meet the needs of the organization. Procurement is a phase involved in this project (Chavan et al., 2020).

### 1.2 Resource Allocation 5M (Manpower, Material, Machinery, Money and Method)

Resources are items that are waiting to be distributed after site ownership in the construction phase according to project activities (Ismail et al., 2014 ; Kannimuthu et al., 2019).

### 1.3 Cost Control Element

While budgeting is often not a controlling factor in handling projects well, ultimately the allocation and cost expenditure should be addressed, including estimating each task within the scope definition (Badiru & Osisanya, 2016).

### 1.4 EPC project in Oil and Gas Industry

The oil and gas industry is divided into three main sectors namely upstream, midstream and downstream (Suppramaniam & Ismail, 2019). The upstream concentrates on exploration and production which covers facilities for production and processing of oil and gas; whereas midstream covers transportation, storage and marketing of the raw product; and downstream focuses on refining of the raw products and distribution of the by-products. EPC is an important step in the operation of the oil and gas industry, focusing on the upstream. The EPC project included the fabrication project, which was assigned to the contractor and fabricator. Each sector of the Oil and Gas Industry its operation cycle (Mohd Roshdi et al., 2021).

## 2.0 LITERATURE REVIEW ON ATTRIBUTES AND STRATEGIES FOR PROCUREMENT TO AVOID COST OVERRUNS AND DELAYS

Several criteria, including their relative importance, influence the choice of a procurement technique. These will make it easier to choose the appropriate procurement strategy to use. Production quality, stable delivery, demand change in time, service, pricing, delivery performance, technical ability, manufacturing capability, financial position, and lead-time were utilised as decision factors in the study by (Chang et al., 2009). Collaboration, environmental investment, resource availability, environmental management, research and design activities, and green purchasing were all considered by Gupta & Barua, (2017).

Therefore, delays in the design process, delays in the awarding of subcontracts, delays in the procurement of materials, delays in the awarding of subcontracts, delays in the management and control of subcontractors, and delays in communication and coordination are all factors in the delay.

The value of the client's prompt approval for the documents permits the following phase to start as soon as possible and prevents any standby by the consultant or the construction contractor, even though Hamzah et al., (2011) views this procurement stage as being of utmost importance. It was corroborated by Le-Hoai et al., (2008), which claimed that the Client's modifications during execution resulted in extensions and deviations to the original timetable as well as additional delays and excessive expenses Mohd Roshdi et al., (2021).

## 2.1 Decision Making Theory

The use of decision-making theory to organise resource allocation in order to achieve the best method for reducing project costs. A supplier may offer a low-quality product with a better and more reliable delivery time, while another may offer a high-quality product with an uncertain delivery time, posing trade-offs to decision-makers. Uncertainty has long been considered an essential component of decision-making (Kaviani et al., 2019).

Decision-makers may have to make trade-offs between a supplier's low-quality product and a better, more dependable delivery time with another's uncertain delivery time and high-quality product. It has long been believed that uncertainty is a crucial part of the decision-making process (Kaviani et al., 2019). The most important factors for evaluating suppliers are risks, relationship closeness, technical level of the supplier, warranty level and experience time, which are regarded as the most important and determining factors for supplier evaluation (Kaviani et al., 2019).

## 2.2 Supply Chain Management

Comparing the operational regions of the supply chain in the manufacturing sector to those in the construction industry, supply chain management has also been extensively studied in academic literature. Supply chain management is the effective management of supply chain operations, and it is carried out in order to maximise customer satisfaction and secure a long-term competitive advantage. It demonstrates a focused effort on the part of supply chain management firms to build and manage supply chains in the most trustworthy and effective way possible. All building processes are represented by the construction supply chain. (A. Papadopoulos et al., 2016) state that the initial client/owner standards for design, building, repair, replacement, works, and subsequent demolition should be followed.

The management of materials in the construction industry is now fragmented, with inadequate communication and ambiguous roles for the parties involved. The division of design and construction, a lack of coordination, and poor communication have all contributed to a large amount of fragmentation. Time delays, higher prices, and unhappy owners are just a few of the negative effects of this. The system is crucial to the procurement of subcontracting and material is an efficient construction environment. The supply chain is typically involved during construction planning and scheduling.

