

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY: APPLIED BUSINESS AND EDUCATION RESEARCH

2024, Vol. 5, No. 5, 1872 – 1964

<http://dx.doi.org/10.11594/ijmaber.05.05.30>

Research Article

Sustainable Lean Procurement and Contract Management in Oil and Gas Industry

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Article history:

Submission May 2024

Revised May 2024

Accepted May 2024

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ABSTRACT

Lean methodologies have enabled numerous businesses to enhance their processes, reduce inventory levels, and improve ergonomics. Additionally, lean has allowed organizations to adapt their technologies and keep pace with necessary advancements. However, despite the numerous benefits it offers and the implementation of lean thinking and procurement in the oil and gas industry, companies have frequently encountered challenges related to the timely delivery of materials and services.

This research aimed to understand how the oil and gas industry implements lean procurement practices, investigate the relationship between lean procurement and supply chain performance, and identify the challenges faced by the industry in implementing lean procurement. The study employed a case study approach, focusing on the oil and gas industry's command centre as the target population.

Through stratified random sampling, a sample of 37 leaders from the oil and gas industry was selected, representing 20% of the target population. Secondary data sources included the industry's annual reports and financial summaries, while primary data was collected through questionnaires.

The quantitative data gathered for this research was analysed using the Statistical Package for the Social Sciences (SPSS) version 20, employing both descriptive and inferential statistical techniques. Descriptive statistics components included percentages, standard deviation, frequency, and mean. Data presentation was facilitated through tables, charts, and diagrams. A narrative framework was utilized to present the results of the content analysis conducted on the qualitative data. Additionally, regression analysis was employed to further understand the relationship between lean procurement and supply chain performance.

The study results demonstrated the existence of a positive and significant correlation between lean procurement and supply chain

How to cite:

Umasekar, V. (2024). Sustainable Lean Procurement and Contract Management in Oil and Gas Industry. *International Journal of Multidisciplinary: Applied Business and Education Research*. 5(5), 1872 – 1964. doi: 10.11594/ijmaber.05.05.30

performance. Furthermore, the study indicated that the oil and gas industry utilized lean procurement strategies such as electronic procurement, 5S, comprehensive quality management, continuous improvement, supplier-firm collaboration, the pull system, and employee involvement and empowerment.

The study's findings suggest that the oil and gas industry should foster relationships with service providers staffed by knowledgeable personnel capable of efficiently implementing lean procurement practices. By doing so, the industry can effectively address the challenges associated with timely material delivery and optimize its supply chain performance.

Keywords: *Contract Management, Industry, Procurement, Sustainable Lean*

CHAPTER 1 Introduction

1.1 Introduction: - Phenomenon and Importance of Oil and Gas Industry:-

Since the mid-20th century, the oil and gas industry has emerged as the foremost energy provider worldwide, serving as the lifeblood for industries, residential heating, and transportation networks across the globe. This sector plays a pivotal role in sustaining modern civilization by powering industrial operations, heating homes, and fuelling vehicles that facilitate global transportation and trade. Moreover, it serves as a cornerstone of employment in diverse regions, ensuring energy security and affordability for consumers.

Amidst the dynamic landscape of the oil and gas sector, companies face enduring challenges, particularly in managing the intricate balance of supply and demand dynamics. It is imperative to reassess supply chains, procurement strategies, and operational costs amidst fluctuating oil prices, which have recently hit historic lows with uncertain prospects of recovery in the near term.

In this context, oil and gas enterprises must focus not only on hydrocarbon supply chains but also on non-hydrocarbon procurement networks, which play a critical role in sourcing essential components, materials, and services necessary for operational efficiency. The efficacy of these supply chains is paramount, given their role in facilitating exploration, extraction, refining, and distribution processes within the industry. Addressing procurement and supply

chain management inefficiencies is crucial for mitigating the challenges faced by oil and gas firms, particularly against the backdrop of declining oil prices.

In recent years, countries within the Gulf Cooperation Council (GCC) have witnessed significant advancements in the oil and gas sector, particularly in exploration and production (E&P) activities. Notably, the United Arab Emirates (UAE) has made strides in developing a resilient and efficient ecosystem, prioritizing the health and operational excellence of its workforce.

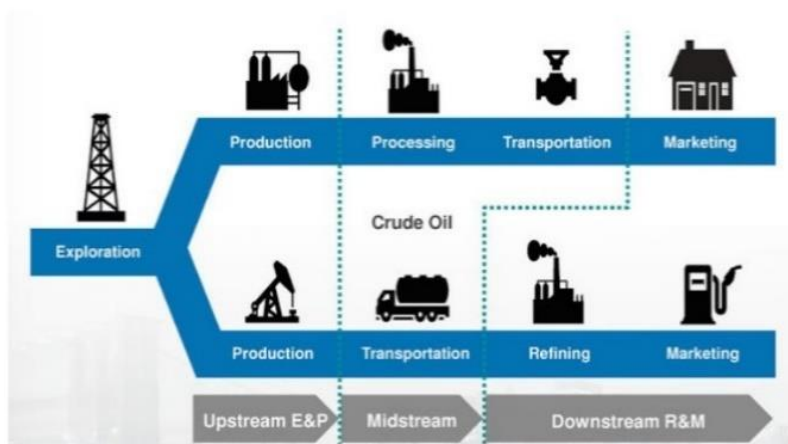
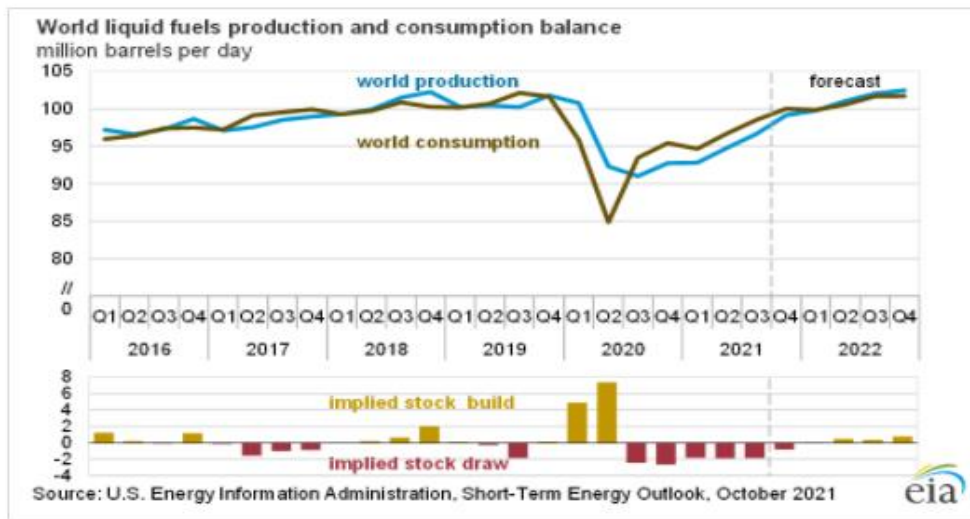
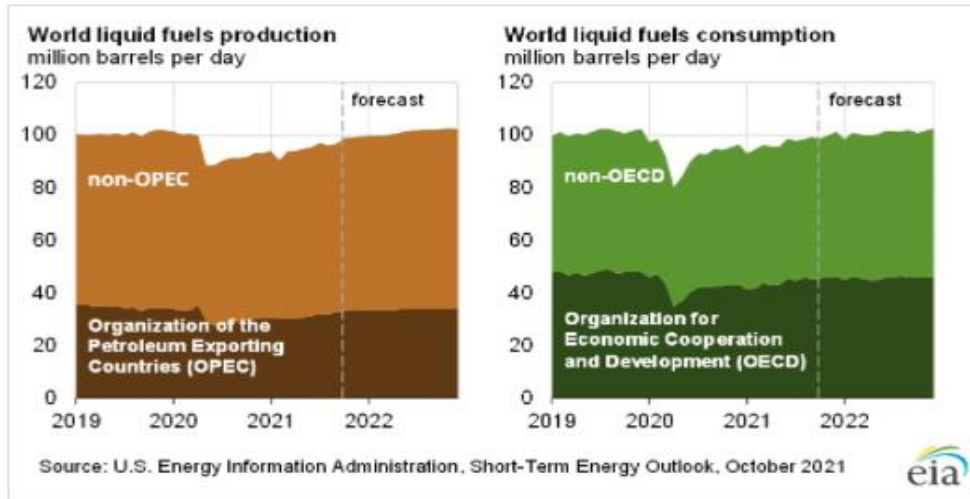
Technological innovations have also reshaped the industry landscape, enabling the extraction of oil from previously untapped shale reserves, thereby altering traditional supply dynamics [Hamilton, 2009]. As such, the imperative lies in identifying optimal strategies to maintain competitiveness amidst evolving market conditions, while also ensuring seamless execution of operational processes.

This approach hinges on robust quality control and validation processes, leveraging methodologies like Six Sigma, Lean, and Kaizen, to solidify its position as a leading global manufacturer in the oil and gas industry. Kaizen, specifically, underscores the ethos of continuous improvement. The literature presents numerous instances of Six Sigma implementations, exemplifying its relevance in this domain.

However, it is surprising that a significant portion of industry stakeholders remain unaware of Six Sigma's applicability within the oil and gas sector. During our exploration of Six

Sigma adoption among major oil and gas corporations, we were astonished to discover that several entities in the Gulf Cooperation Council (GCC), including the Abu Dhabi Company for Coastal Oil Tasks and the Abu Dhabi Gas Lique-

faction Company, have embraced this methodology. This revelation underscores the potential for broader adoption and underscores the need for greater awareness and dissemination of best practices within the industry.



Processes involved in the supply of oil and gas

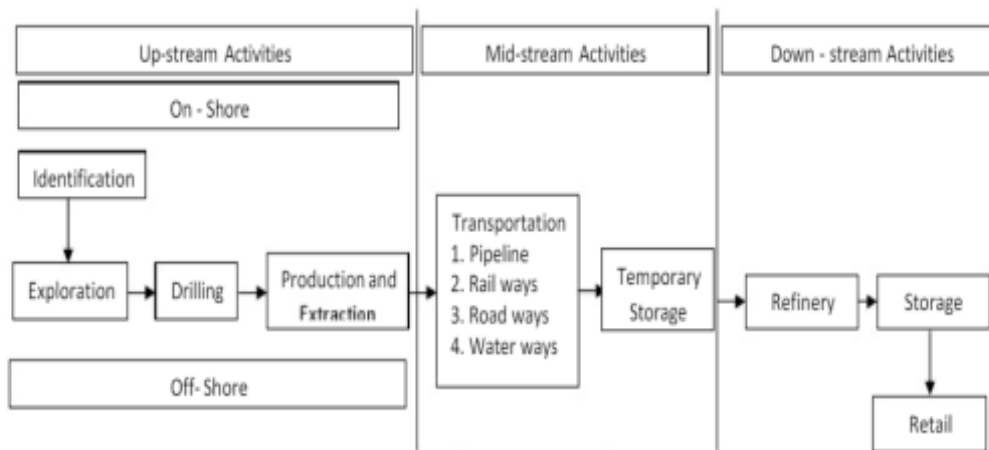
In the realm of the oil and gas industry, supply chain operations are delineated into two main segments known as "upstream" and "downstream." These terms are pivotal in characterizing the trajectory of operations within companies operating in this sector. Proximity to the end consumer determines whether a capacity or firm is categorized as downstream or upstream, irrespective of their position within the supply chain.

The upstream segment encompasses activities such as raw material extraction and man-

ufacturing processes. Entities situated upstream are responsible for the exploration and extraction of oil and natural gas reserves from underground reservoirs. These organizations are commonly referred to as exploration and production companies.

Conversely, the downstream segment of the oil and gas supply chain is primarily concerned with the refining process, which involves processing crude oil and natural gas into usable products. This segment represents the culmination of the supply chain, wherein oil and gas are transformed into refined products ready for distribution and consumption.

Gas and oil distribution network



Upstream Activities

The upstream sector of the oil and gas industry, often referred to as exploration and production (E&P), encompasses operations centered around the exploration, extraction, and delivery of crude oil and natural gas. This sector is characterized by a diverse range of activities, including rig operations, feasibility studies, equipment leasing, and provision of extraction chemicals.

Key activities within the upstream segment include:

- **Exploration:** Involving airborne surveys, seismic analysis, geophysical studies, and topographical assessments to identify potential oil and gas reserves.
- **Drilling:** Conducting exploratory drilling, including wildcat and test wells, to assess the viability of identified reserves.

- **Extraction and Production:** Utilizing various techniques to extract and produce oil and gas from identified reserves, along with rehabilitation and de-charging processes.

The primary focus of upstream operations is optimizing well performance, including aspects such as well placement, depth, and design, with the aim of maximizing profitability while minimizing operational risks and environmental impact.

Midstream Operations

The midstream sector acts as the intermediary between upstream and downstream operations, primarily focusing on the transportation and storage of crude oil and its derivatives. Infrastructure such as pipelines, tanker fleets, and rail transport systems facilitate the

movement of oil and gas from production sites to refining facilities and distribution centers.

Key components of midstream operations include:

- **Transportation:** Utilizing various modes of transportation to move crude oil and natural gas from production sites to processing facilities.
- **Storage:** Providing storage facilities for hydrocarbons extracted from oil and gas wells until they are ready for processing.

Downstream Activities

The downstream sector of the oil and gas industry is responsible for refining crude oil into marketable products and distributing them to end consumers. This sector encompasses a wide array of activities, including refining, marketing, and distribution of petroleum-based products.

Key downstream operations include:

- **Refining and Processing:** Converting crude oil into refined petroleum products such as gasoline, diesel, heating oil, and asphalt.
- **Supply and Trading:** Managing the supply chain logistics to ensure a constant flow of refined products to retailers and consumers.
- **Marketing and Distribution:** Promoting and distributing petroleum-based products to end-user markets worldwide.

Given the complexity of oil sector supply management, information technology plays a crucial role in ensuring seamless coordination across the supply chain, from refineries to end consumers. Supply chain coordination within the oil industry relies heavily on logistics concepts to optimize operations and meet market demands efficiently.

Supply Chain Management

Supply chain management (SCM) entails orchestrating a company's operations to minimize costs and optimize efficiency in delivering essential commodities to their final destinations. At its core, SCM aims to maximize the flow of goods and services from suppliers to consumers while ensuring cost-effectiveness.

Key Principles of Supply Chain Management:

1. **Efficiency Maximization:** The fundamental objective of SCM is to optimize the flow of goods and services, ensuring the best possible service to customers at the lowest feasible cost.
2. **Customer-Centric Approach:** Customers, or end-users, are central to SCM efforts. The goal is to meet customer demands efficiently and effectively.
3. **Collaboration and Information Exchange:** Effective SCM involves collaborating with partners across the supply chain to enhance end-user value, reduce costs, and facilitate information exchange. This includes forecasting methods, inventory management, transportation logistics, and primary cooperation strategies like just-in-time systems and co-locating plants.
4. **Performance Improvement:** Implementing a robust SCM strategy leads to improved customer service, enhanced product accessibility, and faster order processing, thereby enhancing overall performance.

Benefits of Supply Chain Management:

Research by reputable organizations such as AMR and Forrester highlights the following benefits of effective SCM implementation:

- Increased profitability by 5% to 15%
- Reduction of processing time and costs by 20% to 40%
- Decrease in market lead time by 15% to 30%
- Lower procurement expenses by 5% to 15%
- Reduction of warehouse inventory by 20% to 40%
- Cutting manufacturing costs by 5% to 15%

Role of Artificial Intelligence in SCM:

Artificial intelligence (AI) plays a pivotal role in optimizing SCM processes, particularly in decision-making. AI technologies leverage simulated experiences and past knowledge to streamline research, manufacturing, and operational phases, resulting in significant time and cost savings. In the oil and gas industry, AI and data-intensive technologies have the potential

to save billions of dollars by enhancing decision-making and optimizing supply chain management.

Challenges and Opportunities in Oil and Gas SCM:

The oil and gas industry faces unique challenges in managing its supply chain due to the complexity of processes and vast amounts of data involved. Decision points, such as procurement, transportation, refining, and distribution, require sophisticated management to navigate effectively. To enhance the value of their supply chain and increase overall revenue, oil and gas firms can explore innovations, supplier relationship management, and strategic arrangements within the supply chain.

Supply Chain Intelligence (SCM Intelligence):

SCM Intelligence involves gathering and analyzing data to enhance market understanding, improve execution of market strategies, and better anticipate and respond to changes in the commercial landscape. By leveraging market data effectively, oil and gas companies can address critical issues such as regulatory compliance, infrastructure planning, and market volatility, while also optimizing strategic decisions regarding procurement, spending, and performance benchmarks.

1.2 Background of the Problem: Sustainable Lean Procurement and Contract Management

In today's fiercely competitive business landscape, maximizing efficiency while minimizing costs has become a paramount objective for the procurement industry. Amidst this climate of escalating rivalry, Lean procurement has emerged as a crucial domain that consistently unveils striking parallels to efficacy across various industries. It is imperative to acknowledge that pivotal procurement strategies in the contemporary business environment are susceptible to elite business decisions that successful enterprises actively pursue (Davies, 2000). The just-in-time (JIT) methodology, initially pioneered by Toyota in the 1960s, has acquired a multitude of monikers. Hewlett-Packard's "stockless production," Motorola's

"quick cycle manufacturing," and Boeing's "lean manufacturing" are merely a few examples. The driving force behind this endeavour was the necessity to manufacture a more diverse array of products in smaller batches, utilizing the same production facilities in a redundant fashion. Eliminating unnecessary steps and processes in the value chain, as well as work-in-progress (WIP) inventory, was one of its secondary objectives. Bhasin and Burcher (2006) assert that the lean and six sigma management approaches originated from the principles of just-in-time (JIT) and total quality management. The procedures and techniques that constitute the lean mindset trace their roots to the earlier iterations of JIT and TQM. This is particularly evident in scenarios where just-in-time or lean procurement is the prevailing methodology, especially concerning purchasing capability. Nearly every industry began adopting lean manufacturing and supply chain thinking methods following Toyota's success and the increased attention garnered by the lean concept (Liker, 2004). Accompanying this shift was a global movement within the industrial sector. The government, service industry, and healthcare services are just a few of the non-automotive sectors that have successfully embraced Lean, and according to Bowen and Youngdahl (2006), this trend is poised to continue. Liker (2004) highlights that lean can be effectively implemented across all areas of a company; including procurement and that there is ample room for innovation in discovering new and improved ways to apply it. Moreover, lean heavily relies on robust relationships with suppliers to achieve its objectives. In the cutthroat business environment of the commercial core, the supplier is often the determining factor. The oil and gas industry must remain lean and agile to seize opportunities during challenging times. Unless the association undergoes transformation, it is likely to become lax and susceptible to unpleasantness. The oil and gas industry is now compelled by climate change to continuously monitor its operations for potential variations, obscurities, or aging. Oil and gas project companies have been adopting lean methodologies such as JIT, supplier relationship management, Six Sigma, Continuous Improvement (CIP)/Kaizen, and six sigma to

adapt to the new and highly challenging market conditions. This stands in stark contrast to other industries worldwide, which have been reformulating themselves in an effort to remain competitive through the implementation of standards like continuous improvement, reengineering, proper estimation, restructuring, social transformation, and total quality management.

Lean Procurement: Varied Perspectives

Various groups hold diverse perspectives on the meaning of "lean procurement." It is often employed to define a mindset, a workplace culture, a strategy, an ethic, guiding principle, methodology, or management philosophy (Lysons, 2000). The notion of continuous and incremental improvement, both internally and across groups, is a recurring theme. Harland et al. (2007) state that for lean procurement to be effective, a company's supply chain partners must demonstrate high levels of accountability, self-control, consistency, and support. This follows the same four-tiered pattern as any other hierarchical system. As each company employs its own strategy when implementing lean procurement, it is safe to assert that no two lean procurement systems are identical. One plausible explanation for these variations is that each company faces its own unique set of challenges and circumstances. According to Boyer and Sovilla (2003), lean procurement often utilizes techniques such as supplier development, Kanban systems, and kaizen. For a company to become lean, it must possess the correct mindset, well-defined processes, employees, and culture. One of the most crucial aspects of lean supply, as highlighted by Handfield (1993), is maintaining long-term partnerships with suppliers. Harland et al. (2007) assert that the current demand-driven supply chains necessitate lean procurement practices. The objectives of these approaches are to maximize customer satisfaction, reduce procurement lead time and costs, decrease inventory investment, boost inventory turnover, and eliminate waste in all procurement processes. These methodologies ensure higher levels of competence and system standardization. By applying lean methodologies to its purchasing processes and procurement capability, a company can enhance its

financial performance and overall benefits. However, a lack of systems thinking can lead businesses to ineffectively implement lean procurement practices (Lysons, 2000). Employees may exhibit resistance to change and struggle to adapt to new processes. Potential factors hindering the effective implementation of lean procurement include the organization's internal capabilities to work with education and training, a lack of commitment from suppliers and management, and unclear responsibility in the supply chain. Inadequate planning, monitoring, and control also play a role. The effective implementation of lean procurement techniques may be hindered by the lack of supply chain transparency and the difficulty in limiting and differentiating between value and waste. Lean procurement techniques may require more resources to be utilized, which could lead to higher expenditures for an organization (Harland et al., 2007).