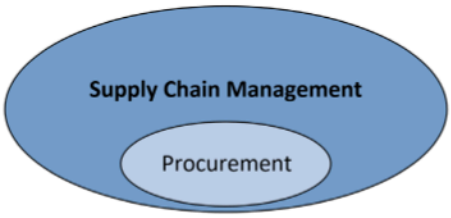


**Fig. 1** Procurement Phase in Supply Chain Management
Source: Self-developed by author(s)

According to Solomon et al., (2004), supply Chain Management is difficult to implement in the construction sector because it requires controlling a sizable and active group of institutions that operate to meet a number of different and incompatible business objectives (2003). The main problems caused by the restricted and independent regulation of the construction supply chain manifest themselves at the intersections of various participants or phases. Love et al., (2004) assert that the building industry is highly fragmented. As an illustration, the separation of design and construction, a lack of coordination and integration across various functional disciplines, and poor communication are all major impact factors that contribute to performance-related problems like low productivity, cost and time overruns, conflicts, and disputes.

### 2.3 Engineering Procurement Construction (EPC) Project and Contract

The term procurement illustrated in stage as Figure 2 and major part appear in EPC project and contract that discover the similar responsibilities.

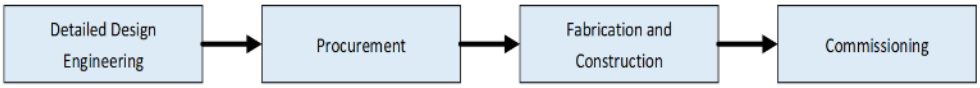


**Fig. 2** Development Stages on EPC contract
Source: Self-developed by author(s)

Therefore, procurement action for purchasing and at the same time to furnish to end user and project management the request that aligned with the contract. Changes are the post-stage after the decision for the new development is made. As a result, the contract agreement between Client and the contractor is written. A tender process, similar to that of other construction projects, is being used. Once the conceptual stages and capital to build a new platform are approved, the development stages. Clients issue a tender to select the best technically and commercially qualified fabricators under their contract for the building projects of a steel structures platform. These contracts reflect the design and construction concepts. The contract is well-known in the EPC contract in the Oil and Gas industry, whereas the phase starts with preparing a detailed plan (Ismail et al., 2014). The stage is in the Engineering phase. Thus, the Procurement phase of the contract is used to process long-lead equipment or bulk orders, as well as resource allocation for project needs. According to the contract, Engineering and Procurement supported with the construction or fabrication phase. With money as capital, resources are derived to support the construction phases in the form of material, manpower, machinery, and method.

Important stakeholders which include the owner as the owner and subcontractor, vendors, special consultants, and service providers are involved in managing the fabrication project operation in onshore fabrication projects, to manage the EPC contractor, as shown Figure 3.

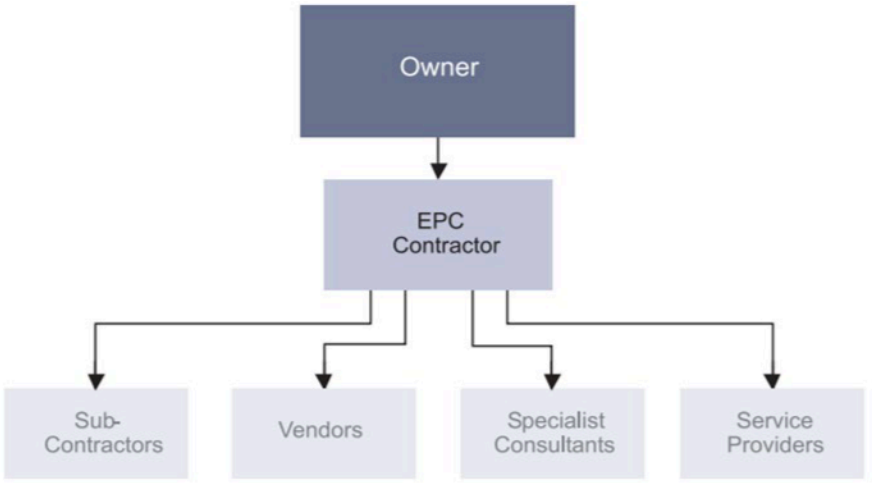


**Fig. 3** Stakeholders in EPC Project
Source: Schramm et al., 2010

Procurement manages their responsibilities in this project under EPC Contractors in order to handle the request of 5M convert into the award of subcontractors, vendors, specialist consultants or service provider to support the project EPC operation as a whole.

**Table 1. A review of the literature on global studies on the importance of 5M resources at the procurement phase in supply chain management.**

| Authors | Issues and Resources' (5M) Classifications | Importance of Procurement | Oil and Gas Projects | Country |
|---|---|---|---|---|
| (Nissi Kalio, Isaac Zeb-Obipi, 2018) | Manpower : Human resources management is one of the arms of the organization that uses information systems to support activities | The Employee Information System is an extensive and comprehensive system that maintains and tracks information pertaining to all the employees in an organization and applicants who chose the organization making human resource planning easier by providing a high degree of customization that allows the user to set up the system with the necessary requirements before recruitment. An organization should implement Employee Information System EIS in order to improve human resource procurement activities in the organization. | Oil and Gas sector | Nigeria |
| (Vytvytska et al., 2019) | Money : development of methodological approaches to | Divide the life cycle of oil and gas resources development into three periods - the period of investment costs (exploration, | Oil and gas fields | Ukraine |

| | | | | |
|---|---|---|---|---|
| | the capitalization of resources of oil and gas fields For each period, appropriate methods are provided for determining the influence of the time factor, taking into account natural and geological features, as well as the risks of investing and receiving cash flows during the development of oil and gas resource | drilling, field development), the payback period of investments and the main operational period. | | |
| (Al-juboori, 2017) | Material : Inventory management represents an important thing for any company because it is considered as a competitive feature of the company in the market | Aims to model and manage the inventory when the demand of product is sudden (unexpected) and how the company can deal with it especially, if there is a limit time for delivery which affects the company work and required additional cost for overtime work. | Material manufacturing (none oil and gas industry ) the system can be applied to the inventory management in Oil and Gas Industry | Jordan, Saudi Arabia |
| (Ghaeli, 2019) | Machineries : Maintenance engineering plays an important role in management of oil and gas projects. This paper presents a dynamic programming approach for resource allocation in oil and gas projects. The study presents a dynamic programming approach to allocate human resources for repairment of oil and gas equipment. | Many heavy equipment normally needs to be repaired on predetermined scheduled and the process normally takes days or even weeks. The process can be divided into three stages of disassembling the equipment, executing the repairment and assembling the equipment. | Oil and Gas projects | Canada |

| | | | | |
|---|---|---|---|---|
| (Silvianita et al., 2017) | Method : The development process of jacket structure is not always in accordance with the planned schedule in advance. Many factors affect the planning failure, among others, the time or the planned schedule, budgeted costs, equipment and material needed, the human resources (manpower) and hours of labor (man hours) | The objective of this paper is identifying what are the impact of delays on the jacket construction project. One method that can be used to analyze these problems is the method of Event Tree Analysis (ETA). This method is useful in analyzing the consequences arising from a failure or undesirable events. | Oil and Gas Fabrication Project | Indonesia |

## 3.0 METHODOLOGY

The first phase involves reviewing the literature reviews from previous researchers in the specified field of study. The significance of a literature search is to gain an understanding of the procurement responsibilities and their importance incurred in terms of cost control elements while determining the problem and research gap. To capture the issues in managing the oil and gas industry with various oil and gas megaprojects, a similar area of study is required. Exploring procurement phase is part of the bigger perspectives in supply chain management managing resource allocation and contributing factors related to managing oil and gas projects in fulfilling resource allocation are extracted at this stage. Journals, articles, conference papers, annual reports, and books as secondary data sources for this study. An inductive approach that can also be combined with a deductive approach and thematic analysis will be used to perform a qualitative case study method-based interpretivism research in greater detail as Figure 4.