Supply Chain Performance

At its core, successful supply chain performance is the ability to reliably and promptly deliver the right items to the right places at the right prices. Martins and Jochem (2001) state that suppliers will be valued more highly and regarded as great partners within the business if they contribute to establishing systems and procedures that aid in achieving the performance objective. The administration can only be assured upon completion of the necessary steps after an assessment of the supply chain's efficiency has been conducted. The key to an efficient and dependable supply chain is having the right quantity of high-quality goods available at the right place and at the right price (Boyer and Sovilla, 2003). When evaluating the supply chain's efficiency; researchers could employ either quantitative or qualitative methods. Mathematics makes short work of a wide array of performance measurements. In this context, "items produced," "items expected to be delivered," and "orders completed on time" are all examples of such metrics (Harland et al., 2007). However, numerical explanations become much more challenging for a significant number of performance outcomes metrics. Product quality, degree of preparedness, and customer loyalty are a few examples (Martins

and Jochem, 2001). When providing an indication of a basic level of output, it is customary to disregard the relationship between the costs that are expected to achieve further degrees of outcome. How much more expensive or valuable are the items that are delivered earlier? A similar question arises: what would the costs be if the goods arrived late? Additionally, yield measurements require short and limited horizons. Consequently, resources influence supply chain outcomes, and supply chain outcomes drastically affect the system's adaptability. Since most businesses' primary goals revolve around meeting customer needs, it is crucial to compare yield performance metrics to both the organization's critical objectives and the customers' aims and values (Bonavia and Marin, 2006). In light of the current challenging economic climate, customers expect their suppliers to reliably and promptly deliver items, as well as labour and materials. Problems with delivery variations, especially late deliveries, are currently causing issues in supply chains, according to Wilson and Roy (2009). Lead time to market (LTTO) has a significant influence on how well all the links in the supply chain collaborate. According to this perspective, a shorter lead time may have the effect of encouraging collaboration throughout the supply chain. Reducing lead time has been considered a potential theoretical approach, according to Shah and Ward (2003). Consistent implementation of a systematic performance measurement approach is essential to the process of further improving supply chain performance (Esben, Gjerdrum, & Mahad, 2011). Additionally, it requires an element that initiates the processes necessary to meet key performance indicators. Furthermore, "key performance indicator achievement" is defined by Esben, Gjerdrum, and Mahad (2011) as the ability to integrate project planning and execution, including the identification of performance objectives, into the daily routine. When evaluating the efficiency of a supply chain, various combinations of variables may be used to depict the impact of calculated supply networks on overall system revenue and expenditure. Supply chain management methods provide this data, which is considered a performance driver in the supply chain. Managers must distinguish between

them and continuously enhance them through routine activities of planning, monitoring, and implementation. Numerous challenges, such as performance measurement and performance improvement, are associated with this performance management cycle (Esben, Gjerdrum, and Mahad, 2011). The variables used to measure supply chain performance fall into four main categories: quality, time, cost, and flexibility. Other classifications include supply chain processes, core processes, functional processes, strategic focus, cost and non-cost processes, and quality and quantity processes (Bhasin and Burcher, 2006). These groups have been arranged with other groups. However, many measurement techniques fail to provide the essential structure, balance, and systematic thinking. When issues arise during the process of systematically determining the most suitable metrics, managers investigate them. To address this challenge, methods such as activity-based costing and balanced scorecard have been employed to analyze the supply chain's performance.

Supplying customers with the products and services they require in a timely manner while maintaining low costs and high quality has always been procurement's primary focus. Nevertheless, its role has expanded to significantly impacting the flow of data and goods across the supply chain. Effective procurement management practices extend far beyond merely exchanging contracts. To achieve this, they engage in crucial acquiring activities including market research, vendor evaluation, and integration, in addition to establishing basic functional requirements. Inventory management and the acquisition of supply chain options are fundamental to a company's financial performance. In fact, most companies' production processes account for only about 25% of the total product value. Supply chains offer immense potential for lead time reduction, quality improvement, and cost reduction, making them an excellent choice for the role of supply chain manager.

An uneven assessment of waste in a value chain is directly linked to the failure of procurement methods to function as intended. Businesses typically struggle to limit and discern between value and waste due to a lack of clarity

about their supply chain. As long as everything else remains constant, businesses will continue to face the challenge of balancing the "necessary waste" processes related to procurement with the value-adding ones. A company's bottom line and primary focus could both be profoundly impacted by the advantages that Lean Principles provide to purchasing operations and procurement managers. Traditionally, procurement has been responsible for delivering the acquired goods and services to customers on time, within budget, and to the best of their abilities to meet their needs. Despite this, its role has expanded to significantly influencing the flow of data and goods across the supply chain. Best practice procurement management's capabilities extend well beyond the mere exchange of contracts. Contributing to crucial acquiring activities like market research, vendor evaluation, and integration, as well as establishing essential functional requirements, is how they achieve this. Fundamental to a company's financial performance are inventory management and the acquisition of supply chain options. In fact, most companies' production processes account for only about 25% of the total product value. Supply chains provide a fantastic opportunity for Lean Arrangements due to the immense potential they offer for cost reduction, quality improvement, and lead time reduction. The oil and gas industry was compelled to find new ways to sustain profitability as oil prices began to plummet at the end of 2008. Complex project-based ventures, such as those in the oil and gas industry, necessitate the acquisition of sub-projects and competencies from external providers; according to Martinsuo and Ahola (2009). Companies in this industry are prime targets for efforts to identify cost-saving and efficiency-enhancing measures since they outsource 80% to 90% of their expenditures to contractors. Procurements considered complex often involve multiple parties, are fraught with technological complexity and uncertainty, and may span an extended period (Nevi, 2004). Typically, the buyer is unable to simply purchase individual components (including administrative systems) and assemble them due to the situation's complexity. According to Caldwell et al. (2009), this implies that the conventional method of

procurement, which is often employed in manufacturing, cannot be utilized to complete the procurement process. Olsen et al. (2005) state that oil and gas companies have explored the use of contracts and governance mechanisms to manage their complex procurements. Although there have been numerous studies examining the effects of governance tools (Caniëls and Gelderman, 2010), very few studies have focused on employing multiple governance mechanisms simultaneously. As demonstrated by Olsen et al. (2005), this is particularly relevant to the oil and gas industry.

Supplier risk intelligence refers to the process by which a business can acquire and analyze supplier risks to gain insight into both the present and the future, facilitate the execution of current and future procurement and market sector strategies, and enable the organization to anticipate and respond to changes in the external commercial landscape before others do. When there is an over-reliance on one country or a group of suppliers from one region, Supply Chain Mapping can help mitigate the risk along the supply chain. This is particularly crucial when engaging in international trade. To paint a comprehensive picture of the supply chain, one must possess intricate knowledge about the suppliers—their global locations, nearby facilities, and subcontractors—and everything that originates from or passes through them. Companies that have meticulously mapped out their supply chains in advance can discern the immediate and medium-term impacts of disruptions with greater clarity. This empowers them to respond more effectively. By being forewarned about the likely source of the disruption and the specific equipment or components it will affect, business organizations can implement preventative and corrective measures. These tactics encompass procuring alternative solutions, allocating critical supplies, and eliminating fundamental supply chain bottlenecks.

It is common to encounter fifth- or sixth-tier suppliers farther upstream during the procurement phase of a project's supply chain, and this step can be a time-consuming endeavour. Here lies the greatest potential for increasing the project's supply chain value. A company cannot fulfil its obligation to a client to produce

a product or complete a project without engaging in procurement, which encompasses all the various transactions necessary for this process. Thoroughly completing the "make or buy" analysis is a prerequisite before deciding to purchase from an external vendor. The general principle is that when a business is certain that a product or component will contribute to its core competencies, it should provide it internally. In all other instances, the parts or products must be procured externally. Procurement involves determining the nature of the procurement and the client's requirements, researching and vetting potential suppliers, negotiating contracts, mediating disputes between the two parties, and ultimately, assessing and nurturing vital relationships with the suppliers. Consequently, efficient procurement can significantly enhance a company's competitive edge. This is because a substantial portion of the final cost for certain industries goes towards paying for the materials and components that are procured from external vendors. Dealing with these vendors and ensuring the timely delivery of high-quality components and parts is a formidable undertaking. Consider Boeing's 1997 endeavour to meet an unprecedented demand for new aircraft; the company sought to overnight treble its output. Nevertheless, in its haste to satisfy the demand, the corporation failed to thoroughly consider the ramifications for its supply chain. By discontinuing its sequential manufacturing processes for the 747 and 737, Boeing incurred a \$1.6 billion loss due to component and skilled labour shortages that arose at the assembly stage.

Uncertainty and risk permeate the entire supply chain in the construction industry. Future performance gains in this sector of the economy may be achieved by adopting effective procurement practices, including supplier selection and collaboration, electronic procurement, and supplier kaizen. A recent Hong Kong study investigated the factors influencing the success of the construction industry and found that the processes used to select the overall procurement system, contractors, and subcontractors are crucial. Furthermore, when appropriately utilized, information technology and information systems can benefit all links in the construction supply chain (Kumaraswamy et

al., 2000). Quality management and assurance in accordance with the International Organization for Standardization's (ISO) 9000 standards could prove invaluable while selecting vendors. The International Organization for Standardization (ISO) 9001 certification, for example, attests that a company's internal processes and operations adhere to stringent global quality standards. This allows for the convenience of including these businesses in the pool of potential vendors.

Supply Chain Relationships

Executing projects to their full potential necessitates a high degree of trust and robust relationships among all parties involved. If supply chain participants can cultivate trust and coordinate their information systems, opportunities may arise to streamline processes and enhance procurement, organizational, and contracting techniques. Suppliers with access to accurate and timely information could make more substantial contributions to project planning, thereby boosting planning productivity and project performance (Yes and Ming, 2002). Recent research on two UK construction projects (Ballard and Cuckoo, 2001) revealed that suppliers and subcontractors can reap substantial supply chain benefits and upgrades by collaborating closely from the outset. When all parties in the supply chain work together in a partnership, they can collectively contribute to realizing the vision while remaining within budget constraints. The suppliers and other partners can generate better ideas; problems can be resolved more efficiently thanks to increased communication channels; and ultimately, the project will be completed on schedule, with superior quality, lower costs, and greater value for money. Watson (2001) asserts that a combination of supply chain partnerships and other measures could potentially reduce errors and accidents in the development sector by 20% while simultaneously increasing productivity and quality by 10% and cutting costs and time by 5%.

Supplier Development

Developing suppliers is an additional initiative that could augment the value of the project supply chain's procurement phase. As part of

their global procurement effort, GE Corporation offers a supplier development program. Through this initiative, GE instructors will provide comprehensive training to vendors, enabling them to undertake independent project work. Ultimately, it is crucial to remember that external suppliers must be coordinated with project activities, and procurement in a project context requires significant preparation. Project supply chain value will rise due to lower procurement and inventory costs, shorter lead times, and improved acquired components. Practices such as supplier kaizen, trust-based relationships, vendor development, information and risk sharing, integral long-term collaborations with suppliers, and supplier quality control activities are incorporated.

Discussion

The next step to be considered for value optimization is the project supply chain's conversion or creation phase. Figure 1.2 depicts this subsequent phase that must be addressed. At this juncture, the product is actually manufactured. This could involve the creation of a new product, the production of a different product packaging, or the construction of a ship to drill for offshore oil (Pinto and Rouhianen,

2001).The competence and feasibility of the procurement phase of the project supply chain often dictate the extent of progress that can be made in terms of value creation. Similar to procurement, the nature of the challenges encountered at this stage will be determined by whether the project is reasonably straightforward or highly complex. Regardless of the project's concept, there are a few proven strategies from traditional manufacturing that can be employed to enhance the project supply chain's value during the conversion phase. One example is Boeing Corporation's unique application of lean manufacturing techniques in its commercial aviation sector, leading to the company-wide adoption of large-scale sequential assembly systems. The objective is to overcome the formidable competition from Airbus. It is believed that this process improvement will result in a 50% increase in Boeing's production and double-digit growth in the company's overall revenues from commercial aircraft sales (Holmes, 2001). By implementing lean manufacturing practices, project environments can be enhanced. In addition to reducing processing time, this is achieved by eliminating unnecessary inventory and waste.

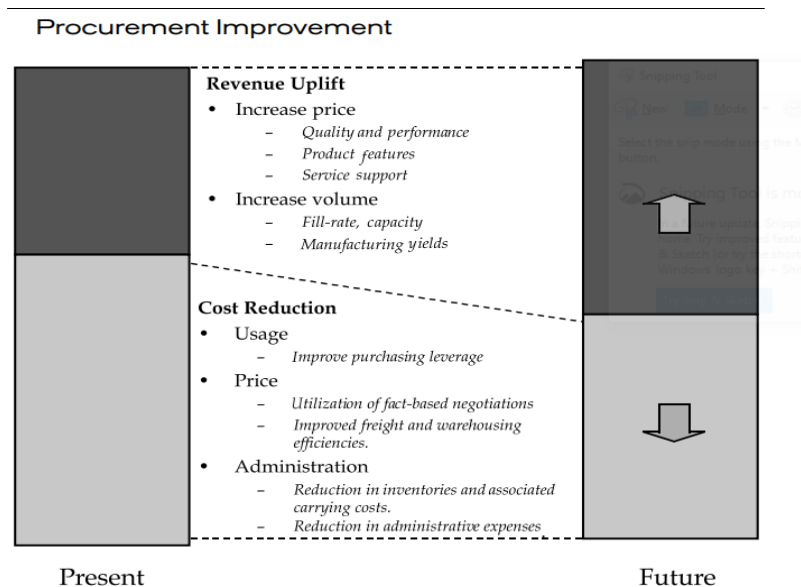


Figure 1.2: Procurement Process Cost Optimisation

Development in the extractive industries (EI) often yields weaker and less prosperous

outcomes than anticipated, as many observers have witnessed. Even resource-rich nations can

experience disastrous consequences. Financially, resource-rich countries in the development phase frequently lag behind their resource-poor counterparts. These regions are plagued by extreme social and political unrest and bloody conflicts, which devastatingly impact basic human development indices and subject them to environmental degradation. The terms "resource curse" or the "paradox of plenty" are used to describe these outcomes (Aunty 1993; Karl 1999), as several factors have been implicated. Policymakers, scholars, the public, and the media are all aware that the expansion of oil, gas, and mining has been linked to adverse consequences. While it is likely that these negative outcomes, such as violent conflict and poor labour conditions, stem from the exceptionally high rents observed in the oil industry, a substantial and diverse body of literature, including case studies and theoretical perspectives, has been produced to analyze the inevitable challenges that arise in extractive industries (Humphreys, Sachs, and Stiglitz 2007; Hogan and Sturzenegger 2010). In contrast to the notion that undesirable outcomes are inevitable, a literature corpus has emerged to refute this idea. The ultimate goal of this endeavour is to uncover the components of resource development that might be responsible for those adverse results, working in tandem with policy interventions that could mitigate their effects. The data presented here provide a high-level overview of the most frequently cited problematic aspects. Several external forces influence this industry, including crude oil supply and demand, oil price fluctuations, transportation costs, and the level of exposure to high risks. This means that supply chain experts in the industry can finally focus their attention on managing their strengths and resources, potentially through supply chain management. Like other industries, the oil and gas sector has become increasingly reliant on operations that involve rethinking. According to research, the proposal would necessitate the relocation of thirty to forty percent of oil and gas activities. Conventionally, oil and gas companies will reevaluate part of their subsectors' capacity to cut costs, overcome labour and capability limitations, and shift some supply chain risk to another partner. To enhance the

firm's overall performance by improving the capacity of supply chain activities, it is crucial to give additional consideration to the management of supply chain performance. According to Anatan's theory, supply chain management strategies can influence a competitive advantage. The objective of this study is to examine the factors that impact the decision-making process regarding performance metrics in the oil and gas industry. Five supply chain experts are being interviewed in-depth to help assess these factors. Modern features impact the structure and organization of supply chains, meaning that different sectors need to utilize different approaches. For instance, the apparel industry has a highly competitive market, so the performance framework must focus on agility metrics driven by innovative products and fluctuating demand due to the intense competition. Indeed, the accuracy of decision-making is crucial to the performance of the automotive industry's make-to-stock system, which requires measuring the accuracy of forecasting. According to the presented models, a diverse supply chain environment will provide a range of perspectives on how to manage their supply chain. New insights into this issue could not have progressed without their viewpoints. These findings align with those of Gunasekaran et al., who emphasized the importance of focusing on the most fundamental performance characteristics when developing performance measurements. They also stated that many companies have yet to figure out how to properly measure the efficiency of their supply chain systems. According to Chima and Hill, the availability of oil and gas resources is not the primary issue facing the oil and gas industry; rather, the production and delivery of refined products to customers at the lowest feasible cost constitute the industry's core challenges. Varma et al. use an example of an industry that must operate despite the high cost of transportation to reinforce this argument. The authors also proposed several other features that set this industry apart, such as flammability, pollution, large volumes, a long supply chain, and raw material fluctuation, including its classification as a process industry. Although Varna et al. established performance metrics for the downstream oil and gas sector,

they failed to examine a critical component of the industry—its impact on public health and the environment.

The current set of goals is an attempt to replace the eight-point Millennium Development Goals (MDGs), which have been discarded. Due to this inherent interdependence, progress towards achieving any one Sustainable Development Goal (SDG) will almost certainly have far-reaching consequences for the other SDGs, and vice versa. The interconnectedness of the SDGs emphasizes the need for multi-stakeholder commitment, combined effort, and collaborative relationships between public, private, and civil society organizations, as there are many entry points for various types of actors to contribute. Several areas covered by the Sustainable Development Goals (SDGs)—including networks, ecosystems, and economies—may be adversely affected by oil and gas activities. In addition to creating direct and indirect jobs, providing energy that enables economic activity and social development, contributing significant taxes and other forms of revenue to governments, facilitating the development of innovative technologies and products, allocating resources towards the social and economic advancement of the communities in which they operate, and managing the impacts of their activities by emphasizing environmental protection, health and safety, and human rights, the industry contributes to sustainable development in many other ways as well. Nonetheless, environmental concerns are part of the Sustainable Development Goals (SDGs), which call for further action to mitigate the impact of industries like oil and gas on the planet.

1.3. Statement of the Problem

According to Howard (2004), the goal of lean procurement is to achieve a remarkable workflow while simultaneously minimizing waste and demonstrating adaptability and readiness to change. The implementation of lean procurement in this manner will assist in the elimination of waste, the reduction of cycle and flow time increment limit, the reduction of inventories, the increase of customer loyalty, the elimination of bottlenecks, the further development of correspondences in general cen-

tre activities of the organisation and the general improvement of efficiency and viability in utilitarian tasks. Research has been conducted to demonstrate the effectiveness of the lean manufacturing approach. By adopting the Kodak Operating System (KOS) in 1998, the Director of Global Manufacturing and Logistics at Kodak Canada Inc. was able to steer the firm in the direction of adopting lean productions, as stated in a case study of the company. Consequently, Lean not only has better strategy, less inventory, and improved ergonomics, but it also enables the organisation to calibrate its science and keep up with developments that are actively sought after. According to Bhasin and Burcher (2006), less than ten percent of lean implementations in the United Kingdom are considered to be successful. Lean procurement has been used in a variety of enterprises, including manufacturing, automotive, and many types of industries, as well as in the hospitality industry, such as hotels. Kabuga (2012) conducted a research on the Lean procurement approaches that are used by a large scope of organisations. Automobile manufacturing companies in the sense that the techniques used by automobile manufacturing companies had an effect on lean procurement and unquestionably assisted manufacturing companies in gaining an advantage. Lean reasoning, electronic procurement, excellent supplier relationship management, and the control development of materials through the use of the Kanban system were some of the methodologies that were adopted by automobile manufacturing companies. The advantages of implementing lean procurement methodologies include the elimination of waste in all phases of the procurement process, a reduction in lead time, a decrease in inventory, a reduction in cost, an increase in customer loyalty, and an increase in request management. Nevertheless, in spite of the fact that it has progressed with the application of lean thinking and procurement in the oil and gas sector, the firm has often encountered challenges in terms of the optimisation of their costs and the timely delivery of materials. In accordance with Wilson and Roy (2009), lean procurement initiatives are able to suffer a lack of assistance from suppliers, transporters or-

ganisations, engineers, and senior management, in addition to experiencing bad product quality and a lack of communication. According to research conducted by Achanga et al. (2006), the most significant issues are the lack of assistance from suppliers, the low levels of refinement of suppliers, and the geographical distance between the company and its suppliers. There have been a variety of investigations conducted in Africa that are related to lean manufacturing and procurement. For instance, Nyakagwa and Muthoni (2014) conducted a study on the factors that influence the implementation of lean procurement in global endeavours: a case study of English American Tobacco (Kenya). They found that incorporating suppliers and making common advantages by engaging in continuous upgrades and development with suppliers are two of the most important opportunities for lean procurement. In order to fulfil the requirements of their company's oil going project, the procurement centre obligations have ensured that materials and administrations have been purchased on schedule, at the lowest possible cost, and of the highest possible quality. According to Virolainen (1998) and Hines (1996), the job has evolved to become an essential component in the process of ensuring the smooth flow of information and commodities across the whole supply chain. This has resulted in the job being an essential requirement for the success of the supply chain. In accordance with Van Weele (2002), the acquisition of raw materials, components, and administrations is the most significant portion of the total cost of the goods. It is possible that effective procurement might result in a major advantage in this regard (Langley; Coyle and Gibson; Novack and Bardi, 2008). Karlsson and Ahlstrom (1997) and Kaynak (2005) state that lean manufacturing is an essential step that must be taken before lean procurement can be implemented. The task of purchasing offices has undergone significant transformations in light of the current severe situation. In addition to the better manufacturing processes and innovative production techniques, it is essential to have a compelling material procurement procedure in order to meet the promises made to customers. Taking on the active and demanding duty of using the lean

procurement standards to the greatest extent possible in order to further expand effectiveness, seriousness, and guarantee the association's productivity is something that a purchasing office can do (Larson, 2008). There has been a significant amount of study conducted in the subject of lean procurement, and a significant portion of it has pointed to the manner in which lean may stimulate productive procurement (Womack, Jones, Roos, 1990; Liker, 2004; Hines and Taylor 2000; Lee, 2003). In addition to this, Lubben (1988) explains that the objectives of lean supply chains include the enhancement of the suppliers' productivity, quality, and delivery performance. Wilson and Smash (2009) investigated the application of lean procurement among small and medium-sized businesses. Imprint was the company that conducted the research. They believed that in order to successfully adopt lean, it was necessary to have the collaboration and complete assistance of all of the personnel involved in the supply chain. Additionally, they believed that it was dependent on variables such as consistent interest, long-term organisation, and the ability to quickly and continuously exchange information. In the academic literature, a significant portion of the discussions on lean are still centred on the application of the model to manufacturing, and the majority of the research have been focused on the created world. There is also a lack of consensus about the implementation and accomplishment of lean standards. Bhasin and Burcher (2006) point out that less than ten percent of organisations in the United Kingdom that have implemented lean are considered to be successful. Polito and Watson (2006) argue that lean procurement is only appropriate for a certain set of financial and social situations, and that it is not applicable to small to medium-sized businesses under any circumstances.

As a result of the contemporary insurgency, the Oil and Gas sector plays a significant role in the economic transformation of the globe. This industry is responsible for fuelling the need for heat, light, and adaptability among the whole population. The oil and gas sector is now in possession of a priceless opportunity to redefine its limitations via the practice of digitization. The oil and gas business is able to provide

functional arrangements after a period of time in which crude prices have been declining and frequent financial plan and schedule overruns have occurred. Additionally, there have been increasingly significant calls for environmental change responsibilities and difficulties in attracting additional capacity. The implementation of digitalization may serve as a facilitating agent to manage these shifts and provide some incentive to each and every one of its collaborating partners. Despite the fact that digitization has the potential to be a source of good change, there are a number of obstacles that need to be conquered in order to fully comprehend its potential for both the corporate world and society as a whole. On occasion, the benefits that have resulted from the advent of digitalization have not been distributed fairly, with the benefits not reaching the who are in most need of them. At the same time, the remarkable growth in global information flows has resulted in the emergence of new threats to data protection and security. Additionally, businesses in a wide range of industries are struggling with challenges associated with shifting customer expectations, shifting social norms, outdated regulations, and skill gaps, to name a few examples.

The oil and gas industry must confront these obstacles head-on in order to fully capitalize on the transformative potential of digitalization. By doing so, the industry can position itself as a pioneer in harnessing digital technologies to drive innovation, enhance operational efficiency, and promote sustainable practices. The digital revolution presents a unique opportunity for the oil and gas sector to redefine its boundaries and unlock new avenues for growth and value creation. By embracing digitalization, companies can streamline their operations, optimize resource allocation, and foster collaboration across the entire value chain. However, realizing the full potential of digitalization requires a comprehensive and strategic approach. The industry must address the challenges of data security, privacy concerns, and skill gaps within its workforce. Investing in cyber security measures, implementing robust data governance frameworks, and up skilling employees to leverage digital tools effectively

are crucial steps in this journey. Moreover, the oil and gas industry must collaborate with stakeholders, including governments, regulatory bodies, and civil society organizations, to ensure that the benefits of digitalization are distributed equitably and in alignment with sustainable development goals. By fostering an inclusive and responsible digital transformation, the industry can contribute to economic growth, social progress, and environmental stewardship. The digital revolution is not merely a technological shift; it represents a paradigm shift in how businesses operate and create value. By embracing digitalization proactively and addressing the associated challenges, the oil and gas industry can position itself as a leader in the digital age, driving innovation, efficiency, and sustainability for the benefit of all stakeholders.

This thesis sought to address the following research questions:

- To explore sustainable contract management and lean procurement practices in the oil and gas industry.
- To investigate the relationship between efficient procurement and the performance of the oil and gas supply chain.
- To examine the oil and gas industry's supply chain performance concerning lean procurement practices.
- To identify the challenges faced by the oil and gas industry in implementing lean procurement.

The primary purposes of this thesis are:

1. To understand how the oil and gas industry applies sustainable methods for managing contracts and implementing lean procurement practices.
2. To analyze the impact of lean procurement on supply chain performance in the oil and gas industry.
3. To evaluate the relationship between lean procurement practices and the performance of the oil and gas supply chain.
4. To explore the obstacles confronting the oil and gas industry in adopting lean procurement methodologies.

Research Methodology

This study employed a mixed-methods approach, combining quantitative and qualitative research techniques. Quantitative Analysis: Quantitative research is a method for studying and understanding the significance that people attribute to social or human issues from various perspectives. The research process involves formulating questions and procedures, collecting data from participants' environments, inductively analysing data from specifics to general themes, and the researcher interpreting the meaning of the data. A flexible structure was utilized in the present study. This aspect of the inquiry is supported by those who embrace an inductive reasoning approach, emphasize personal meaning, and recognize the importance of interpreting complex situations. The primary data was collected through surveys. Using SPSS (version 20), descriptive and inferential statistics were applied to the quantitative data gathered for this study. Descriptive statistics components include percentages, standard deviation, frequency, and mean. Tables, charts, and diagrams were the subsequent means of data presentation. A narrative framework was utilized to present the results of the content analysis conducted on the qualitative data. Furthermore, regression analysis was employed to establish the relationship between lean procurement and supply chain performance. The target population for this study comprised Middle Eastern oil and gas

companies and their respective leadership teams. A stratified random sampling procedure was used to select 20% of the target population for this research study. The sample consisted of 37 leaders from each group. Secondary data was sourced from oil and gas industry annual reports and financial summaries. The primary data was collected through questionnaires.

Research Questions

1. How does the oil and gas industry implement sustainable methods for contract management and lean procurement?
2. In the oil and gas industry, how does lean procurement relate to supply chain performance?
3. What are the benefits of lean procurement and sustainable contract management in the oil and gas industry?
4. How does the oil and gas industry address the challenges of implementing lean procurement?

Hypothesis

The relationship between lean procurement practices and supply chain performance has been studied independently concerning various aspects of the supply chain, such as sourcing, manufacturing, and logistics. In this context, variations can be observed in factors such as lead times, fill rates, and on-time deliveries. The structure of the hypotheses is illustrated in Figure 1.3.

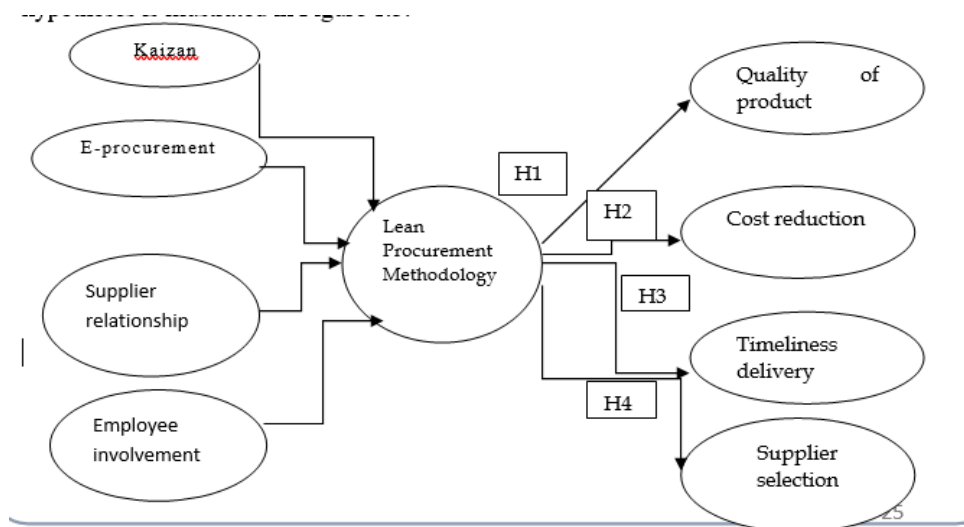


Figure 1.3: The hypotheses of lean Procurement to supply chain performance Research Hypotheses

The hypotheses formulated in this study aim to investigate the relationship between lean procurement practices and various aspects of supply chain performance, including quality, cost, timeliness, and supplier selection.

Hypothesis 1 (H1) - Quality and Lean Procurement

- Quality in lean procurement enables organizations to enhance and standardize B2B data exchange processes, reducing supplier-caused defects by 98% across the entire process.
- Lean MRP solutions helped limit inventory discrepancies to an annual exercise, increasing inventory data quality.
- Enhancing a claims process reduced errors by 98% across the entire process, consequently improving product quality.
- Zero Defects: Enables root cause analysis and problem-solving, prevents issues from propagating through the process, increases quality, and fosters an open culture of problem-solving rather than blame-shifting.

Hypothesis 2 (H2) - Cost and Lean Procurement

Cost reduction in lean procurement allows organizations to decrease their cost of supplies by optimizing their supplier list according to "best-fit" criteria, ensuring the most cost-effective products are utilized. Inventory accuracy improvements from Lean MRP solutions reduced inventory by a marginal amount of capital spending on projects. Consequently, significant cost savings can be achieved.

Hypothesis 3 (H3) - Timeliness and Lean Procurement

Implementing inventory reporting and accuracy standards facilitated faster decision-making and ordering, reducing lead time for acquired items by four hours - a 50% reduction.

Hypothesis 4 (H4) - Supplier Selection and Lean Procurement

An effective and flexible supply chain enables organizations to select the right supplier. Supplier selection is a significant consideration, as purchasing decisions significantly impact the entire supply chain system. Moreover,

"supplier relationship" is a crucial aspect of lean production. Considering these theories, it can be concluded that lean practices have a relationship with supplier selection.

This research proposal's theoretical framework offers a more detailed perspective on lean procurement approaches for managing organizations considering lean as a potential path to achieving sustainable performance and increasing profitability. Managers, purchasers, and leaders in the oil and gas sector seeking to change the traditional mindset will find enduring and fundamental guidance in this framework. Managers will also gain helpful insights into potential issues that organizations might encounter while attempting to implement lean, which could prompt them to reevaluate their strategy and make adjustments to better address any obstacles they face. The study will lay the foundation for future research on lean procurement strategies, which could benefit the global oil and gas industry, its contribution to the overall economy, and large-scale manufacturing organizations in particular. It will also examine the critical barriers that hinder the effective implementation of these strategies. The findings of this study will hold significance for academics, providing them with information to use as references in their own work and offering ideas for new areas of research. The study may assist the government and other partners, such as suppliers, by revealing the lean procurement practices that oil and gas project companies can adopt. In addition to aiding implementation, the results may provide organizations with the tools needed to overcome obstacles to successful lean implementation. Furthermore, consumers of the manufactured products will be able to obtain them at competitive prices offered by companies that have adopted lean methodologies.

Theoretical Framework

This chapter provides a clear and concise explanation of the underlying premise, as well as ideas and interpretations of essential theories. It is critical for understanding the issues at hand and the Lean concepts that are motivating this research. As a concept, "lean" is based on the principles established by the Toyota Production System (TPS). With the help of training

and employee participation, the Total Productive Maintenance (TPM) system was created to identify and eliminate inefficient steps in production processes so that consumers could receive better service. Although they were initially developed for use in Toyota's manufacturing facilities, wasteful actions are inherent in any process, whether inside or outside of production. In an effort to be more efficient and provide better service to their customers, many businesses are streamlining their processes and eliminating unnecessary office procedures. Lean has been adopted across various industries, including traditional manufacturing, supply chain management, retail, specialized organizations, healthcare, banking, transactional processes, marketing, and sales, due to its emphasis on sound judgment and the importance of the premise to a company's success. Companies have saved billions of dollars through lean adoption, which has reduced wasteful processes.

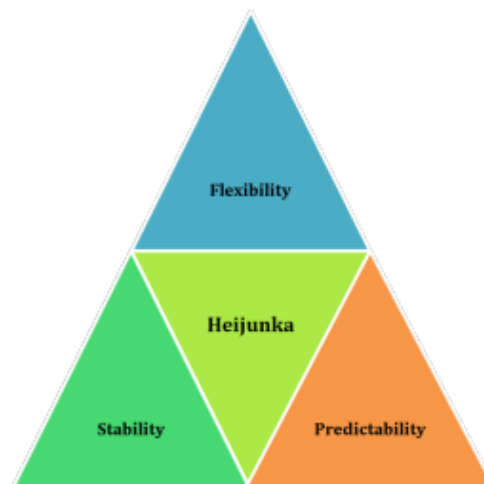
Judoka

The Japanese term Judoka, meaning "automation with a human touch," aptly describes the Toyota Production technique. It implies that the machines attempt to detect when a process has stopped and automatically halt the sequential assembly approach. In this way, a single person can monitor multiple machines instead of having to inspect each one separately. Consequently, two distinct quality control systems emerge from this: First, every production station has a measurement device to

determine the relevant quality parameters. If the measurement is negative, no product can be discharged from the production station to the downstream station. Second, there is a "big red button" at each production station that, when pressed, will quickly stop the entire sequential assembly system if an operator notices a quality issue with the product. Not only were assembly line workers authorized to press the button, but it was also their responsibility to do so if they observed any quality issues being passed down the line. This practice occurred alongside the pre-transaction preparations required to handle the production line. The three wastes that are eliminated from the production system are murk (overburden), mural (unevenness), and mud (waste), as they are essential for achieving Jidoka and Just-in-time.

Heijunka

The direct translation of this Japanese word is "levelling." According to the latest version of the Lean Dictionary, the term heijunka means: "Leveling the type and quantity of production over a required period." This results in the lowest potential stock levels, capital costs, labour supply, and manufacturing lead time across the entire value chain, and it also allows production to effectively meet customer needs without batching. The Heijunka principle states that a consistent or levelled flow of work is necessary for companies to adapt to changes in customer demand. There are three elements that influence the deployment of heijunka: Being stable, flexible, and predictable.



Heijunka triangle

Heijunka recommends producing various types of items in the same amount of time due to its flexibility. For example, in a twenty-minute production run, the company may be required to use a nearly identical machine to make three different products. This configuration will cause it to switch over twice every twenty minutes. To ensure they can offer all three versions of the product within the given time, they need to ensure the machine can switch between products quickly. Achieving the process's intended results requires determining the average output of each department in terms of the number of items in each category. Organizations must be aware of their lead time or the time it takes for a product to become completed while developing their production strategy to meet customer demands. Any reputable company will have a method for measuring customer demand. Finding out how much of a product the market truly needs and basing the production strategy on that number is always better, even if it won't be pinpoint accurate. This occurrence will make the production more predictable and reasonable for the organization. Considering these three aspects allows us to recognize that heijunka is indeed a possibility within the current Just-in-Time system. Additionally, the company has likely already examined its value streams to ensure they can advance them sufficiently to make heijunka work. Although heijunka is not a particularly complex branch of science, it may prove to be more perplexing than anticipated when applied to actual production scenarios. Patience is required, as it may take some time to fully grasp everything. It is critical to adapt your approach based on the current situation while being responsive to customer needs. However, to achieve the goal of creating a more consistent workflow, the organization should continuously improve and streamline its processes.

Kanban

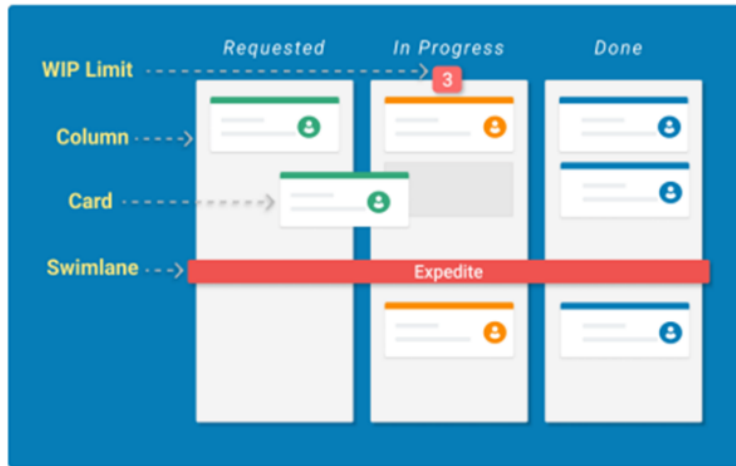
Visual systems like Kanban allow for tracking the flow of work as it progresses through a process. The Kanban system depicts both the process (the workflow) and the actual work

being performed by that process. The goal of implementing a Kanban system is to ensure that work moves through a process at an appropriate rate by identifying and eliminating potential bottlenecks. The Japanese term "kanban" translates to "signal" or "visible record," referring to the ability to see work in progress. Kanban is a concept closely associated with lean manufacturing and just-in-time (JIT) production. It can be utilized as a planning tool to determine what to produce, when to deliver it, and how much to manufacture. The development of Kanban was significantly influenced by the realization that American automakers were outperforming Toyota in terms of efficiency and productivity. Kanban was the efficient and adaptable just-in-time production control method that Toyota achieved. This strategy enabled the company to increase output while reducing costs associated with raw materials, semi-finished items, and finished goods inventory management. A Kanban system is ideal for managing the value chain from the supplier to the customer. Consequently, it prevents disruptions in the production chain and unnecessary product accumulation at various points. To implement Kanban effectively, the process must be monitored continuously. One crucial factor to consider is the need to take special measures to prevent bottlenecks in the manufacturing process. The objective is to improve throughput while simultaneously reducing delivery time. Over time, Kanban has evolved into a methodology that can be applied effectively in various production systems. The Kanban Method is an approach that can be used to incrementally improve any process step, including software development, IT and operations, staffing, enrolment, marketing and sales, procurement, and many more. In fact, the principles of the Kanban Methodology can benefit nearly every type of business. So, what exactly is Kanban? Kanban is a problem-free method of transformational change management. This is why the current technique is being developed in small steps. Instead of implementing a massive change all at once, it is possible to reduce the overall system risk by introducing a series of small changes. Because the Kanban method is transformative, it encounters little to no

resistance from relevant parties within the company. One of the first steps in understanding Kanban is visualizing the workflow.

A basic Kanban board can be created using a whiteboard with 24 squares and some sticky

notes or cards, which can aid in this visualization. Every single card on the board represents a specific task or work item. A typical Kanban board model consists of three main sections, as illustrated in Figure 1.4:



To Do: This section contains all the tasks or work items that need to be done but have not yet been started. Sometimes referred to as the "backlog."

Doing: This section represents the tasks or work items that are currently in progress.

Done: This section contains all the completed tasks or work items. This basic representation alone promotes a great deal of transparency about the task's progress and any current obstacles, if any exist.

Kanban boards can be used to depict complex processes, depending on the complexity of your workflow and the importance of visualizing and analyzing specific aspects of your workflow to identify and eliminate bottlenecks. A key principle in Kanban is the concept of "Flow." This means that the cards should be able to move through the system with minimal variation and without significant bottlenecks. It is crucial to investigate and address any obstacles to the flow. The constant application of the various techniques, measurements, and models that comprise Kanban can foster a culture of continuous improvement, or kaizen. By monitoring and striving to improve flow metrics, you can significantly enhance the speed and simultaneously decrease the duration of your delivery operations. Flow is a vital concept. Faster feedback from clients, whether internal

or external, can also help you improve the quality of your products or services.

Work in Progress Limits in Kanban

A key aspect of Kanban is the encouragement to "Stop Starting!" and the subsequent reduction in the amount of time spent on multiple activities, a tendency shared by most teams and knowledge workers. Dr. Arne Roock coined several mantras, one of which is "Start Finishing!" A Kanban board will display the work in progress (WIP) limits for each process stage under the "Doing" section. By setting these limits, you're encouraging your colleagues to complete the tasks that are within their capabilities and to move on to the next task immediately. Limiting the amount of work in progress and encouraging teams to "Stop Starting!" and instead "Start Finishing!" is one of the most significant features of Kanban. This approach aims to reduce the tendency of most teams and knowledge workers to work on multiple activities simultaneously. Each process step on a Kanban board has its own set of defined WIP limits. These limits motivate colleagues to focus on completing the tasks they can handle and then move on to the next task promptly. By adhering to these limits, teams can avoid overloading themselves with too much work in progress, which can lead to inefficiencies and delays.

Kaizen

The concept of kaizen provides a framework for addressing the challenge of continuous improvement by embracing the idea that small, steady gains can lead to significant leaps forward. In contrast to methods that rely on hierarchical structures or drastic changes to effect transformation, it often emphasizes teamwork and personal responsibility. The idea of kaizen is fundamental to lean manufacturing and the Toyota Way. Its origins can be traced back to the industrial sector, where its developers sought to improve efficiency by reducing waste, increasing output while empowering employees to think for themselves and take initiative. The belief that there is always room for improvement and that nothing remains static is crucial to the success of kaizen. It adds value by fostering a standard of respect for others. The kaizen process involves identifying opportunities and problems, deciding on a course of action, and then implementing it. If any issues or problems are not adequately addressed, the process is repeated. A seven-step cycle can be employed to promote continuous improvement and provide a systematic approach to the process of responding. It is essential to cultivate an environment that encourages employees to think creatively and solve problems. From the available options, select an effective solution or set of solutions.

- Test the chosen solution: All participants should be involved in rolling out the previously selected effective solution. You can

either conduct pilot projects or devise various small-scale ways to test the solution.

- Conduct a thorough analysis of the results: It is critical to examine the progress achieved at different points in time, with detailed plans outlining the point of contact and the best ways to maintain the involvement of ground-level workers. Evaluate the success of the change. If the outcomes are positive, it is appropriate to implement the solution across the entire organization.
- Iterate: These seven steps should be continuously iterated, with new approaches tested where they make sense or old issues tackled in different ways.

The Kaizen process can be summarized in four simple phases:

- Plan: Outline a strategy for achieving your goal and develop a plan to get there.
- Do: Implement the strategy without hesitation and make any necessary adjustments to ensure its effectiveness.
- Check: Evaluate the results and learn from the previous step.
- Act: Take action based on what you learned from the previous cycle.

The Kaizen approach emphasizes continuous improvement through small, incremental changes. By fostering a culture of problem-solving, respect, and personal responsibility, organizations can achieve remarkable results over time while minimizing disruption and resistance to change.



KAIZAN CYCLE

Muri - Designing Out Overburden

Muri, meaning anything that is difficult or beyond one's control, is the first item to be designed out of the set of goals in the Toyota Production System. A process is considered overburdened if it is too complex or difficult for the personnel (or machines) to reliably complete. Eliminating muri will result in a more uniform workload. For each procedure, there must be a codified standard operating procedure. This method should make it crystal clear to everyone what the worker is expected to do and should eliminate the need for variation. For instance, in production lines that don't utilize Lean techniques, a worker may be tasked with tightening and installing four bolts at their workstation. If the bolt inventory is running low, they need to contact the supply division to restock. However, the Toyota Production System would establish a standardized process that allows the worker to determine which order to work on, how far to tighten the bolts, and how long it should take. Once the worker's bolts are depleted, the methodology will specify who to contact and assign the responsibility of replenishing the inventory.