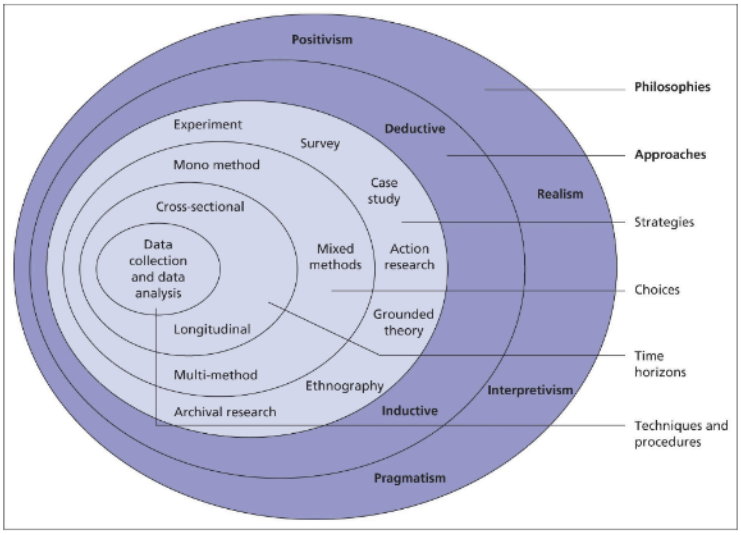


**Fig. 4** Identification of the direction of the researcher's methodology
Source: Saunders et al., 2016

## 4.0 RESULT AND DISCUSSION

Procurement is the phase that involves the intelligent in delegation of furnishing the request from the project team on 5M to the realistic at construction and engineering phase. The support from the Procurement on time basis and urgently readiness of 5M for the onshore fabrication projects assist the project on track with control delays and cost overruns. Request of 5M will go through phases under Procurement is managing the bid packages as request from the end user aligned technically and commercially are deserved in this project in controlling project value. For the Procurement to float bid to the vendors and expert on 5M as requested, the Project team including Project Manager and Project Engineer shall provide the details of request confirmed specification and approved details drawings which are related and aligned with the Client's approval. This information required by Procurement to set up Request for Quotation (RFQ) to get the right 5M on the right activities of fabrication, schedule and procure right at one time avoid cost overruns within budget and maintain the quality in procuring 5M. Therefore, the information details also assist to expedite the 5M quickly aligned with the project schedule which require the responsibilities of project team of onshore EPC project in compilation.

The next step is to manage, execute and mobilize the delivery once biddings are closed at this stage, the responsibilities of Procurement to acquire the best award, bidding and the right 5M a per requested by onshore EPC project team. The procurement must endorse the best of their expertise to procure the 5M aligned with the time, cost and quality. Before finalisation, the Procurement again get the approval thru the preparation of technical and commercial proposal or evaluation and present to the end user, led by Project Manager in order to proceed for award. Purchase Request (PR) are processing from initial stage until the preparation of technical and commercial evaluation completed with the recommended vendor. Suggested vendor always the best vendor that fulfil with time, quality, and cost within budget meeting project value with profit calculated. Some potential vendors of 5M provide the proposal completed with timeline, availability of 5M , fastest mobilization and good quality of products and services are chose. The procurement workflow for processing 5M request for EPC projects and contract award for project procurement performance process is shown in Figure 5.