Mura - Reducing Inconsistency

Mura, which translates to "unevenness and inconsistency," is the term given to one of the three goals that comprise the Toyota Production System. Maintaining consistent production levels when there is fluctuating demand for the manufactured goods is highly precarious. In fact, most plant managers would prefer a consistently low level of demand for their products than a demand that is constantly changing and may sometimes be quite high. To avoid mura, the plant will employ a "pull" principle. In other words, every activity within the system must be triggered by the demand from the previous step. Subsequently, components are not produced until they are required, and the finished goods are consumed by the market as soon as they are available. This is achieved by implementing a system of kanban cards, which can be either physical or digital.

Muda - Eliminating Waste

The third category of waste is also the most commonly associated with the Toyota

Production System out of the three. That is probably because it is the most prevalent and the most natural approach. Simply put, the Japanese word "Muda" means "futility, uselessness, and wastefulness" in English. Therefore, this third principle within the Toyota Production System is all about continuously improving the system by eliminating components that are not functioning effectively. In terms of manufacturing efficiency, Toyota's engineering team has focused on the following seven forms of waste:

- **Transportation:** We must eliminate the unnecessary movement of materials, equipment, and component parts. Relocating components to break areas or simultaneously relocating multiple components results in waste since the material did not require relocation. Waste reduction becomes feasible when material transportation is minimized. This category also includes tasks like transferring machinery and equipment and goods between different manufacturing facilities.
- **Inventory:** Storing items that don't sell is a waste of space since it requires the utilization of physical space and the production of unsold items. Storage of inventory takes up space, which leads to waste, whether it's an excessive amount of components kept at the production plant, an excess of finished product, or a large overall inventory.
- **Motion:** Unnecessary movements by individuals and equipment to manufacture the products should be eliminated. This effort is wasteful and should be rejected. We advise minimizing the total number of movements required to deliver the merchandise. The number of people expected to handle the merchandise should also be limited.
- **Waiting:** Delays in a production effort caused by waiting for a process that has already been completed are inefficient. It is common for the production department to experience significant financial losses due to this occurrence.
- **Overproduction:** When too many finished goods are produced, they are expected to sit idle until they are sold. During this time, components are stockpiled, and unsold items are stored. Compared to the value

stream, these items are wasteful due to the associated costs.

- Over processing: This waste can be avoided when the process is not designed efficiently. Overprocessing occurs while components are being processed.
- Defects: It is possible to take manufacturing quality to the next level by fixing or replacing defective products. This process is carried out after manufacturing is completed. There is a direct correlation between the reality and the expense of defect correction. Having customer service and maintenance staff is crucial for overseeing the process of managing defective products. The low quality of the product has already damaged the company's image, and it will only worsen. As defective items detract from the value stream, their production should be limited to curb this problem.

The goal of lean operations is to minimize waste by continuously improving the process so that customers receive precisely what they need, when they need it, through continuous improvement. All lean-related activities are driven by the workflow that begins with the "pull" of the customer's demand. Continuous and focused critical thinking is at the heart of the just-in-time (JIT) methodology, which prioritizes throughput and reduced inventory as cornerstones of process improvement. JIT's stated goals include increasing throughput while decreasing waste and variability.

Lean Six Sigma

Lean Six Sigma, or Six Sigma as it is often called, is a comprehensive, process-centered, and highly practical application of quality principles and techniques. The Six Sigma methodology aims to achieve virtually error-free organizational performance. It was developed through the contributions of numerous quality pioneers. The Greek letter σ (sigma) is a statistic used by analysts to quantify the process-specific variability. A company's performance can be measured by examining the sigma level of its business processes. This section uses the term "Lean Six Sigma" to illustrate how the lean and Six Sigma approaches converge. Six Sigma complements the lean methodology by providing the tools and knowledge to address the unique challenges that arise along the lean journey: Lean eliminates the word "noise" and establishes a standard. Sometimes it's a way to save money, but if it isn't done in conjunction with lean, it can lose sight of the customer. While the proposed standard fails to fully concentrate on the needs of the customer, Six Sigma focuses project efforts around the clear deviation from it. By combining the principles of lean and Six Sigma, organizations can achieve a comprehensive approach to process improvement, waste elimination, and customer focus. Lean Six Sigma enables organizations to streamline processes, reduce variability, and enhance quality while simultaneously aligning their efforts with customer requirements and expectations.

Lean	Six Sigma
Establish methodology for improvement	Policy deployment methodology
Focus on customer value stream	Customer requirements measurement, crossfunctional management
Use a project-based implementation	Project management skills
Understand current conditions	Knowledge discovery
Collect product and production data	Data collection and analysis tools
Document current layout and flow	Process mapping and flowcharting
Time the process	Data collection tools and techniques, SPC
Calculate process capacity and Takt time	Data collection tools and techniques, SPC
Create standard work combination sheets	Process control planning
Evaluate the options	Cause-and-effect, FMEA
Plan new layouts	Team skills, project management
Test to confirm improvement	Statistical methods for valid comparison, SPC
Reduce cycle times, product defects, changeover time, equipment failures, etc.	Seven management tools, seven quality control tools, design of experiments

SYENERGY BETWEEN LEAN AND SIX SIGMA

Motorola was the pioneer in using six sigma into a project to assess and improve quality performance in the 1980s. The entry of Motorola into the field was signalled by this. General Electric, Boeing, DuPont, Toshiba, Seagate, Partnered Signal, Kodak, Honeywell, Texas Instruments, Sony, and countless more industrial companies have now successfully adopted the Six Sigma technique.

We construct and offer the precise advantages and reserve funds within the scope of six sigma by researching numerous literatures. Within the realm of business, six sigma is known as a "business methodology that is used to further develop business benefit, to work on the adequacy and proficiency, everything being equal, to address or surpass client's issues and assumptions."

The six sigma approach first found usage in manufacturing employment as businesses realised its advantages. A number of other pertinent domains, including marketing, engineering, buying, updating, and regulatory help,

were subsequently added to it in a short amount of time. To be more precise, businesses were able to demonstrate the monetary returns of six sigma's advantages by drawing a link between process improvement and cost savings, which allowed for the methodology's broad adoption. The original quality programmes, including TQM and CQI, were not as all-encompassing as Six Sigma, which is applicable to a far broader range of situations. Elements of the six-sigma management technique include incorporating estimated and revealed monetary outcomes, employing extra, further developed data analysis tools, concentrating on customer difficulties, and utilising project management apparatuses and methodology. To summarise the six-sigma management approach, consider the following: Total Quality Management (TQM) with an increased focus on customers, more data analysis tools, improved financial outcomes, and project management make up 6σ .

The table presents the key steps of six sigma

Six Sigma Steps	Key Processes
Define	Define the requirements and expectations of the customer Define the project boundaries Define the process by mapping the business flow
Measure	Measure the process to satisfy customer's needs Develop a data collection plan Collect and compare data to determine issues and shortfalls
Analyze	Analyze the causes of defects and sources of variation Determine the variations in the process Prioritize opportunities for future improvement
Improve	Improve the process to eliminate variations Develop creative alternatives and implement enhanced plan
Control	Control process variations to meet customer requirements Develop a strategy to monitor and control the improved process Implement the improvements of systems and structures

Procurement: The term "procurement" encompasses a wide range of activities, including but not limited to: managing supply market research, conducting supplier negotiations, managing purchase contracts, overseeing sup-

plier quality, purchasing inbound transportation, and investing in the development of requirements and their specifications. Procurement is the process of acquiring goods or services from external sources, gaining access to

those resources, and managing them effectively. It is a critical responsibility of organizational management. To achieve its primary objectives, a company requires or may need certain assets. The goal of procurement is to find the best possible supply solution for the company, its stakeholders, and its customers by analyzing the supply market and implementing strategic sourcing methods. The discipline of procurement involves the science and art of managing external resources and supplies through the application of a body of knowledge evaluated by qualified professionals and specialists. Procurement encompasses not only the events and activities that occur during contract formation but also the general management tasks associated with the contract scope:

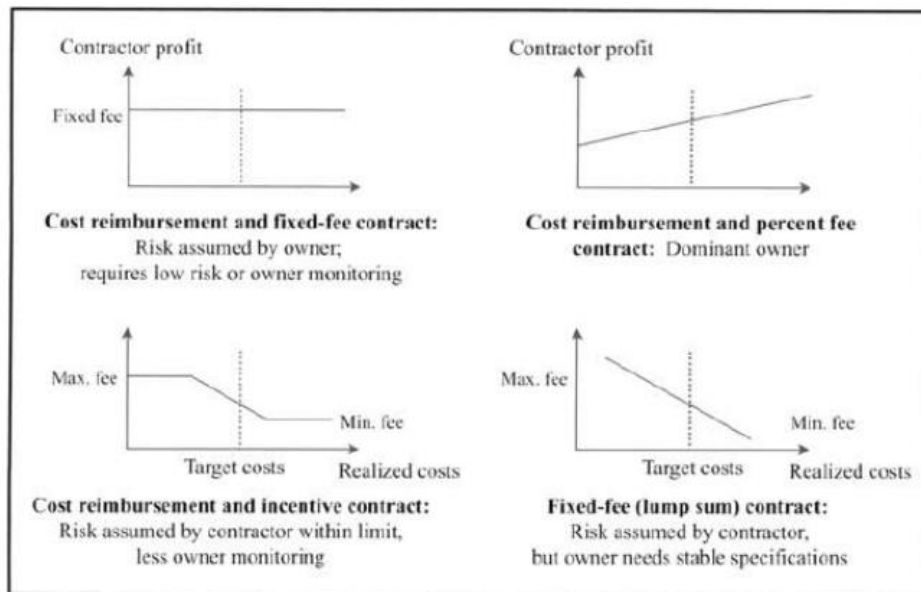
- Pre-contract activities such as planning, needs analysis, differentiation, and sourcing.
- Post-contractual tasks including contract administration, supply chain management, and disposal; general post-contractual tasks such as corporate governance, supplier relationship management, risk management, and administrative compliance; and so on.

Having a well-developed procurement system is crucial for organizations seeking to streamline operations and reduce costs. As a result, it enhances overall business performance and growth while mitigating supply-related risks. Procurement goes beyond the simple acquisition of goods and services for an organization. To ensure a smooth procurement process, it is essential that all specialized units fully understand the requirements, and then select the best supplier to meet those needs. The supplier's performance should be evaluated regularly, and contracts should be structured to deliver maximum value for the least cost. There are seven key steps to follow when planning a successful procurement process:

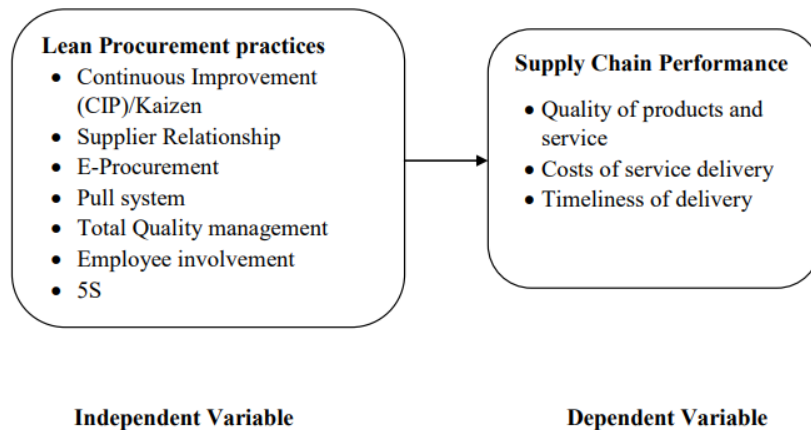
Contract Design in the Face of Complex Projects

Rarely are massive projects undertaken by a single entity due to the following reasons: the asset commitment is too high, the risk becomes

too great, and the range of specific skill areas required extends beyond what is available within one organization. While these benefits need to be weighed against the fact that different interests are seldom perfectly aligned, leading to complex interactions with various implications, it is inevitable that compromises must be made when working with other parties. It is helpful to view a contract from the perspective of an agreement. In this case, it is imperative that the contract thoroughly addresses all essential aspects of the prospective business arrangement. It was determined that the project's commercial viability would be defined by the decisions, the budget, and the schedule of the venture, with the execution conditions dictating the rest. Following that, there are numerous mechanisms that can be employed for mutual protection, assurances, risk allocation, and associated limitations. For two reasons, the contract has a significant influence on daily operations: first, staff turnover is commonplace during the project, and second, a project is not a particularly long-lasting relationship where the prospect of future collaboration would regulate behaviour. In this way, the contract serves as the most crucial document for setting expectations for how others should conduct themselves and the level of trust they should demonstrate, as well as for measuring the overall success of the project's outcome. Integral components of building the required confidence in the agreement are its perceived fairness, authenticity, readiness to fulfil its obligations, and clarity. The three most common types of contracts mentioned in project management literature are incentive contracts, fixed-price contracts, and cost-reimbursable contracts. However, none of them are suitable for capturing opportunities. They seem to have become increasingly important over time due to the fact that they clearly delegate authority to a single, large contractor that is willing to take on the greatest risk and manages the project's execution, reducing the number of points of contact and increasing the amount of overlap in their work. In the case of single-source turnkey fixed-price contracts, the entire risk is transferred to the contractor.



Contract design



Value Stream Mapping

Value stream mapping is a lean management tool used to analyze the flow of materials, information, and data associated with a process, system, or product. For value stream mapping (VSM) to be effective, there must be regular coordination and dialogue across multiple departments. Organizations with soloed or independent-style operations may benefit from changes that facilitate collaboration among specialized units. If you decide to examine a complex process, product, or system, implementing value stream mapping could be a lengthy endeavour. A larger project will involve more personnel and specialized units. Consequently, you should be prepared for an extended duration—perhaps even years—before

you can complete and implement your VSM strategy.

Value Stream Mapping Process

A thorough and unbiased evaluation of your company's operations, products, and systems should precede the development of any value stream maps. Begin by consulting with senior management, department heads, and any other key stakeholders who can provide you with additional details on the next steps. While several individuals will guide you through your tasks, you will still need to be an active participant in the process, product, or system. Gathering comprehensive data is of paramount importance. As part of this process, data on process defects, worker involvement, resource utilization, and

downtime will be collected. Any relevant or interesting data is welcome to investigate your current VSM flow diagram in depth and identify opportunities for improvement or advancement. The next step is to create a value stream map for the current state and another for the future state; these will be separate VSM flow diagrams. The current state VSM allows us to assess the process's existing operation and our company's capabilities. Here, you should outline the issues, highlight your key findings, and list the most relevant requirements. However, the future state VSM will focus on the process's appearance after your organization has implemented all the necessary improvements.

Value Stream Mapping Steps

In 1997, Peter Hines and Rich Griffiths, who were employed at the Lean Enterprise Research Centre in Cardiff, United Kingdom, developed seven tools for value stream mapping. These tools were created to assist organizations in initiating the value stream mapping process. It should be emphasized that according to Hines and Griffiths, the VSM toolbox should not be limited to "a specific theoretical methodology." The authors state that following these seven steps will help you adopt value stream mapping in conjunction with whatever IT management framework you choose, even though the decision to use a lean or agile management system is ultimately up to your organization. Relevant examples of lean and agile IT management solutions include kaizen, Lean Six Sigma, Kanban, and business process reengineering.

1. Process activity mapping: You must first establish process flows, then identify waste and redundancy, and then conduct research on workflow and business processes.
2. Supply chain response matrix: Identify potential bottlenecks throughout the process by utilizing a simple graph.
3. Production variety funnel: Investigate the various companies and competitors in the field to see what others have done to solve similar issues.

4. Forrester effect mapping: Create line charts showing supply, demand, and potential delays by comparing customer demand with production.
5. Quality filter mapping: Identify any defects or issues in the supply chain.
6. Decision point analysis: Determine production orders as they relate to inventory or customer demand. The goal of this analysis is to identify the supply chain's fluctuating demand.
7. Physical structure mapping: An industry-level hierarchical representation of the supply chain.

Nature of the Study

This study's findings benefited numerous stakeholders in the oil and gas procurement industry, government policymakers across various institutions, and academics and researchers. In this study, we surveyed the literature on the effects of lean procurement on supply chain performance. This study informs policymakers about the oil and gas industry's lean procurement practices. Organizations participating in oil and gas projects can utilize this data to develop strategies for lean procurement, which will enhance their supply chains. The study lays the groundwork for future academic and research investigations into lean procurement and supply chain performance, opening up a wide range of potential questions. This is based on the recommendations for further research. Additionally, the study can be used as a literature review to identify areas where more research is needed to fill knowledge gaps.

Definitions in the Oil and Gas Industry

1. Abandonment: The process of rendering a formerly producing well inactive for an indefinite period, such that it no longer produces oil or natural gas. To ensure the well's decommissioning does not adversely impact the environment or human health, all equipment used for oil and gas production must be dismantled.
2. Accelerated Capital Cost Allowance (CCA): The Canada Revenue Agency (CRA) authorizes a CCA, which is effectively an annual deduction, to reduce the value of a depreciating asset. For example, if you purchase a

- computer, you likely won't need to pay for it all in one year since most computers have a three-year lifespan. The amount that should be deducted from assets is determined by assigning them a useful life and then applying an annual rate. An accelerated CCA allows a company to recover the cost of capital more quickly by shortening the number of years over which assets are depreciated.
3. **Active Well:** A well used for extracting oil or natural gas that is actively producing.
 4. **American Petroleum Institute (API) Gravity:** If the API gravity of an oil fluid is greater than 10, it will float on water; otherwise, it will sink. The API gravity, often called the American Petroleum Institute gravity, is a measure of an oil fluid's density relative to water, expressed as a percentage. The API gravity can be used to determine the potential yield in barrels of crude oil per metric ton. Since the market value of oil is directly proportional to its density, the API gravity is a key performance indicator.
 5. **Barrel:** A standard barrel can hold approximately 42 gallons (or about 159 liters) of oil. The barrel was one of many methods for transporting oil during the early days of American oil and gas production. Currently, we still use it to calculate global transportation figures and assign values.
 6. **Battery:** The basic equipment required to process or store crude oil from at least one well.
 7. **Carbon Capture and Storage (CCS):** The process of capturing and retaining carbon dioxide (CO₂) before releasing it into the atmosphere, which is a waste product of using petroleum derivatives. The next step is to deposit the carbon dioxide in a carefully selected geological formation underground.
 8. **Carbon Leakage:** Carbon leakage refers to the movement of greenhouse gas emissions from one country to another, starting with one part of the planet. This scenario occurs when oil and gas companies decide to relocate their operations to a region with lower pricing and little or no environmental regulations. Consequently, global greenhouse gas emissions have not decreased.
 9. **Centrifugal Pump:** The most common pump used for the transfer of liquids, this particular type finds widespread application in the oil and gas industry. Centrifugal pumps facilitate the continuous transfer of liquids. They draw liquid into the pump's inlet, and then, by applying centrifugal force, discharge it from the pump's outlet.
 10. **Coaled Methane (CBM):** The gaseous form of natural gas that is generated and trapped within coal seams.
 11. **Coalbed Methane (CBM):** The gaseous form of natural gas that is generated and trapped within coal seams.
 12. **Condensate:** Hydrocarbons that are in liquid form at normal temperatures and pressures; commonly derived from natural gas.
 13. **Conventional Crude Oil:** Oil that is found in a liquid state, flows naturally, or is pumpable without further processing, dilution, or treatment.
 14. **C-ring Tanks:** Massive containment systems located on-site, designed to safely store water that is either produced or utilized in the process of oil and gas extraction.
 15. **Criteria Air Contaminants (CAC):** Emissions of various air pollutants, including particulate matter, that pose a threat to human health and contribute to air quality concerns. Criteria Air Contaminants (CAC) is monitored by Environment Canada.
 16. **Cumulative Impacts:** Changes to the environment caused by a single human activity, as well as its past, present, and future components.
 17. **Cumulative Production:** The total amount of oil or gas produced up to the present moment.
 18. **Cyclic Steam Stimulation (CSS):** A process involving the injection of steam into a well located within a heavy oil reservoir. This process reduces the oil's viscosity and generates heat, allowing the oil to be subsequently pumped through the same well.
 19. **Declining Balance:** The declining balance method is an accounting term for an accelerated depreciation technique. According to this method, the depreciation of an asset is recorded at a higher rate in its early, more productive years of service life, and at

a lower rate in its later, less productive years. The decline is not constant from year to year; rather, it is more pronounced in the initial years and gradually diminishes in subsequent years.

20. **Density:** Density is a physical property represented by the mass-to-volume ratio. Oil density can be approximated using either the American Petroleum Institute's gravity scale (API) or kilograms per cubic meter (kg/m³). In Western Canada, oil with a density up to 900 kg/m³ is classified as light to medium crude, while oil with a density greater than this is referred to as heavy oil or bitumen.
21. **Development Well:** An oil well that is drilled into or near a portion of a reservoir that has been evaluated for its potential to enhance oil production. Development wells are drilled after the successful exploration and discovery of hydrocarbons.
22. **Dilbit:** To create "diluted bitumen," or "dil-bit," diluted bitumen is mixed with a diluent—a lighter oil-based product—to make it a more manageable consistency. Naphtha and other natural gas condensates are examples of diluents. Transporting bitumen, such as through pipelines, becomes much easier when its viscosity is significantly reduced.
23. **Diluent:** Oil-based products with a lighter consistency used to prepare bitumen for transportation through pipelines.
24. **Directional Well:** Directional wells can be drilled at an angle or by deviating the borehole from its original vertical orientation, either from a conventional drilling pad or to reach an inaccessible subsurface area beneath the surface. A directional well is a type of well drilled at an angle or by redirecting the borehole from its original vertical position.
25. **Discovery Well:** The first oil or gas well drilled in a new field.
26. **Downstream Sector:** An industry segment that handles the marketing and refining of petroleum products. Examples include refineries that process crude oil and gas stations.
27. **Ecosystem:** Ecosystems encompass not only the climatic conditions in which living

organisms reside but also the surrounding natural environment. They can originate on land, in water, or in both.

28. **Enhanced Oil Recovery (EOR):** A technique that increases oil production by using materials or methods not typically associated with water flooding or pressure maintenance operations. For instance, oil production can be "enhanced" or increased by injecting natural gas into a reservoir.
29. **Established Reserves:** The estimated portion of the identified resource base that can be recovered using known technologies, considering current and future economic conditions. It includes both proven and probable reserves (typically 50% confidence level).
30. **Exploratory Well:** A well drilled in an area where oil or gas has not been found previously, or a well drilled with the emphasis on finding new reservoirs above or below known reservoirs.

1.12. Limitations and Delimitations

Researching procurement in a lean setting differs significantly from researching traditional manufacturing processes; the former is a vast and intricate area of study in itself. This study is subject to several limitations and delimitations:

1. **Scope of Procurement Process:** For this study, we have narrowed the procurement process down to three stages: system development, contract establishment, and contract follow-up. Furthermore, it is not feasible to monitor and analyze every action that occurs throughout the procurement process in granular detail. Such an endeavour would require an extensive amount of time and a thorough examination of issues, neither of which are within the scope of this thesis.
2. **Focus on Lean Principles:** Specifically, this study concentrates on the first three attributes of the five distinct Lean principles—value, waste, flow, and pull. The concept of perfection is also considered.
3. **Uniqueness of Procurement Projects:** No two procurement projects are ever exactly alike, especially when compared to similarly completed projects. Additionally, not

every procurement situation will necessitate the same analysis and conclusion; at best, it should serve as a guiding framework for future endeavours.

4. Stakeholder Perspectives: There is a process that lies between the disciplinary and procurement levels, involving the customer and the contractor as the primary actors. Given the number of different parties involved, it is challenging to adequately address all of their perspectives and facts within the confines of this thesis.

The results derived from this study are based on the essential responses to the evolving environment of the gas and oil projects. Furthermore, due to the reasons already discussed, the findings cannot be generalized to all oil and gas companies. Another obstacle that had to be overcome was the administration of the questionnaires. It was unrealistic to assume that sending out questionnaires and waiting for respondents to return them within a certain time frame would constitute data collection. Consequently, the surveys were distributed and collected on the same day. This introduced another limitation: it was impossible to ascertain with certainty that had completed the surveys. The constraints and lockdown measures imposed due to the Corona virus pandemic dictated both the quantity and duration of the study participants.

1.13. Summary of the Chapter

Lean principles, when implemented enterprise-wide, have several beneficial effects on the business. This is due to the fact that it boosts job satisfaction and motivates workers to think critically and creatively. A more flexible and team-oriented management culture structure replaces an ordered and controlling one as a consequence of this change. However, the deployment of lean methodologies within the organization is a complex and sometimes challenging journey, requiring administrative commitment and consideration. The study's

stated goal of demonstrating improved performance seems to be directly related to the adoption of lean procurement practices. The oil and gas industry will face numerous challenges over the years, as business in this field has historically followed a cyclical pattern. Due to the increase of globalization, American manufacturing and chemical sectors have been seeking lower pricing in eastern regions to enhance their competitive advantages. We are well aware that the temptation to hastily integrate supply chains poses serious risks. Whether acknowledged or not, the oil and gas industry is deeply interdependent with the American manufacturing and chemical sectors, and the fortunes of one industry have a direct impact on the other. Active note-taking, attention redirection, and the ability to channel frustration into competence are all skills that participants in these pursuits are expected to demonstrate. The procurement process, which involves an enormous and complex undertaking, accounts for 45–65 percent of the public sectors varied expenditure plans. For governments, public procurement is a powerful means of setting an example for sustainable development and demonstrating their commitment to "walking the talk" on this issue. The enormous purchasing power that governments possess can drive the delivery of sustainable development agreements and revitalize the market for sustainable products and services, provided that governments actively seek out goods and services that are both environmentally friendly and socially beneficial. Sustainable procurement practices (SPP) encompass the laws, regulations, and guidelines necessary to incorporate social and environmental considerations into public procurement strategies and decisions for the benefit of all stakeholders. Starting with an overview of the research's background and the public setting, this summary will next offer a concise explanation of the findings from the SPP readiness assessment in Vietnam. The report will conclude with some recommendations for next steps.

CHAPTER 2

Literature Review

2.1. General Restatement of the Research Purpose

This chapter delves into the three main research questions by reviewing previous work on the subject of lean procurement. At the outset, lean procurement is defined, and its rise to prominence and the evolving nature of the role are detailed. Today, procurement has transitioned from a primarily transactional function to a more strategic, managerial role, serving as a support function for businesses. In this section, we will examine various lean procurement strategies, describe some of the fundamental limitations of lean methodology, and discuss the advantages of implementing these methodologies.

2.2. Summary of the Literature

Various companies have different interpretations of what lean procurement entails when examining the existing literature. Since every business is unique and must address its own set of challenges, the ways in which lean methodology is applied vary greatly from one organization to the next. Maintaining priorities of quality, delivery, and cost must be a consistent focus throughout the entire lean adoption process. Building a solid, long-term relationship with suppliers is also essential to the success of this approach. Every link in the supplier chain must work together seamlessly if lean procurement is to be achieved. Lean has several beneficial effects on the business when implemented enterprise-wide. This is due to the fact that it boosts job satisfaction and motivates workers to think critically and creatively. A more flexible and team-oriented management culture structure replaces an ordered and controlling one as a consequence of this change. Since it requires managerial commitment and consideration, implementing lean methodologies within the organization is not always a straightforward journey, and it may sometimes fail to be productive. Demonstrating a causal relationship between lean procurement practices and performance gains is one of the primary objectives of this research. Organizations in the oil and gas industry face complex and challenging conditions where they encounter

ongoing challenges, most notably related to market demand. With oil prices currently much lower than before and no signs of an immediate recovery, now is an opportune time to reassess the supply chain, procurement methods, and pricing strategies. Oil and gas companies must pay attention to both their product supply chains and the non-hydrocarbon supply chains that handle the materials, components, and services needed to operate. The non-hydrocarbon supply chain plays a crucial role in the oil and gas industry by facilitating the transportation of services and equipment needed for exploration, extraction, processing, and sales. With oil prices now trending lower, it's no surprise that procurement and supply chain operations are at the heart of the problems afflicting the oil and gas industry. In the oil and gas industry, namely in Exploration and Production (E&P) operations, the member states of the Gulf Cooperation Council (GCC) have achieved tremendous success over the last few years. United Arab Emirates oil and gas companies are working on a framework that will be robust and efficient, with an emphasis on safety and functionality. Recent technical developments have made the extraction of a small quantity of oil from shale feasible [Hamilton, 2009]. Now, more than ever, you need a method that excels at paying meticulous attention to detail whenever you search for anything. So, the next question is: how can we achieve this goal, and which technique is typically suitable for the required system? If this organization wants to continue being the most prominent oil and Gas Company in the world, it must rely on quality control and assurance methods like Six Sigma, Lean, and Kaizen. In the published materials, you may find several instances of Six Sigma in action. However, most have never heard of Six Sigma or how it applies to the gas and oil sector. As part of our investigation into the level of Six Sigma adoption by major oil and gas companies, we discovered, to our surprise, that several GCC oil companies, including Abu Dhabi Gas Liquefaction Company and Abu Dhabi Company for Onshore Oil Operations, had implemented the quality management system. Oil and gas firms can significantly increase their net income by investigating the following procurement and supply chain opportunities,

which offer great potential to enhance supply chain value:

- Supply Chain Market Intelligence
- Supplier Relationship Management
- Supply Chain Arrangements and Development

Supply chain intelligence (SCI) is the practice of gathering and analyzing data to understand the present and future state of the market, facilitating the execution of current and future procurement strategies, and enabling organizations to anticipate and respond to changes in the external business environment before others do. Effective supply chain market intelligence helps oil and gas firms address critical supply chain challenges, including infrastructure, volatile markets, and imposed constraints. Additionally, it assists companies in selecting the best markets to procure from, determining how much to spend, and achieving their objectives by identifying which benchmarks and targets will yield the best results. Howard (2004) states that the objective of lean procurement is to attain an exceptional workflow while minimizing waste and displaying flexibility and openness to change. Implementing lean procurement in this manner will assist in eliminating waste, reducing cycle and flow time, increasing capacity limits, decreasing inventory, increasing customer loyalty, eliminating bottlenecks, enhancing communication in the organization's overall core activities, and improving overall efficiency and effectiveness in functional operations. Research has demonstrated the effectiveness of the lean manufacturing approach. According to the case study, the Director of Global Manufacturing and Logistics at Kodak Canada Inc. was able to

guide the company towards implementing lean processes by adopting the Kodak Operating System (KOS) in 1998. As a result, Lean boasts an improved strategy, reduced inventory, and enhanced ergonomics, and it also enables the organization to adapt its technology and keep up with actively sought-after advancements. According to Bhasin and Burcher (2006), the success rate of lean implementations in the UK is below 10%. Aside from its widespread usage in manufacturing, automotive, and various other industries, lean procurement has also found its way into the hospitality industry, particularly in the form of hotels and other accommodations. The methodologies used by automobile manufacturing companies had an effect on lean procurement and greatly assisted manufacturing companies in gaining an advantage, according to research by Kaluga (2012) that focused on the lean procurement methods employed by large-scale automobile manufacturing companies. Automobile manufacturers have embraced a number of approaches, including lean reasoning, electronic procurement, Kanban for material control, and effective supplier relationship management. Among the many benefits of adopting lean procurement methodologies are the following: a more streamlined process overall; shorter lead times; less inventory; lower costs; stronger customer loyalty; and better demand management. Regardless of the circumstances, the organization has often been subject to adjustments based on their cost optimization and the timeliness of material deliveries, even though it has progressed with the implementation of lean thinking and procurement in the oil and gas industry.

2.2 Documentation of the Literature Search

Topic	Author	Description
Best Practices in Oil and Gas Store network and Obtainment	Vinodkumar Raghobhamarao,	Oil and gas companies operate in a delicate balancing act between supply and demand, two factors that cause them ongoing challenges. Now is the moment to evaluate the supply chain and procurement processes and associated expenses, since oil prices have dropped significantly and show no signs of quickly recovering.

Topic	Author	Description
		<p>Companies in the oil and gas industry must concentrate not only on the supply chains that carry out the production of their products, but also on the non-hydrocarbon supply chains that manage the components, resources, and services necessary to run the company. A non-hydrocarbon supply chain is vital for transporting the equipment and services needed to locate, extract, process and ultimately sell the oil and gas. With oil prices now winding down, procurement and supply chain practices are likely to be at the forefront of fundamental challenges affecting oil and gas organisations.</p>
<p>Utilization of LEAN Store network The executives as a Panacea to Maintainable Future Productivity in the Nigerian Oil and Gas Industry</p>	<p>Obaro Ugolo</p>	<p>Jerry</p> <p>There is a significant potential for great success or great disaster in the highly capital-concentrated Nigerian oil and gas business. The price of oil has been very volatile and cyclical during the last 30 years.</p> <p>Reason being, worldwide supply and demand are affected by monetary and international factors such as the value of the dollar, the actions of governments, and groups (such as OPEC).</p> <p>Due to its significant negative impact on demand, overall wellness became a crucial variable influencing oil cost in 2020 as a result of the Coronavirus crisis.</p> <p>According to research, there is no improvement in industrial productivity that can be achieved via increasing output numbers alone. The efficiency of future oil and gas supplies is dependent on cost management, which includes a lean supply chain that ensures production materials and services are available at the proper price and on time.</p>
<p>Oil requires an optimum supply level</p>		<p>In order to communicate its result seriously, oil producing companies need an optimal supply quantity of materials and administrations. The effect of Lean supply chain management on the efficiency of Nigerian oil and gas companies is the subject of this article.</p> <p>Additionally, it assesses how oil and gas production companies might improve their operational efficiency by using lean procedures. An online survey has been used to collect data from a variety of oil and gas companies using descriptive and quantitative research approaches. Secondary data was also obtained from major companies' annual reports, which display their crude oil production levels vs profit over a five-year period.</p>
<p>Supply chain and procure-</p>		<p>There is a pressing need for oil and gas companies to evaluate their supply chain in order to ascertain strategies and costs in light of the recent drop in oil prices and the</p>

Topic	Author	Description
ment strategies for oil and gas		<p>disruptions caused by the Coronavirus. Vinodkumar Raghohthamarao, Director of Counselling at IHS Markit, describes a number of possible actions to take throughout the supply chain.</p> <p>Coronavirus and other major pandemics pose a significant threat to the reliable supply of oil and gas hardware and components used in the industry, including valves, turbines, blowers, and so on.</p> <p>Executives should take note of the coronavirus crisis and incorporate new business practices into future supply chain plans.</p> <p>With the present downward spiralling of oil prices and Coronavirus, procurement and supply chain techniques are going to be at the forefront of fundamental challenges affecting oil and gas companies.</p> <p>The current disruption has been caused by many oil and gas companies' suppliers or sub-suppliers being located in the affected areas, such as China, Italy, South Korea, and Spain. It is also understood that obtaining everything from one geology or nation has been a problem.</p>
List the Advantages of Material Obtainment in an Oil and Gas Organization	Diane Perez	<p>Organisations in the oil and gas sector have been improving their material procurement strategies in response to technological and economic developments.</p> <p>Both the investor and the buyer stand to gain from the contracts that oil and gas companies enter into with suppliers from all over the world. Get the most out of your procurement efforts by teaming up with a seasoned professional who is well-versed in administrative matters, goods, and the inner workings of your business.</p>
Risk The board in the Store network for the Oil, Gas and Petrochemicals Industry	Vladimirovna	<p>Numerous risks are essential to the oil and gas sector. From external variables like the state of the global economy and the rise of competing technologies that impact demand to internal elements like natural consistency and project overruns, and finally to supplier-related issues like the availability, quality, and estimation of labour and goods, there are many potential threats.</p>
SUPPLY CHAIN OPPORTUNITIES IN OIL & PETROCHEMICAL INDUSTRY	Dr Pranjali Kumar Phukan	<p>Historically, physical game plans across systems have been crucial to supply chains in the majority of oil and gas enterprises. When Industry 4.0 arrives, it will have a profound effect on how supply chains function. Saltine unit, LLDPE/HDPE Swing unit, Poly-Propylene plant, and Brahmaputra Wafer and Polymer are four of the many workstations and inventions at this petrochemical complex that was built with the idea of Assam's total financial growth in mind.</p>

Topic	Author	Description
		<p>This essay delves into a lot of ground, including how traditional transportation networks differed from supply chain systems based on Industry 4.0, how growing digitization interests might help businesses advance, and much more besides.</p>
<p>The gamble in Petrol Production network: A survey and typology</p>	<p>Raoudha Ben Amor, Ahmed Ghorbel</p>	<p>Incredibly complex and resolute is the fuel supply system. It seems to be a massive risk with far-reaching consequences for the public sector.</p> <p>Because of its complexity, there are many different types of risks that must be taken into account during the system's design, development, and operation. This paper's main objective is to promote a taxonomy of risk management by addressing a literature review on risk in the oil sector.</p> <p>First things first: this piece separates the main risks associated with the oil supply chain's various stages. After that, it gives a synopsis of the test processes used by the risk management team.</p> <p>There are three types of risk management approaches, according to the results: qualitative, quantitative, and blended models. The kind of risk depends on the country (merchant or exporter) and on the particular activity in the fuel supply chain. Research efforts moving forward should aim to strengthen the tactics proposed in this area.</p>
<p>Dynamic Supply Chain Capabilities: A Case Study in Oil and Gas Industry</p>	<p>Shatina Saad, Z. M. Udin,</p>	<p>The supply chain (SC) is an efficient system that meets the needs of customers and increases their benefit via the continuous movement of resources (including information) between various useful locations, both within and between chain participants.</p> <p>This one-of-a-kind procedure calls for quick acquisition and continual reevaluation of collaborators, innovations, and power structures. Still, businesses may face challenges related to the one-of-a-kind procedure. Among the strong supply chain compounds in this age of globalisation, petroleum organisations need dynamic processes of abilities due to their significant degree of vulnerability.</p> <p>Dynamic SC management is the goal of this research, which is motivated by the complexity of vulnerability in petroleum organisations and its shared characteristic of SC.</p> <p>With the asset-based perspective and authoritative learning hypothesis serving as the study's foundation, this investigation aimed to identify and understand how dynamic SC abilities work.</p>

Topic	Author	Description
		<p>A Malaysian oil and gas company will serve as a case study for acquiring the process of strong SC skills and performance.</p> <p>This study suggests using an interpretative worldview, which would lead to thorough qualitative approach, because to the subjectivity of the research that involves comprehending the SC process.</p> <p>The findings will contribute to the theoretical and administrative perspectives on SC management in the oil and gas sector, and the research will provide a detailed picture of SC's dynamics.</p>
Problems of Procurement at An Oil Company	Zagrebelskaya Milena	<p>The essay delves into the importance of oil organisations' use of Integrated Supply Chain Planning to improve logistics overall and reduce inventory and operational expenses.</p> <p>This is the revised S&OP that an oil production business has recommended for use.</p> <p>Any oil delivery organisation, no matter how big or little, might benefit from the suggested S&OP, which takes into account the key objectives of an oil producing firm within the Supply Chain.</p>
Strategic Sourcing for the Oil & Gas Industry	N. Hasnan	<p>There have always been unique challenges to oil and gas procurement. The oil and gas sector is under constant pressure to find better solutions to deal with the following issues: foundational instability in oil and gas prices; marginal oilfields; outrageous areas; and new global business trends.</p> <p>For Procurement Pioneers to increase their value to their organisations, they must reflect on the acquiring systems they use.</p> <p>This highly engaging course is tailored to educate procurement professionals on the numerous benefits of implementing and adhering to a comprehensive key acquiring strategy, which encompasses real value for money. It also highlights how this approach enables procurement professionals to pool their purchasing power to get the best deal available in the market.</p>
Strategies for Imparities for Improving Local Content Developing Local Content Development in Nigeria Oil elopement	Ukaegbu Onwuka	<p>With pivotal efficiency and advantage proposals, close by happy creation is quickly turning into a significant administration worry for overall extractive associations in Africa.</p> <p>Legitimate gatekeepers of nearby satisfied in Nigeria's oil and gas area need to build the business' typical neighborhood content worth — which was 26% in 2017 — to 70% in 2027, accordingly chiefs of supply chains are needing</p>

Topic	Author	Description
<p>in Nigeria Oil and Gas Industry</p>		<p>reasonable systems to integrate more nearby happy into their labor and products.</p> <p>In view of the mediated influence model of provider improvement and the close by happy advancement structure, this subjective different contextual analyses set off on a mission to look at the techniques utilized by store network chiefs at global oil and gas organizations in Nigeria to build how much neighborhood content in their items and cycles.</p> <p>Engaged with neighborhood content creation drives, the Nigerian Substance creation and Observing Board was contained eight chiefs and pioneers from worldwide oil and gas supply chains. Data was gathered by means of semi-organized meetings and optional sources, like yearly reports and plans.</p> <p>To investigate the information, effective examination was utilized. Business esteem drivers for neighborhood content creation, generally system for neighborhood content turn of events, and checking and assessing neighborhood content improvement are the three primary concerns that arose.</p> <p>A significant idea is that forerunners in the store network ought to reveal succinct and clear business esteem drivers while choosing and executing neighborhood content creation systems.</p> <p>Because of productive social change, there would be more opportunities for work improvement, which could altogether bring down the joblessness rate and ease youthful worry in the Niger Delta locale of Nigeria.</p>
<p>Challenges Confronting Production network The board in The Oil Showcasing Organizations in Kenya</p>	<p>Joel Jeffreys Barua</p>	<p>The SCM has critical difficulties because of the intricacy of the stockpile organizations of oil-advancing associations. The motivation behind this subjective and quantitative review was to analyze SCM in 23 different Kenyan oil promoting organizations to recognize the difficulties these offices face and to decide the degree to which they are carrying out standard working methodology to oversee store network issues.</p> <p>Transportation, equipment, correspondence, providers, clients, work, and funds are regions where oil showcasing associations in Kenya are encountering store network the executives challenges.</p> <p>Oil showcasing organizations are moving their strategic activities to outsider coordinated factors suppliers with an end goal to control costs and further develop production network the board.</p>

Topic	Author	Description
		<p>Organizations in the oil business likewise partake in essential preparation. E-obtainment, organizations with providers, outside guides, reconsidering non-center undertakings, dealing with few providers, vertical coordination, store network benchmarking, and the sky is the limit from there.</p> <p>The review's creator suggests expanding the limit of the Kenya pipeline to convey oil to bring down transportation costs.</p> <p>Oil displaying associations ought to teach their workers to comprehend SCM as an idea and the perceived cycles and frameworks that are fundamental to defeating SCM's difficulties.</p> <p>Likewise, they ought to chip away at working on their provider and client relationship the board rehearses and teaming up more intimately with different gatherings, the public authority, and nearby entertainers. Associations in Kenya that elevate oil likewise need to put resources into data innovation.</p>
<p>Evaluating the Risk of Natural Gas Pipeline Operation Management in Intuitionistic Fuzzy Linguistic Environments</p>	<p>Ming Li, Liangliang Liu, Ying Li, and</p>	<p>Among the most critically important national infrastructure projects, the natural gas pipeline has long been considered the safest and most cost-effective way to carry gas.</p> <p>In this complex business environment, it is essential to manage risks when operating the pipeline to ensure safe and easy operation.</p> <p>In order to evaluate the risk associated with managing natural gas pipeline activities, this research offered a method to do so in intuitionist, fluffy etymological circumstances.</p> <p>To begin, the fundamental, market, financial, activity, and legitimate risks are considered while establishing the evaluation criteria for the risk of managing natural gas pipeline activities.</p> <p>After that, experts may use the semantic phrases to evaluate the degree of risk and the weight of criteria. Semantic structures hold the criterion ratings, and the intuitionist fluffy etymological model demonstrates the phonetic words. The final result is a database of phonetic evaluations.</p> <p>Finally, the model is provided to outline the method's practicability and practicality.</p>
<p>Supply Chain Optimization approaches and Market Demand Analysis of Petroleum</p>	<p>Bislimi</p>	<p>In order to address a multitude of concerns, such as transportation delays, functional management problems, supplier selection issues, and administration satisfaction at many levels, the petroleum sector relies heavily on supply chain management. Choices for optimising fuel</p>