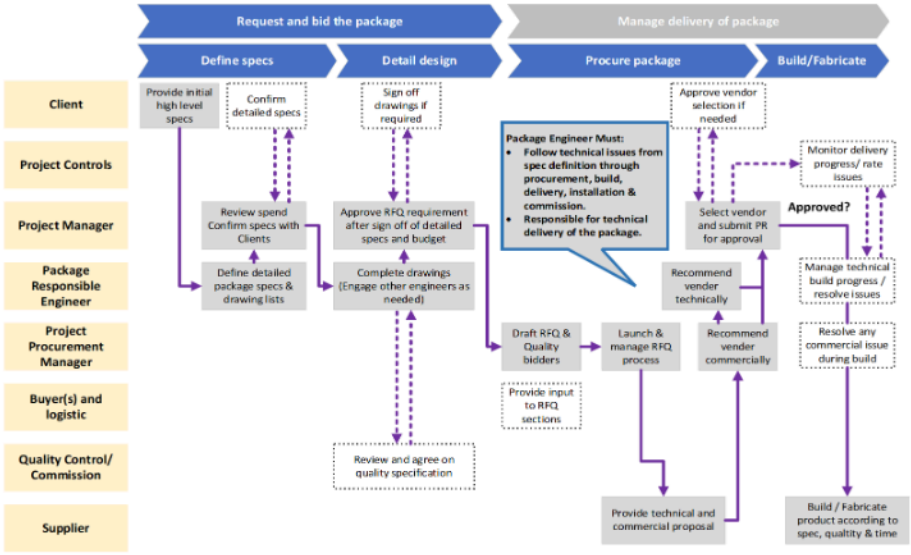


**Fig. 5.** Procurement Workflow for processing 5M request for EPC projects and Contract award for project Procurement Performance Process
Source: Self-developed by author(s)

The workflow in this research illustrated the procurement workflow that entitled from Procurement to process the 5M requests in onshore fabrication projects created due to project schedule or activities and approval requirements in terms of budget and time. The responsibilities weightage in under Procurement which is led by Procurement Manager, distribute by Procurement Executive, Buyer and Subcontract Executive aligned with the Quality Control team and Cost Control team to acquire the best 5M upon request. The procurement process is successfully furnished due to the support by the Project Manager, Project Engineer, Project Control directly liaised with Client.

## 5.0 CONCLUSION

Therefore, procurement cost control is a cleaning activity that promotes resource efficiency and cost awareness while avoiding valuable resources. Costs can be reduced by improving the efficiency of material use, labour productivity, and machinery. In contrast Afshari et al., (2011) , non-excusable delay factors with the largest impact are failing to select a competent subcontractor, poor project change management, and a lack of a mechanism for recording and transferring project lessons. Therefore, delays in material procurement, delays in subcontract award, a lack of proper management and control of subcontractors, delays in design, and a lack of communication and coordination everything that contribute to the delay. While Hamzah et al., (2011) considers this procurement stage to be very important, the value of the client's quick approval for the documents allows the next step to commence as early as possible and avoids any standby by the consultant or the construction contractor. It was supported by Le-Hoai et al., (2008) stated that the Client's changes during execution caused additional delays and high costs because they impacted the designing documents and ordered materials, resulting in original schedule extension and variations.

Implementing supply chain management in the construction industry is challenging because it necessitates overseeing a sizable and active group of institutions that collaborate to address a range of requirements. However, it's also important to strengthen competing company goals.

The limited and independent management of the building supply chain creates significant issues at the intersections between several phases or participants. Among other things to consider is the general supply chain. There is still no defined management in the construction sector, notably in Malaysia. The highest recommendation shows that the response executive has a desire to change the way they conduct themselves to advance in supply chain management for building materials. This is since the contractors discovered they were unaware of the benefits of supply chain management for materials in the building business. One of their extremes would be willing to have solid knowledge about it. Spending within budget, financial control, meeting project value, optimising material usage, and sufficiently matching project goals within contract are all important factors that contribute to project control. 5M are linked together in project management according to project requirements. It can be characterized as the integration of project management, supply chain management, procurement, engineering management, and construction management into a single circle to successfully complete the management of an EPC project in terms of cost, time, and quality. The use of an inductive strategy, which can also be combined with a deductive approach and thematic analysis, will be used to conduct interpretive research based on qualitative case study methods in the future with interviews in greater depth.

## AUTHOR CONTRIBUTION

All authors contributed to the research, theoretical research, case study techniques and write up. The methodology was undertaken by the researcher.

## ACKNOWLEDGEMENTS

The authors are thankful to the Centre of Graduate Studies, Universiti Teknologi MARA (UiTM) Perak Campus Seri Iskandar for knowledge contribution and all respected participants willing to participate in this research.

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