Topic	Author	Description
Industry: A Case Study of ONGC''		companies' supply chain management are the primary focus of this thesis.
Supply Chain Management and Strategic Sourcing for the Oil & Gas Industry	Gang Chen	<p>Upstream exploration and production, midstream catchment areas, downstream refined product manufacturing, entire deal and mass distribution terminals, and retail conveyance units are all links in the supply chain of the oil and gas (O&G) industry. Various sellers, fabricates, and organisations that handle these links are also involved.</p> <p>Due to the complex nature of the supply chains in this sector, specialised knowledge is required to manage the applications that are essential to the smooth operation of the company. A complete supply chain model that includes all data points and essential components should be in place from the beginning of the oil exploration process all the way to the final user.</p> <p>Looking at this data may help shed light on problems and provide opportunities that can be solved at various stages of transformation, manufacturing, and distribution.</p> <p>Modern oil and gas companies are investing heavily in cutting-edge technologies that will revolutionise production, storage, and appropriation; this is all in an effort to improve product quality and eliminate environmental dangers.</p> <p>The ability to analyse, identify improvement areas, produce new guides, and take necessary actions is repeatedly needed by these organisations due to the testing nature of the worldwide interest and supply fluctuations and market factors that they often look at.</p> <p>For customers in the oil and gas sector, leading system integrators have developed solutions that allow for comprehensive activity management, which in turn improves company performance. These business partnerships have proven performance, flexibility, and the capacity to increase supply chain profitability.</p>
Investigation into the performance of oil and gas projects	Zhenhua Rui, Xiyu Zhou	<p>A major problem in the oil and gas business is the frequent occurrence of enormous cost overruns in various projects. The purpose of this research is to analyse the financial results of around 200 publicly-funded oil and gas projects in order to draw conclusions about their cost performance.</p> <p>There is a standard variation of 29% and an average cost overrun of 18% for the projects. The results also demonstrate that the error of understating is more common and serious than the error of overestimating.</p>

Topic	Author	Description
		<p>Project size, kind, district, joint venture information, and Last Venture Decision (FID) year are other factors that are included while analysing the cost performance of the projects.</p> <p>To shed light on the differences in cost performance, we test the effects of every component using statistical techniques and suggest new drivers for cost performances. Some suggestions on how to enhance project performance in the future will be provided by the results of this study.</p>
<p>Challenges of Adoption and Acceptance of E-Procurement on Supply Chain Management Practices in Multinational Companies in The Oil and Gas Industry.</p>	<p>Ujakpa M. Ma, R. Arorab, Fianko K.S c, Asirifi G. Oc. Mohebbi</p>	<p>The term "procurement" refers to the processes involved in acquiring goods and services and managing their entry into an organisation centred on the customer. It includes stocking up on paper products for a bank and producing components for a sequential building system. Procurement operations are crucial to the success and performance of organisations and businesses as most organisations spend around 33% of their revenue on purchasing (Caldwell, 2009).</p> <p>Similarly, procurement may be defined as the act of acquiring goods and services for a person or business, whether those goods and services are intended as raw materials (direct procurement) or as finished goods (circuitous procurement). Buying items and doing quality and quantity checks are both parts of the procurement process.</p> <p>In most cases, the purchasing firm will not make a permanent record of its suppliers.</p> <p>Because of this, everything goes more smoothly, and the buyer and seller have a good working connection (Lewis, 2009).</p>
<p>Project Risk Management: Methodology Development for Engineering, Procurement and Construction Projects - A Case Study in the Oil and Gas Industry</p>	<p>Amir Hassan, Ngadhnjim</p>	<p>This thesis aims to limit and promote an altered methodology suitable for engineering, procurement, and development (epc) projects in the oil and gas business by focusing on the overall limits impacting project hazards and by examining alternative methods of project hazard management.</p> <p>The bidboland II gas treatment facility project was selected as an appropriate case study to achieve this goal. After conducting an examination of this example project that consolidated several risk management approaches, a new methodology for hazard management was suggested to the organisation.</p> <p>Additionally, in order to address the project danger problems at different levels more effectively, it has been suggested that the association undergo certain fundamental</p>

Topic	Author	Description
Emerging Issues of Procurement Management: A Review and Prospect	Paul Hong, -Boong Kwon	<p>modifications. Various organisations involved in epc initiatives may find the developed technique useful.</p> <p>As competition increases, procurement management is becoming more important for companies to maintain a competitive advantage.</p> <p>In today's competitive market, procurement has shifted its focus from short-term cost reduction to the generation and delivery of long-term value, and it is positioned as an essential integrative corporate activity. This study provides an analysis of a substantial body of procurement literature and proposes a framework for the collection and documentation of exemplary company procurement practices.</p> <p>Procurement literature has progressed from particular beneficial direction to more integrative and important techniques, according to this evaluation of papers issued in prominent journals about procurement management. Outlining the procurement literature in terms of its essential features and emerging designs, this article provides a comprehensive overview. We look at challenges for future studies.</p>
Investigating the Causes of Delay Within Oil and Gas Projects in The U.A.E.	Mohamed Salama1, Moustafa Abd El Hamid, Bill Keogh	<p>UK In order to calculate the monetary impact of postponements inside oil and gas projects due to profits foregone, the escalating oil prices are depended upon. The primary objective of this research is to identify the primary factor that causes oil and gas projects in the UAE to experience delays. Looking at the literature on oil and gas projects, I didn't find many studies that seemed concerned about this issue.</p> <p>There are a handful of similarities between development programmes and the literature. However, due to the differences between oil and gas projects and development projects, the factors identified in the literature as causes of development project delays are unlikely to apply to oil and gas projects.</p> <p>Accordingly, further study in this field is necessary, according to the literature review. In order to identify the primary factors causing delays, the study strategy included conducting interviews with experts.</p> <p>In order to identify the most important causes of setbacks, a survey was sent out to 100 professionals that took into account both the interview results and relevant variables cited in the development literature.</p> <p>In addition to presenting the key variables as identified by the sample overview, the study reasoned that data analysis showed a strong correlation between delays in the FEED stage and total postponement towards the end</p>

Topic	Author	Description
		<p>of the project, even though most experts believe that deferrals within the (FEED) stage have no effect on the overall duration of the project.</p> <p>In order to prevent a general postponement, which is likely to occur, the research recommends that delays in the FEED stage serve as an early warning and call for assured healing activities.</p>
<p>Sustainable procurement practices in oil and gas industry: empirical study of internal and external factors</p>	<p>Mohammed Hassan Al Hashmi</p>	<p>A thorough examination of the internal and external authoritative factors influencing sustainable procurement (SP) in the UAE's oil and gas sector is necessary due to the growing and controversial sustainability concerns within these businesses.</p> <p>Internal and external variables influencing SP in the UAE oil and gas sector are investigated in this research. The researcher surveyed 200 procurement specialists from 5 UAE-based oil and gas companies to compile the data.</p> <p>Using main equation demonstrating (SEM), the research system that was developed via a comprehensive literature review was reviewed and tested. While both internal and external factors influence sustainable procurement, the results show that internal factors are somewhat more significant. The research found that the most influential internal variables affecting SP are management system, authority in change management, and infrastructure cost management. The most influential external variables, on the other hand, are social and financial factors. Oil and gas companies in the UAE may greatly improve their SP performance by focusing on these internal and external factors.</p> <p>However, there was a mixed result when considering the internal and external variables that affect SP. In terms of internal variables, SP was positively and statistically significantly affected by the management system, the cost of infrastructure, and the project management office. There was a positive and statistically significant effect on SP from the monetary, social, and natural components of the external factors.</p>
<p>Emerging technologies to support indirect procurement: two case studies from</p>	<p>Judith Gebauer & Arie Sege</p>	<p>In this article, we will talk about how to use new web technologies to aid indirect procurement procedures, which are not directly related to manufacturing. We lay out some of the fundamental success criteria and important choice points, and we provide an overview of the goals and available developments.</p>

Topic	Author	Description
the petroleum industry		To help illustrate the points, two examples from the petroleum sector are provided.
Project procurement management: procurement strategy - the missing link between project and business strategies in the oil & gas industries	Al Mahri, Saeed Ahmed Saeed	<p>Insights on the future of project management in the United Arab Emirates are provided in this paper. Studies are being conducted to assess how Procurement Methodology impacts Business and Project Systems in relation to the administration of Oil and Gas projects.</p> <p>There are a lot of different ongoing projects in the UAE, and organisations from all over the globe are working together on them.</p> <p>In order to attract and retain majors, procurement initiatives should focus on achieving important goals and strengthening partnerships.</p> <p>The study's overarching goal is to delineate the relationship between project management and business procedures. If you're having trouble meeting your project's objectives, the Procurement Technique might be the answer you've been looking for.</p> <p>The aims of this research are to describe the components of procurement methodology that aim to achieve critical objectives, to demonstrate how momentum procurement procedures impede the achievement of project and critical goals, and to examine the influence of procurement techniques on business systems and projects.</p> <p>Literature reviews based on up-to-date information on relevant topics have suggested a link between business and project techniques via portfolio and project management systems.</p> <p>There was a flurry of activity investigating the supply chain's connections to procurement techniques for rethought projects. The study hypothesis and survey objectives were tested using a combination of quantitative and qualitative research methodologies.</p> <p>A survey was developed to investigate the pivotal role of Project Procurement in the oil and gas industry.</p> <p>A case study was also developed as a qualitative tool for evaluating four major projects in the oil and gas refining sector. As part of the case study, we looked at how the projects' procurement teams met and what problems they encountered.</p> <p>As a result of implementing these strategies, important new ideas emerged to bolster the role of project procurement in the oil and gas industry's projects.</p> <p>After that, the two structures (quantitative and qualitative) were filled up with data from the review. The data was then analysed using the literature results to propose the activities.</p>

Topic	Author	Description
<p>. The Joining of Corporate Social Obligation (ecological perspective) into Undertaking Obtainment The executives; an Investigation of the Oil and Gas Industry</p>	<p>Dilana Ramirez D'Avanzo Nguyen Hoai Thuong</p>	<p>Some of the suggestions address oil and gas project challenges by suggesting procurement procedures while others link procurement to business methodology in the industry. Finally, the goals have been defined, and more study on the impact of procurement techniques on project performance has been suggested.</p> <hr/> <p>Corporate social responsibility (CSR) is a new paradigm that has emerged in recent decades, attracting the attention of many scholars. The literature review does reveal, however, that CSR studies are required at both the functional level and the explicit industry level.</p> <p>The designers are particularly interested in the oil and gas business since companies in this sector are leading the way in corporate social responsibility (CSR), but recent events in the industry have made researchers doubt the companies' sincere dedication to CSR.</p> <p>This thesis fills a gap in the literature by focusing on how oil and gas projects use CSR in their procurement management. The study also primarily focuses on the climate component of CSR because, as many studies have shown, this is the key concern of the oil and gas sector.</p> <p>In light of the aforementioned goals, the research examined and portrayed the actual use of SPM in oil and gas projects by determining the extent to which SPM techniques are accepted and by discovering which methods are most often used.</p> <p>An investigation into sustainable procurement management at the key, middle management, and strategy levels was completed since, in reality, implementation is affected by management's discernment and enabling practices.</p> <p>A response rate of 24% was achieved after sending out a survey and welcome to 62 oil and gas organisations worldwide.</p> <p>Findings from the study show that oil and gas projects have adopted many of the well-known practices highlighted in the literature review, including those dealing with sustainable procurement management, supplier management, reporting, auditing, and correcting such practices. The review did not reveal any novel procedures. Still, we're just halfway over the permissible range when it comes to the degree of embracement.</p> <p>Supervisors of oil and gas projects have a positive impression of sustainable practices at the key level of sustainable procurement management, but greening procurement procedures is not one of the top significant goals of procurement management, and the level of commitment with suppliers is at the normal level.</p>

Topic	Author	Description
		<p>Rehearses are accepted at the bottom half of the allowed range for the intermediate and strategic management reception levels. We have produced some recommendations for oil and gas projects based on the study results and practical considerations. At the very end of the thesis, the author also makes recommendations for further research.</p>
<p>Development of industry performance metrics for offshore oil and gas project</p>	<p>Zhenhua Rui, Chaochun Li, Fei Peng, Kegang Ling, Gang Chen, Xiyu Zhou, Hanwen Chang</p>	<p>There is an urgent need to provide seaward O&G projects with a robust evaluation system to identify project shortcomings and enhance project performance, since verified records on the accomplishments of these projects reveal that the majority failed to meet industry expectations. To evaluate offshore oil and gas projects in five categories—amount, cost, plan, security, and production—a battery of multi-layered industry metrics were developed, taking into account their unique characteristics. To validate the reliability of the measures, we used the project data in conjunction with the findings of an industry expert overview. The drivers of each measurement are also validated by experts in the field and reviewed using the first guideline. Finally, we provide instruction on how to use these metrics.</p> <p>When all factors related to offshore oil and gas projects are taken into account, these metrics will be shown to be an effective tool for gauging the severity of a project and pinpointing areas where performance may be enhanced.</p>
<p>A Contextual investigation of Obtainment and Change The board in the Oil and Gas Industry in Malaysia</p>	<p>Tie, Ting Huat (2016)</p>	<p>Supply chain mix (SCI) is suggested to increase functional capabilities in the research. A substantial dedication to operational performance has been shown over the last 34 years by highly coordinated information exchange and critical acquisition via SCI.</p> <p>In contrast, the local Attach and Authorising (HUC) specialised organisations in Malaysia's oil and gas sector have had almost a fifteen-year growth starting in the year 2000. Regardless, it is still believed that the SCI process inside logistics and procurement is disjointed.</p> <p>Focusing on sharing some procurement processes from a logistics perspective, such as goods affirmation records during the HUC project, is the main objective here. We conduct an in-depth qualitative case study of the actual process of creating the goods affirmation records by interviewing relevant parties, seeing the field generally, and auditing various types of documentation.</p> <p>We use the triangulation approach to look at all of the data that we have collected. Due to impolite faculty members' inaccurate announcements, this research found that</p>

Topic	Author	Description
		<p>procurement and logistics records have a significant rate of product information errors.</p> <p>The main cause is that information is not being shared starting from the procurement stage. Reduced activity skills and increased waste are the results of an insufficient SCI. The cost of producing oil has above the breakeven threshold due to variables such as the current worries about an oil-cost emergency, wild functional wastage, and other full-scale economic issues.</p> <p>Given the importance of HUC development in Malaysia's oil and gas industry—which encompasses all remaining activity activities and administrations such as seaward drilling, subsea, establishment, and other types of oil and gas activity—this study is significant because it contributes to providing a system to procurement change-management that further develops overall functional performance.</p>
<p>Designing a Sustainable Procurement System Model SNI</p>	<p>Gendut Su-prayitno, Alex Permana Stendel</p>	<p>One of the most important natural resources on Earth, second only in importance to water, is oil and gas, neither of which can be replenished quickly. Whatever the situation may be, the public oil and gas business has recently been struggling with a number of issues, including dwindling reserves and the difficulty and expense of discovering new supplies.</p> <p>Achieving production and state income from the upstream oil and gas sector requires cost control for effective tasks, such as implementing sustainable standards in the labour and product procurement management system (SNI ISO 20400: 2017). This is necessary to endure the industry's difficulties and unpredictability and to make an ideal commitment to these goals.</p> <p>Based on the results, it is clear that there is a need for a sustainable procurement system model that incorporates both PDCA and SEM LISREL for data analysis of questionnaires.</p>
<p>Provider/Organization Choice Framework Examination In view of Logical Progressive system Technique Cycle in Oil and Gas Penetrating Undertaking (Contextual</p>	<p>Ahmad Fardian Firdaus, Sugiyono Madelan, Ahmad Badawi Saluy</p>	<p>When faced with complex problems like selecting partners, the Logical Pecking Order Process may help you agree on a solution using Multi Criteria. Regulatory, quality, delivery, financial, technical, and cost factors are going to be the meat and potatoes of this study's attempt to build an affiliate decision system. In order to gather data, the researchers sent questionnaires to closeout boards and useful chiefs.</p> <p>This study's underlying assumption is that, among serious needs criteria for choosing, cost is the most important (at 0.506 of the total), followed by specialised cri-</p>

Topic	Author	Description
analysis: PT. KMI)	PT.	<p>teria (at 0.197), quality criteria (at 0.142), financial criteria (at 0.057), and transportation criteria (at 0.057). This study assumed that, out of all the partners, Partner B was the best provider since they had the most demand, and that Partner A, Partner D, and Partner C all had relatively high values (0.261, 0.224, and 0.223, respectively). Based on the findings, the researcher recommends using the Analytc Order Process method when deciding which suppliers and collaborators to work with. This is especially true when selecting partners for the Coordinated Management Project (IPM), in this case the drilling project at the KMI Company, which requires the participation of nineteen different support services. Because this method has certain advantages and uses the same components as other approaches when making complicated judgements.</p>
Procurement as innovation policy and its distinguishing effects on innovative efforts of the Brazilian oil and gas suppliers	Frederico Rocha	<p>Using data from Brazil's oil and gas industry, this article will assess how PPI has influenced suppliers' level of innovation. It highlights the potential role of PPI in agricultural countries because to its ability to cater to a variety of company sizes and contribute to the more equitable distribution of specialised advancement.</p> <p>The findings demonstrate that treated enterprises exhibit a greater intensity of creative endeavours compared to the control sample, using small data from RAIS and coarsened careful coordination. Little businesses are more likely to complete creative activities when PPI is present.</p> <p>The creative effort forces of the treatment and control samples are comparable when these activities are undertaken by small enterprises. The therapy has a beneficial effect on the probability of innovative activities for large enterprises, but a smaller effect for small firms. No matter how strenuous these efforts are, they will provide an important and useful result. Given its applicability to a variety of business sizes, the research posits that PPI may be a useful tool for reducing the main heterogeneity in developing countries.</p>
Maximizing strategic value from megaprojects: The influence of information-feed on decision-making by the project manager	John Eweje, Rodney Turner, Ralf Müller,	<p>The value of enormous initiatives is known to crumble as they are being carried out. Project managers' choices, which in turn impact the resource's core value, are dependent on the data feeds upon which they are based. This study investigates how project chiefs' use of information feed impacts the vital value given by oil and gas sector super projects using theories of hierarchical behaviour, decision-production, and programme management.</p>

Topic	Author	Description
		<p>The 69 superproject directors were the subject of a worldwide evaluation. The results demonstrated that the whole influence on the key value produced by megaprojects is the information provided to the project directors. Furthermore, a few of guiding effects of logical factors on this correlation were also identified. What they saw as the drivers for their projects from Senior Management is related to the logical factors that affected the development of project chief decisions.</p> <p>Strange as it may seem, the predicted effect of a project director's background on decision-making did not materialise. The amount and quality of information that has to be sought after should be influenced by how much control project directors believe they have.</p> <p>The influence of multi-area execution, government relations, having local area contacts, contract management and procurement, and megaproject value generation in the long run were considered as four risk areas.</p>
<p>Effectiveness of Engineering, Procurement and Construction (EPC) Major Projects in Abu Dhabi's Oil and Gas Industry: End User's Perspective</p>	<p>Mohamed Salem, Obaid Ald-haheri</p>	<p>Traditional project management is responding slowly due to either false biases or ineffective communication among project stakeholders, even if the field of project management is moving in the direction of improving project viability.</p> <p>The purpose of this research is to improve the likelihood of achieving product advancement at the site level by expanding our understanding of the appropriateness of Engineering, Procurement, and Development (EPC) contracting methods.</p> <p>From the perspective of the end-client, this study aims to examine the efficacy of EPC contracting methods in capturing product objectives.</p> <p>The necessary information is collected from end-users participating in six major Abu Dhabi oil and gas projects using an online evaluation survey. The data collected from the survey is analysed using the structural equation modelling (SEM) statistical technique.</p> <p>The results show that there are very significant connections between the "viability" concept and its constituent parts. Giving a few commitments to both literature and practice, it is the major realised study that assesses the influence of both "end-client's commitment" and "arrangement of goals" criteria on project adequacy. The following commitments are highlighted: 1) creating a reasonable model for estimating the "adequacy" extraordinary idea, which could be useful for researchers interested in studying this idea; 2) identifying potential variables that influence the calculated space of "end-client's commitment" and "arrangement of goals" criteria in</p>

Topic	Author	Description
		<p>the oil and gas industry; 3) putting the theoretical model into practice using estimation instruments that have been validated by literature and industry experts; an Experts in the oil and gas sector are being called to attention by the present study to the impacting factors of "adequacy," "commitment," and "arrangement" concepts. Consequently, the developed SEM model serves as a motivational tool for acknowledging the end-client's investment throughout the project's phases and maintaining a suitable alignment between project objectives and product targets to enhance the project's future viability.</p> <p>https://doi.org/10.59890/ijfbm.v1i1.1102</p>

2.3 Literature Strategy

➤ **Definition about Project:**

Projects are defined as "brief undertakings with a start and an end, and it should be utilised to make a special product, administration, or result." Referenced here is the Project Management Body of Knowledge (PMBOK) definition from version 3. Furthermore, it is developed in an active way. This definition of "project" holds that projects are defined as endeavours that should not be undertaken endlessly and should have a clear purpose.

Any set of coordinated efforts with the end goal of creating a superior service or product is known as a project. Consequently, projects cannot consist of actions conducted with the aim of accomplishing mundane tasks. Your project has only been underway for ninety days, and there are fewer than twenty people working on it. Based on the meaning of the term, you could not be planning for what the future holds. Keep in mind that the impact of the term short on the project's administration or production is minimal. This is an important consideration. Although the project may have certain constraints, the end product does not. Consider a project to build a monument; although the landmark itself may be maintained indefinitely, the period of the endeavour is set.

The goal of every endeavour, whether it a project or an activity, is to produce something novel. Although many of the produced workplaces are similar to one another in many ways, every single one of them is unique in its own way.

At last, a rational breakdown of a project is required. This points to the project moving in the direction of development and improvement. This also means that the project's significance is enhanced with each step, and that the reasoning for each step is laid out in the conclusion. What this means is that project definitions are reviewed as the project develops, after which they are revised. Furthermore, the project's scope and the underlying issues related to it are now more clearly defined.

➤ **What are the fundamental periods of a project and their motivations?**

Project managers will find that breaking the project down into manageable chunks makes it much easier to keep tabs on progress. After that, we go into detail about each step's success and see it through to the end. The importance of each phase of a project is directly related to the nature of the project being completed. There may be several stages to a product project, including planning, designing, building, testing, and implementing. The construction of a subway or a building, on the other hand, might include many steps, each with its own unique title. This means that the expectations at each level of a project dictate the terminology used to describe those stages. Depending on the final goal of definition, the processes may be grouped as follows: original contract, scope explanation, plan, baseline, progress, acknowledgment, endorsement, and handover. We have established this arrangement in line with the PMBOK. Because of this, there is a

clear correlation between the stages of a project and the stages of the project life cycle. There is a set of predetermined expectations for each stage of the project that serves as a foundation for each stage. In a product development project, for example, archives must be created at the need stage, a design record must be created during the design stage, and so on. The test phase focuses on completing testing for expectations, whereas the form-progressively-ease phase of a project sends the final code. In order to provide consistency and

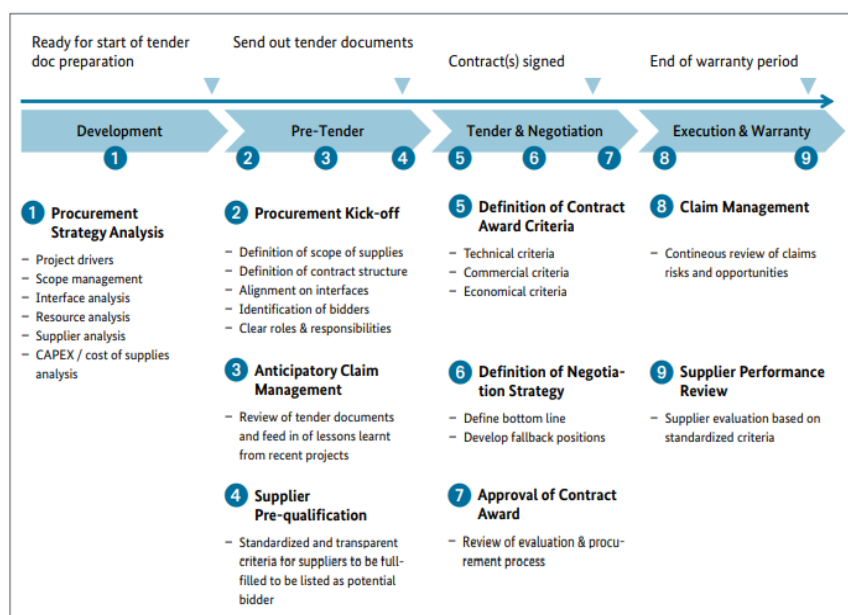
successfully complete the project, it is important to follow the sequence of expectations that each stage is anticipated to convey after each phase is connected with a certain achievement. According to the Project Management Body of Knowledge (PMBOK), the four phases that make up the Project Life Cycle are system initiation, execution, management, and termination. Keep the project on track and finish it according to the choices made by following each and every one of these steps.

➤ **Various Stakeholders in the Oil and Gas Projects:**



Stake holder map in oil and gas projects

➤ **Project Procurements Process in oil and gas Industry:**



➤ **Contracts in Procurement Process:-**

Procurement contracting is the process of establishing legally enforceable agreements between suppliers and contractors about the management of a project. In order to get the required supplies, materials, and administrative resources, projects must have these contracts.

The parties involved in a purchase and sale are better able to settle their differences over the relevant commodities, services, and labour via the use of procurement and contracts. In line with this comprehension, the contract's obligations and the payment of solicitations are included. A purchase contract is an agreement between a buyer and a seller that is legally enforceable. Both parties' interests and preferences are safeguarded by this instrument, which also specifies their relationship with respect to the firm.

Selecting the vendor and the product, screening the vendor, settling on terms and conditions through transactions, and managing the process through ordering, installing, and delivering the material, supply, or administration are all boundaries within procurement contracting.

➤ **Procurement Contracting Significant**

Procurement contracting is significant because it preserves businesses' capacity to dissolve in a key commercial hub while effectively increasing advantages. By agreeing to terms in the procurement contract, the two sides may work together without worrying that the other will get in the way. Furthermore, it aids the organisation in making better use of its resources by transferring tasks to outside parties who can do them more cheaply.

➤ **Kinds of Procurement Contracts**

There is more than one way to have everyone on the same page when it comes to contracts. Each of these contract types brings its own unique set of hazards to the procurement process. In development projects when the expansion is known in advance, they work well. Here are the three main types of contracts used to buy products and services:

Contract with a Fixed Value: At the time of contract marking, the amount paid for materials, labour, and goods is defined in a fixed-cost or single-amount contract. Regardless of internal or external events that cause expenses to raise or postpone the timetable, the total paid stays the same from that point on. The benefit of this kind of agreement is that it specifies, in a straightforward and simple way, what each party is responsible for, how much money will be needed to accomplish the task at hand, and what information has to be supplied. They are the most famous, simple, and easy-to-work-with sort of contract there is.

Reimbursement Contract: The buyer under a cost-reimbursement contract (or cost-control contract) agrees to pay for all of the direct and indirect costs associated with making the product or providing the service, including raw materials, labour, and utilities. In order for this to be profitable for the customer, you need to charge a decent price or provide them more than what they paid for. Which means the dealer takes the brunt of the risk. Once the expenses have been confirmed, they will get their reimbursement. The dealer will make sure it works for them by adding costs that keep changes to a minimum while addressing their main concern.

A "time and materials contract" is a kind of arrangement where retailers get payment for both the resources they utilise and the time they dedicate to this project. The vendor may operate as if they were a separate agent for the job under certain conditions. In cases when the project scope is more clearly specified, this contract works well since it provides for some flexibility. When using one of these contracts, the buyer must always be more hands-on to ensure the project stays on track and under budget.

➤ **Key Processes and Best Practices for Procurement Contracts**

There is still work to be done once the contract has been signed. It goes without saying that there is the outsourced task and the fulfilment of all contract obligations.

Key Driver	Definition/key Issues to be clarified
Technical Specifications	Adequacy, completeness, and consistency of the description of the scope of work. Consistency between technical and commercial parts.
Price (quality of cost estimates)	Consistency of price and cost estimates with technical specifications. Adequacy of contingency and profit margin.
Payment terms	Schedule of partial payments. This determines to what extent cash receipts by the contractor cover his cash expenses over the course of the project, defining the contractor's exposure from cash flow during the project.
Schedule	Achievability of key (intermediate and final) completion dates and consistency of their definitions. Impact of possible project delay/acceleration costs relative to contractual liquidated damages.
Performance guarantees	Acceptable tolerances of key performance measures; definition of preconditions for achievement of these performances; and liquidated damages that compensate for deviations from the performance tolerances.
Limitation of liability	What is the maximum extent of the contractor's liability toward the client under the contract (excluding tort or negligence)? Is it contractually clearly limited, and are indirect and consequential damages excluded?
Securities	How does the contractor ensure his performance toward the client? How does the client ensure his payment obligations toward the contract? For example, deposits, bonds, or guarantees by third parties.

Definition of Key Drivers for Sustainable Contract Business Deals

The Collins English Dictionary (1998) offers two definitions of sustainability: first, capable of being supported or maintained, like sustainable economic development and energy sources; and second, able to be sustained over time without depleting natural resources or causing severe environmental damage, like sustainable development. The notion of long-term viability underpins both of these explanations. "Green will be green" is an essential aspect that these two different interpretations share. Consider the financial argument for long-term business sustainability in light of an organization's sustainability objectives for the natural environment, or "being green." In other words, green is the color of money. These standards have remained unchanged in the nearly twenty years that have passed. The term's increasing usage from the late 1980s is shown by a rising trend, even though Collins Online (2016) maintains the same sequence in

which they are recorded. The term had no use whatsoever until that point in time. Additionally, the second definition of sustainability, which alludes to the link between development and utilization, prompts discussion of current and future use. John Rawls (1999) coined the term "intergenerational equity" to describe this concept; he argued that society should fairly determine how much of the world's resources it would forego or not use today so that future generations can have access to and benefit from those resources. Brundtland (1987) defined sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This concept somewhat shaped a more widely accepted notion of sustainable development. Since a socially responsible business is expected to ensure that its impact on the environment is minimized, the concepts of sustainability and corporate social responsibility are closely related. Conversely, CSR goes beyond environmental

protection to include issues like fair trade, high-quality work practices, and building healthy relationships with partners, consumers, and suppliers. Chapter 8 delves more into the topic of corporate social responsibility (CSR), however the link to sustainability is established. John Elkington's (1994) "triple bottom line," or TBL, is the foundational concept for sustainable logistics and supply chain management. It considers people, the planet, and profits. The TBL argues that companies should prioritize the needs of their employees, the environment, and their customers, while also ensuring the financial gain of their investors and the value they create. This will ensure that everyone has their basic needs met and more in the future. An assortment of entities, including corporations, governments, and NGOs, have shown their support for the TBL concept. Much time has passed since the first United Nations Conference on the Human Environment in 1972 in Stockholm, where the topic of the natural environment was first raised. Since then, people worldwide have come together in countless gatherings to discuss climate change and other environmental challenges. Some examples include the Brundtland (1987) Commission, the 1992 United Nations Earth Summit in Rio de Janeiro, which passed a resolution holding polluters financially accountable for contamination, and the 1997 Kyoto Protocol, which determined that emissions of greenhouse gases should be reduced. Goldenberg et al. (2015) state that several subsequent summits have not been deemed successful. At the most recent summit in Paris in late 2015, COP 21, nearly 200 nations reached a legally binding agreement outlining ambitious targets to limit temperature increases to below two degrees Celsius and to aim for 1.5 degrees Celsius above pre-industrial levels. To meet their commitments under the accord, nations must drastically cut their emissions of greenhouse gases. This will likely include achieving net-zero emissions by 2030. Additionally, nations must strike a balance between carbon sink removals and emissions caused by human activities. At the same time, wealthier countries have committed to providing \$100 billion annually by 2020 to help poorer countries with economic transformation. For instance, India has proposed

that by 2030, at least 40% of its energy will come from non-fossil fuel sources, according to the Associated Press (2016). By 2022, this will likely lead to the inclusion of a maximum of 175 GW of renewable electricity. According to Manish Bapna, the World Resources Institute's executive vice president and managing director, India "has one of the boldest renewable energy targets in the world, making it poised to be a leader in solar and wind markets." Nonetheless, subsidies will be required to meet these goals; India estimates it will need over \$2.5 trillion USD to do so, and it will rely on other nations to provide funding while limiting technology transfer. Brundtland (1987) outlined five main domains linked to sustainability: ecosystems and species, energy and industry, food and urban development, new water, and logistics and supply chain management. We will now address these sectors comprehensively, including their unique connection to logistics and supply chain management.

Role of Procurement in the Supply Chain

A dramatic change in the function of procurement occurred with the advent of competitive supply chains. Starting with the most basic functions of acquiring and purchasing, procurement has evolved into the boundary-spanning process that connects the organization to suppliers further down the supply chain. Due to rising specialization, global competitiveness, and emphasis on core competencies, a greater number of suppliers from all over the world are now part of supply chains. The complexity level rose, and with it came the necessity to systematically structure and oversee suppliers. Third parties, whose services and goods are purchased from outside the company, often account for a large portion of the expenditure in modern supply chains (Corner, 2010). As the number of outsourced activities increased, so did the importance of supplier selection and management to the supply chain's performance. One step in creating a supply chain map is classifying all of the vendors involved. Those suppliers that are positioned closest to the main association are considered the first-tier suppliers. Additionally, the entities that provide them are called second-tier suppliers, and the process continues thereafter in the same

manner. There is a crucial step in selecting the "right" supplier for a particular service or product. Corner (2010) suggests that systematic approaches should pay greater attention to the evolution of supply networks, product lifecycle phases, procurement risks, the importance of the acquired item or service, and other relevant considerations. As the scenario becomes more complicated and the number of tiers and suppliers increases, keeping track of the supply chain—which includes all of the sub-suppliers—becomes more challenging. Keep in mind that customers and clients will often hold companies accountable for events occurring further down their supply chain (Wilhelm et al., 2016). The fact that most supply chain operations take place outside of an organization's physical borders further suggests that, for the sake of sustainability, businesses should involve all of their suppliers and the activities that make up their supply chain, regardless of whether these entities are directly under their control. Companies are often held responsible for any part of their supply chains that engages in unsustainable activity (Grimm et al., 2016).

Sustainable Procurement

When we speak about sustainable procurement, we mean that the organization's procurement methods and systems take social, economic, and ecological factors into account, in addition to the usual considerations of price and quality. Common sustainable procurement practices include screening suppliers for fair labour standards, ensuring they comply with environmental regulations, and focusing on eliminating hazardous materials and waste from the supply chain. The adoption of sustainable purchasing practices is crucial for the organization's business and its ability to achieve its stated objectives in the future.

Why Sustainable Procurement Matters

Effective sustainable procurement is crucial because it helps businesses achieve their mission and gain trust from their target customers and business partners. If we break down the advantages of sustainable procurement into their four main types, we can easily describe them:

- **Risk and Reputation**—a company's reputation and bottom line might suffer if it has a supplier relationship with another that uses questionable practices, such as child labour or contaminating raw materials. Sustainable procurement partners should take steps to ensure that costs do not raise due to energy consumption and ownership transfers. Having cost savings allows a company to reinvest.
- **Revenue Growth**—Financials, brand value, and customer loyalty may all be enhanced by attracting and retaining customers who identify with sustainability initiatives. A company may be able to save money by using sustainable procurement partners.
- **Future-proofing**—The organization can protect itself against supplier shortages and changes in social, economic, and environmental factors in the future by developing sustainable procurement processes.
- **Compliance**—Sustainable procurement practices help ensure compliance with relevant international, national, state, and local regulations.

Seven Standards of Sustainable Procurement

Our core standards of Sustainable Procurement:

- Human rights
- Compliance with relevant international, national, state, and local regulations
- No forced or compulsory labour
- No child labour
- Equality and diversity
- Employee health and development
- No harsh or inhumane treatment
- Freedom of association

In order to make supply chains greener and more socially responsible, procurement must be prioritized. This is based on the stakeholder theory and the premise that the buyer has a more powerful position in the supply chain and can lead it towards greater sustainability. However, it is a common misconception that the buyer always has the upper hand in the supply chain relationship. This notion may not work in markets where the supply side has too much power, the demand side has too little, and the

purchasing power of the demand side is divided. There is a global competition for resources across organizations; for instance, if companies in one region demand extreme sustainability from their suppliers, those suppliers may look into selling to companies in another region. Furthermore, the prospect of insourcing is usually more of a theoretical option in the case that no suitable external supplier is available. Ultimately, it is envisioned that the buyer or even the customer side would be the one to spearhead the effort towards a greener supply chain. To alleviate the strain on the supply chain further downstream, a great deal of influence from the larger and more powerful players is often necessary. In the management of sustainable and environmentally responsible procurement, public procurement has the potential to make a substantial contribution. According to procurement experts, spending via districts, state governments, or the European Union's own budget accounts for almost a sixth of the overall Gross Domestic Product within the European Union. In contrast, building and infrastructure maintenance and construction account for a large portion of public spending, therefore sustainability concerns in public procurement are likely to have the greatest impact and importance in this sector (Erdmenger, 2012). However, public officials' emphasis on environmentally responsible operations may encourage the development of a market for more environmentally friendly products and services even in areas where public spending is not the principal customer.

The Concept of Lean Procurement

When an activity is not contributing value to the product, it is considered wasteful. A "lean" approach seeks to identify and eliminate this type of activity. This is achieved through a process known as continuous improvement, which involves tailoring the product to meet customer requests until it reaches perfection. Womack and Jones (2009) argue that the implementation of lean methodology would profoundly impact every company's decision-making process, from sourcing to purchasing to the fundamental definition of work itself. Lean methodology is an umbrella term for a set of practices with the overarching goal of

improving productivity, quality, and adaptability to changing customer demands. Womack and Jones (2009) highlight the three aims of flow, pull, and the pursuit of perfection as the foundation of any process associated with lean-ness. In a pull model, the pace of procurement is not dictated by plans for upstream activities but rather by customer orders, which trigger tasks and move materials through the supply chain. The term "flow" describes the uninterrupted movement of goods along a supply chain. For supply chains to be truly exceptional, they need to have processes that are highly efficient and completely waste-free. Many sources, including Womack et al. (2007), the Lean Enterprise Institute (2008), and Liker (2004), argue that lean manufacturing is distinct from conventional mass production systems due to the substantial investment in human labour, factory space, and capital. The importance of having strong ties with suppliers is also heavily emphasized. In the industrial sector, procurement has a long and storied history as a department that supports businesses, according to Fearon (1989). However, this has evolved into a management activity since the 1970s, when the oil crisis and competitive pressures necessitated careful management of purchasing inputs to safeguard the cost structure in public and private enterprises. As Waters and Fuller (1995) state, the traditional approach to procurement involves using multiple sources and short-term contracts, but the lean method is associated with single sourcing and long-term agreements. Lean procurement is characterized by less administrative work, lower-quality research, and smaller teams, as highlighted by Ansari and Modarress (1988). This way of thinking is consistent with the lean philosophy, which holds that more can be achieved with fewer resources. Womack et al. (1990) state that the Japanese term "muda" represents the fundamental concept of lean thinking. In their book about the machines that changed the world, the word "Muda" is used to describe anything that consumes resources without producing any benefit. Examples of Muda include defective production, unnecessary processing steps, unnecessary motion or development of employees or goods, time wasted waiting for resources, inefficient or

wasteful labour or inventory, and products that do not meet customers' needs. The goal of lean procurement is to integrate the upstream and downstream flows of goods, services, finances, and information to eliminate any waste (Abbott et al., 2006).

This is achieved by swiftly and accurately retrieving only the information needed to address the specific issues encountered by each customer. By streamlining information flows and eliminating non-value-adding activities, lean procurement enables organizations to respond quickly and efficiently to customer demands, fostering a culture of continuous improvement and waste reduction. At its core, lean procurement is a customer-centric approach that aligns procurement processes with the needs of the end customer. It emphasizes the importance of establishing strong, collaborative relationships with suppliers, treating them as strategic partners rather than mere vendors. Through open communication, information sharing, and joint problem-solving, organizations can work closely with their suppliers to identify and eliminate waste, reduce lead times, and improve quality. Lean procurement also emphasizes the concept of "pull" production, where materials and resources are only procured in response to actual customer demand, rather than based on forecasts or push-based systems. This demand-driven approach helps organizations minimize excess inventory, reduce carrying costs, and improve cash flow management. Furthermore, lean procurement encourages the adoption of standardized processes and the use of visual management tools, such as Kanban boards and value stream mapping, to enhance transparency and facilitate continuous improvement. By visualizing the flow of materials and information, organizations can identify bottlenecks, inefficiencies, and opportunities for optimization, enabling them to take corrective actions and refine their processes continuously. Ultimately, the goal of lean procurement is to create a streamlined, efficient, and responsive supply chain that delivers value to the customer while minimizing waste and maximizing resource utilization. By embracing lean principles, organizations can achieve significant cost savings, improve quality, and enhance their competitive

advantage in an ever-changing business landscape.

Drivers and Barriers for Sustainable Procurement

There are two main categories of factors that can influence sustainable procurement: external forces and internal considerations. As mentioned previously, external forces exert pressure on drivers through public opinion, regulations set by policymakers, financial stakeholders, and the pursuit of a positive and lasting reputation (Walker et al., 2008). On top of this pressure from consumers, there is also pressure from advocacy groups and non-governmental organizations. The most crucial internal factors are the personal accountability of managers and financial stakeholders, and the aim to reduce costs by decreasing pollution, waste, brand damage, or litigation expenses. One of the interconnected drivers is the internal pursuit of cost savings through environmentally responsible practices, aided by the internalization of costs for emissions through regulatory standards. Sustainability violations in the supply chain have evolved into a significant risk for corporate organizations and procurement departments, who are often involved in or held accountable for supplier selection. As a result, sustainable procurement has been driven by risk management considerations. Aiming to make supply chains more transparent and comprehensible is becoming increasingly important as sustainable procurement practices gain traction. The need for supply chain transparency extends beyond screening for sustainability to include a wide range of additional risks and potential disruptions. Officially mandated supply chain assessments (Awaysheh and Klassen, 2010) and operational adjustments, such as improving inventory management efficiency, are also expected to impact perception. At the procurement level, sustainability is more closely linked to the personal and ethical values of a company's leadership, which then permeates into the broader organization and is supported by middle management. Despite sustainable procurement being a crucial decision that requires buy-in from top management, this remains the case. The growing emphasis on sustainability in the

supply chain has undoubtedly elevated the supplier selection process—and by extension, procurement departments—to a more prominent and strategic position within business organizations. According to Walton et al. (1998), sustainable practices within organizations can be categorized into four types: defensive, reactive, accommodative, and proactive. Defensive adaptations to sustainable practices may be made by organizations if they find it difficult to avoid them. It is often believed that sustainability efforts are fundamentally "anti-business." The organization complies with all sustainability-related regulations to the letter, but these rules do not consider the organization's processes or practices, so there is no inherent incentive to improve them further. The reactive variation arises from the simple goal of avoiding penalties while complying with regulations governing social and environmental responsibility. Instead of focusing on reducing the quantity of waste generated, procedures are typically designed to mitigate the impact of produced contaminants, such as waste, through collection and disposal. The existing processes and structures remain unchanged, even when environmental and social factors are considered. It is common for these activities to occur at the end of the supply chain, with only periodic adjustments in between. The accommodative variation begins to consider the potential benefits that could emerge from more sustainable practices, but there has been little translation into practical methods and procedures. A key component of sustainable planning is incorporating product and process design, which the concept of proactive transformation recognizes as crucial. This type of organization enhances the advantages of both natural drivers and the production of assets. Within the organization, however, these four levels of environmentally and socially conscious behavior do not extend. It is critical to involve more stakeholders in the supply chain if we want to establish practices that can truly be socially and environmentally responsible. Even if sustainable procurement may typically begin at a functional level, the absorption of sustainability concerns into the system is essential. More and more supply chain partners were brought in this manner, and the discussion expanded to include both the

upstream and downstream parts of the supply chain, as well as how to make supply chain management as a whole more sustainable. It had previously focused on the practical side of the supplier-client relationship, but this was a shift. Cost concerns are a major barrier, even if the desire to save money is a powerful internal driver for sustainable procurement. Some buyers may be price-sensitive and unwilling to pay a premium for greener products since they are focused on cost savings. Small and medium-sized enterprises (SMEs) are particularly vulnerable to the costs associated with implementing sustainable practices due to their limited access to investment capital. A significant contributor to the cost barrier is the administrative mindset that views social responsibility and environmental considerations as a trade-off with economic factors. Another potential internal barrier is a lack of knowledge and understanding of sustainable procurement practices. Whether or not managers are aware of the need for more sustainable purchasing practices, the perception of difficulty in integrating sustainability considerations at a substantial and practical level persists. Most managers are 'unskilled' when it comes to sustainability issues, even if they're accustomed to dealing with supplier-side concerns like competency or governance. In such a situation, supplier development may help improve sustainability performance, and supply contracts can help align development goals. The absence of sincerity is another potential barrier. Providing employees with empty rhetoric about sustainability and approaching sustainability solely from a marketing standpoint in an attempt to achieve "greenwashing" can discourage them from becoming invested in the plan and focusing on genuine sustainability improvements. As we discussed earlier, improving supply chain sustainability requires considering not just one but all links in the chain. To better understand the subject, we will first examine the external forces that influence organizations' decisions to forgo sustainable supply chain practices. Regulations can be considered a driving force behind organizations' efforts to be socially and environmentally responsible. While compliance does not guarantee that efforts have been made to enhance social and environmental performance, it is

associated with sustainable procurement practices. If an organization wants to improve its sustainability performance, it should make proactive changes and integrate sustainability into its supply chain rather than relying on a reactive transformation plan. Over time, regulations can spark new ideas for how to reduce our impact on society and the environment while controlling costs. Regulations may encourage more thorough investigation into more effective ways of conducting this activity and reducing non-value-adding activities, ultimately leading to higher production yields. Customers play a pivotal role in influencing supply chain and procurement sustainability in several ways. This pressure may originate from the end consumer and propagate upstream through the supply chain. Customers who are not afraid to challenge companies are valuable assets for advocacy organizations and environmentalists. It is often believed that prominent, large-spending companies should be the ones demanding sustainability changes from the companies further up the supply chain. Therefore, these companies face the highest level of scrutiny from both the government and the media, and they also face the greatest risk from any negative publicity that may ensue. In a business context, competitors might motivate you to upgrade your supply chain operating practices. Competitors may potentially become innovation leaders or guide the industry towards standards and regulatory frameworks, inspiring other firms to follow suit. One source of competitive advantage might be the ability to coordinate and advance initiatives among rivals. This is because, in most industries, the pioneers set the bar for what is considered acceptable practice moving forward. Organizations must respond to the challenge by implementing sustainability improvements at the moment that rivals gain an edge in terms of the sustainability of their supply chains. Two cultural factors that are helping to shape sustainable supply chain practices are the growing public awareness and the influence of non-governmental advocacy organizations. Pressure groups and activists often threaten to publicly shame organizations, which can impact both managers and consumers. Suppliers have emerged as a potential catalyst for sustainable supply chains, according to

academic research. While some believe that suppliers are not the primary drivers of these practices, suppliers can maintain sustainable supply chain practices and provide valuable information (Carter and Dresner, 2001). The ability of the supply chain network and customer collaboration is an important enabler of sustainability improvements, which adds insult to injury. Suppliers may also collaborate with different types of customers to create new products and services, which can help them become more informed partners in sustainability improvements. One potential role for several of the external drivers is that of external constraints. Regulations may achieve the goal of attaining objective sustainability improvements, but they may also impede progress or lead to changes that are required to comply with the law. On the other hand, they could be industry-specific. Organizations may be unable to obtain the socially responsible and environmentally friendly alternative due to regulatory constraints, such as the need to ensure an unimpeded economy. If suppliers are not forthcoming with more information about their relationships with customers, it will be impossible to combine efforts to make the supply chain more environmentally friendly. Given the power imbalance in the relationship, it's likely that customers won't be able to persuade their suppliers to accept the proposed changes, and suppliers will subsequently hinder the implementation of improvements. When it comes to drivers, barriers, and ever-evolving processes, every organization is unique. Sustainable supply chain practices are being adopted at varying rates across different industries. Organizations face unique challenges due to a combination of factors such as ownership structure, ownership dynamics, industry-specific regulations, the surrounding environment, and market structures.

Lean Procurement Methodologies

Improving a company's procurement processes is a continuous effort that requires everyone in the supply chain—suppliers, manufacturers, logistics, and customers—to work together in harmony with the customer's best interests in mind. It is also essential for any company to have the right people, processes, and

tools in place. Many believe in lean procurement strategies as a way to ensure timely, high-quality supplies with minimal waste. Examples of lean procurement practices include employee involvement and respect for people. According to Hines et al. (2008) and Lee (2007), employee engagement and empowerment are essential for growth. It is crucial to remind those implementing lean that it is essentially a people-centric approach rather than a set of processes and tools (Ohno, 1988; Saurin et al., 2011; Dennis, 2007). For employees to excel, their work should be both challenging and rewarding, allowing them to hone their skills while contributing to a meaningful cause (Ichimura and Arunachalam, 2006). It is standard practice to advocate for a systemic, lean thinking approach. Every single process and employee of the company is intended to be governed by the principles outlined in this text. According to Liker (2004), Comm and Mathaisel (2000), Lance (2004), and Dennis (2007), maximizing the benefits of lean requires attention to the entire value chain and employee involvement. Recognizing that employees are, ultimately, the most effective agents of cultural change is crucial. It is also critical to recognize that lean cannot be implemented with standalone tools.

Continuous Improvement (CIP)/Kaizen

Continuous Improvement (CIP)/Kaizen denotes the never-ending pursuit of improvement in terms of design, cost, and delivery quality. The organization as a whole will undoubtedly benefit from this approach. Bhuiyan and Baghel (2005) state that to eliminate waste within a company, a culture of encouraged improvement known as kaizen must be established. This culture seizes opportunities for improvement in the workplace without incurring significant costs by involving everyone in a regular and systematic manner. The objective of waste reduction efforts is to make small but consistent gains over time and to hold periodic kaizen events, which are focused periods of continuous improvement. The central principle of CIP is the self-examination of processes or inputs, and its main thrust is an emphasis on small, consistent improvements rather than major leaps. Streamlining and eliminating

inefficient methods is the primary goal of CIP. Continuously seeking ways to enhance one's own performance should be a habit for every employee. As a result, employees are more likely to take ownership of their work and find solutions to problems independently, which improves teamwork and, ultimately, boosts employee morale. In terms of continuous improvement, organizations reach new heights when led by individuals with the necessary expertise, intelligence, and ambition to push even further. As previously stated by Hines et al. in 2008.

The term "six-sigma" has recently come to represent achieving key performance objectives, improving quality, reducing waste, increasing customer satisfaction, and so on. Six Sigma is a comprehensive, systematic, and data-driven approach to process improvement and design. Six Sigma emphasizes incorporating quality into the process rather than relying solely on inspection for quality control. It also alludes to the concept that employees should be accountable for the quality of their own work, eliminating wasteful errors to ensure perfection. To achieve the lowest possible degree of error, it is likely that processes will be characterized using Six Sigma methodologies. Six Sigma can be applied to almost any process; it is not limited to the manufacturing sector. In the business world, Six Sigma is often used in conjunction with lean principles. This is because Six Sigma prioritizes quality above all else. In their 2000 annual reports, General Electric showcased the innovations made possible by Six Sigma. Our company's focus has shifted from the internal to the external environment as a result of Six Sigma's deployment; our thinking and the way our future leaders are educated have been profoundly impacted; and we are now closer to becoming an engaged organization. Its objectives revolve around reducing waste, and it achieves this through both radical improvement and continuous improvement (kaizen) initiatives.

If the organization cannot figure out how to integrate appropriate practices into its culture, the transition towards lean methodologies will most likely fail, according to Shah et al. (2008) and Liker (2004). Therefore, the organization should be able to adopt lean to some extent,

barring any extraordinary circumstances that might lead to their detection throughout the process of creating the right culture, environment, and conditions to support the transformation.

Managers should ensure that employees are involved as much as possible, that they understand their roles and responsibilities, and that they comprehend the purpose of the transformation initiative. Each link in the supply chain—from suppliers further upstream to customers further downstream—must collaborate to deliver value to the end-user. For collaboration to be effective, it must begin with management's buy-in and understanding of the concept, then be communicated to the workforce in a clear and effective manner. It should foster an environment conducive to learning, where records, such as those of training employees, can serve as an indicator. Finally, a concerted effort must be made to increase stability in a changing environment by reducing waste and making better use of regular meetings, conversations, and information exchange among supply chain partners. Another significant change that must be made for successful implementation is to the compensation system. Fullerton and Wempe (2009) and Sim and Rodgers (2009) both agree that a well-rounded compensation plan based on metrics of operational efficiency, collaboration, continuous improvement, and short-term results is crucial for the success of lean initiatives. Once an organization stops making excuses about its lean journey, standardizing updates and sustaining the transformation becomes critical (Johnston, 2009). Lean thinking emphasizes the importance of involving employees at all levels and fostering a culture of continuous improvement. By empowering employees to identify and eliminate waste, organizations can streamline processes, reduce costs, and enhance customer satisfaction. However, this requires a significant shift in mindset and a commitment to ongoing training and development. Effective communication and collaboration are essential for successful lean implementation. Management must not only understand and embrace lean principles but also communicate them clearly to the workforce. Creating an environment that encourages learning, problem-

solving, and open dialogue is crucial. Regular meetings, conversations, and information sharing among supply chain partners can help identify opportunities for improvement and facilitate a coordinated effort towards waste reduction and process optimization. Compensation systems should be aligned with lean objectives, rewarding operational efficiency, collaboration, continuous improvement, and short-term results. This reinforces the desired behaviors and fosters a culture of accountability and continuous learning. Sustaining lean transformations requires a long-term commitment and a willingness to adapt and evolve. Organizations must resist the temptation to revert to old habits or make excuses for deviating from lean principles. Standardizing updates and maintaining the momentum of the transformation is essential for realizing the full benefits of lean procurement. By embracing lean methodologies, organizations can achieve significant improvements in procurement processes, supply chain performance, and overall operational efficiency. However, success hinges on a holistic approach that involves leadership commitment, employee engagement, effective communication, and a culture of continuous improvement.

Just-in-Time (JIT) and Kanban Systems

As part of lean procurement, just-in-time (JIT) ensures that the right quantity of high-quality components is delivered at the right time, at the right place, and at the right price. This is accomplished by utilizing collaborative efforts and thorough representational inclusion. The term "lean" is often used to describe this approach, which serves as a framework for organizing and managing the procurement process. The primary objective of the JIT concept is to improve procurement performance. It involves acquiring labour and products precisely when they are needed, not in advance to be held as inventory, and not after they are needed, which would disrupt consumers. Instead, the goal is to meet demands swiftly with excellent quality and no waste. Another perspective on "Just in Time" is that it is an approach to supply chain management that prioritizes the timely, high-quality, and exceptionally productive delivery of components to meet

customer demands. Rather than regularly obtaining large quantities of items, JIT favors making a small number of consistent orders to meet immediate needs. These smaller order sizes differ significantly from typical purchasing practices, as they are sometimes sufficient to meet the demands of a single day or even a few hours. Among the many benefits of JIT are the following: a promise of defect-free products to the buyer and merchant; the sequential shipment of small quantities of materials with short lead times and strict delivery performance standards; a mutually beneficial relationship between the buyer and dealer; reliable products and procurement plans sent to suppliers; extensive information sharing among suppliers and individuals involved in the supply chain; and electronic data exchange and free flows of information with suppliers. The Japanese term "kanban" translates to "sign" or "visual signal" in English. This method allows for the management of activities to control the production and movement of materials through a supply chain, utilizing visual cues such as bins, cards, or signals. The Kanban pull system relies on these cards or holders to function. Liker (2004) and Arnold and Chapman (2004) define Kanban as a control strategy that involves signaling precisely what is intended. This signal to produce or provide new components is derived from operations carried out further downstream. Here are a few characteristics they display: They are not planning tools, but they do assist in governing material flow by regulating the movement of materials into and out of the supply chain. They use simple visual cues such as cards, empty containers, or blank spaces to indicate when specific items need to be acquired and relocated. Whether it's between supply chain partners or even within a single department, they can help maintain alignment. Since they initiate the entire material production process, end customers' requirements ultimately constrain the activities performed upstream.

Supplier Collaboration

Supplier collaboration is an essential aspect of lean procurement. The visibility principle states that everyone involved, from customers to suppliers, should be able to "see" what the

other is doing. Womack and Jones (1996) assert that the power structure of lean includes two of the five principles: customer focus and supplier collaboration. Suppliers are crucial for a company to gain a competitive edge, and Womack (1986) argues that their impact is substantial. Trust and commitment, rooted in a long-term perspective, are the bedrock of every successful supplier-buyer relationship (Morgan and Chase, 1994). When the supplier is facing operational difficulties, the buyer steps in, both financially and creatively, to help alleviate some of those challenges. Lean companies prioritize enhancing their suppliers' capacity to decrease costs and increase quality, as demonstrated by Liker and Choi (2006). The market must abandon transaction-centric marketing tactics in favor of relationship-centric approaches to survive the increasing level of competition in the commercial hub. Lean suppliers are flexible and can adapt to new circumstances due to the efficiencies gained by using lean processes. Additionally, they are highly punctual and strive for continuous improvement in all aspects of their operations. If organizations want to foster the growth of lean suppliers, they should consider the value stream of their suppliers. Motivating suppliers to embrace lean techniques and incorporating them into lean operations will greatly benefit them. Consequently, organizations can support their suppliers and set targets to consistently decrease costs while enhancing quality, which boosts the organization's productivity. When selecting suppliers, companies should emphasize establishing long-term relationships with those that provide competitive pricing and high-quality products and services. This allows companies to secure their product line without having to constantly search for new suppliers, which can be a time-consuming and costly ordeal. It is possible to reduce buffer inventory by trusting the supplier or vendor to deliver the products reliably.

Lean Thinking and E-Procurement

A coordinated management plan that utilizes lean thinking can impact the entire organization, including its suppliers, other employees, and customers. Research groups from the University of Warwick and the University of

Bath identified three forms of leanness: leanness as a transaction, in which the organization aims to become lean by delivering, downsizing, and rethinking; leanness as an outcome, through expected primary flexibility through business process reengineering; and lastly, leanness as a process, through Total Quality Management and JIT workflows. This information is based on a report on lean organizational implementations by individuals. The study recognized all three phases of lean development and the associated gains in human resources and production. It is essential that lean thinking be propagated across the organization to increase operational efficiency and effectiveness. Womack and Jones, in their influential book "Lean Thinking," proposed the following criteria for a lean supply chain: The expectation is that all participating organizations will reap sufficient returns from their investments in the value stream. Until every company's profit and cost goals are satisfied, the organizations will work together to detect and eliminate muda, or waste. After all cost targets have been fulfilled, organizations will swiftly undertake fresh studies to identify any remaining waste and establish new objectives. This is a win-win method of defining value. Electronic procurement, or e-procurement, can be part of a company's broader strategy to reduce costs. In contrast to more traditional methods, such as placing an order by mail, fax, or phone, e-procurement utilizes alternative mediums. The use of information and communication technologies has the potential to streamline, accelerate, and reduce errors in the procurement process. These approaches include electronic data interchange (EDI), online commercial centers (also called "e-marketplaces"), and combinations of the two. Businesses employ a wide variety of hybrid traditional and electronic procurement procedures, which may vary across industries. In addition to modern e-procurement tools, some more conventional methods may include phone and fax capabilities. According to Kaufmann (1999) and Lamming (1995), electronic procurement increases supply chain visibility, which in turn allows companies to outsource non-essential procurement tasks and focus on critical acquisitions. While electronic data interchange (EDI) is more commonly used to

illustrate how buyers and suppliers are connected, it is also frequently used to demonstrate how information flows through the procurement process. Additionally, EDI is often utilized internally by departments or offices that handle transportation, purchasing, or finance to transmit data to one another.

Benefits of Implementing Lean Procurement Methodologies

Retailers, distributors, and manufacturers are all starting to adopt lean procurement as a procedural technique to gain a competitive edge and remain in business. This is because companies can no longer generate value while simultaneously eliminating waste. Companies that don't embrace lean manufacturing face competition from products they may not even be aware of, which could harm their business, industry, and the overall economy. Some advantages of lean procurement include the following:

Streamlining Every Purchase Cycle to Eliminate Waste

Lean, as proposed by Liker (2004), boils down to one thing: eliminating waste. The primary idea behind the lean approach is to eliminate any form of waste at the disposal stage. Waste is defined as anything that does not advance the value production process. Several participants in the supply chain have collaborated and worked independently to eradicate wasteful practices and overstocking. Lean product development often utilizes two simple tools. The first step in waste disposal is sorting waste into its respective categories. Meier (2001), Philips and Nystuen (2002), and Siekman, Taylor, and Brunt (2000) all agree that seven distinct types of waste need to be eliminated: transportation waste, unnecessary processing, waiting time waste, inventory waste, unnecessary motions, and defective products. Alternatively, you might follow the 5S, a basic set of rules for waste reduction. Procurement process waste can be identified, characterized, and reduced in the same manner as manufacturing process waste. Furthermore, there is a significant opportunity to create substantial cost savings through the elimination of waste in procurement procedures. If lean

procurement is not implemented, purchasers will waste a considerable amount of time on non-critical tasks such as checking request progress, updating the purchase request section, and maintaining "private" spreadsheets for analysis. This causes them to miss opportunities to enhance operational efficiency and have beneficial supplier interactions. Lean procurement approaches, which eliminate discrete purchase orders and adopt a more effective consumption-based business process, can achieve significantly reduced inventory levels. The lean worldview regards inventory as a resource drain, as manufacturing can be efficiently executed with minimal stock of raw materials, work-in-progress (WIP), or finished goods.

Decrease Lead Time

The term "lead time" refers to the time it takes from the moment a customer places an order for a product until they receive their payment. Lean methodology aims to minimize product flow time by concentrating on the movement of information and materials across the supply chain. Organizations are responding by doing this as market volatility, long lead times, and measurement errors become increasingly problematic. Lean procurement deliveries are efficient and adaptable, making them ideal for a demand-driven supply chain where requirements are constantly changing. Reducing lead time is a cornerstone of lean operations and has the potential to raise the bar for supply chain excellence. As a result, inventory becomes more reliable, production flexibility increases, and inventory costs decrease. Furthermore, the organization can respond swiftly to demands, rather than waiting for them to be forecasted, as lean methods ensure a rapid back-and-forth in the product supply chain.

Reduce Current Inventory Levels

Karlsson and Ahlstrom (1996) state that inventory held as safety stock or waiting inventory needs to be addressed, as it does not provide much value. In demand-driven initiatives, more and more businesses are feeling the pressure to lower inventory levels. There is a significant amount of idle or waiting inventory these

days, so many companies simply produce what they need and load it directly onto trucks, allowing them to maintain consistent production. In one possible manufacturing sequence, all raw materials are consumed without allocating space for storage. An overabundance of inventory is a common symptom of waste that occurs across the supply chain. A potential solution to the problem of excessive inventory is the use of postponement and customization strategies, which move the final assembly of a finished product to the very end of the supply chain. It is possible to significantly reduce the quantity of raw materials and work-in-process by utilizing JIT methods, one-piece flow, and pull systems. One alternative is to use a Kanban board or some other visual cue to indicate when more items need to be removed before moving on to the next step in the process. Eliminating all raw materials and work-in-process (WIP) is a top priority. Even though the best companies have used just-in-time delivery to boost output, this method still requires an unprecedented level of supply chain coordination and visibility. According to Worthington (1998), a company can achieve a continuous flow of inventory without waiting inventory by using JIT-driven processes in inventory management systems, leading to seamless inventory orders.

Cost Reduction

Inventory levels should rise and fall in a regular pattern that mirrors changes in consumer demand. This lowers the costs of carrying products and charges levied by authorities. In traditional large-scale manufacturing, a vast quantity of raw materials is often acquired to increase output, which in turn increases total production over the product's life cycle. This paradigm results in high development and transit costs. Applying lean principles can help reduce the resources needed to create new products. This allows for faster product delivery to market, which in turn makes it much easier to incorporate customer feedback and new specifications. Lean also promotes the use of capital-efficient machinery, tools, and systems, which is a significant advantage. A lower initial cost to recover and greater flexibility are the outcomes of this. As a result, limits on product lifespans may be imposed. Because of this,

there is less variation in product prices, which leads to more stable and predictable revenue.

Customer Loyalty Maintenance

Lean procurement practices can establish an adaptable and responsive supplier network. This ensures that the supply chain can handle a spike in client demand while avoiding being understaffed when demand decreases. Improvements in supply chain efficiency, responsiveness, and speed are all within reach with the help of lean procurement technologies. The lean philosophy accelerates all connections to the degree that it controls the entire supply chain. Over time, a culture that values speed in decision-making and responses becomes the norm. However, this does not mean that decisions are not thoroughly reviewed. A "predisposition for action" would seem to represent the new organizational culture, to put it plainly. It becomes the norm rather than the exception when responses are slow or nonexistent.

Continuous Demand Management Improvements

Traditionally, buyers have been responsible for managing material requirements planning (MRP) and relaying those needs to suppliers via various electronic communication methods, including email, fax, and telephone. To accommodate the demand-driven efforts of today's lean supply chains, these traditional methods are too slow and complex. Instead, a lean supply chain aims to distribute products through the channel in a way that prioritizes customer demand. Starting with the point-of-sale systems, actual customer purchases trigger replenishment signals that flow upstream through the supply chain. Since there is real and immediate demand for the products, forecasting is unnecessary. One of the necessary prerequisites of the lean approach is to transition to a pull system. In particular, a product or service is triggered for replenishment the moment the most recent customer purchases it. Obviously, a third-tier supplier will not give much thought to the end-customer's demand for the finished product. This is because the third-tier supplier is unlikely to provide more than a small portion of the materials used to make the final product, and even more unlikely

that they will fully understand the significance of their contribution to the product's structure. However, during implementation, all processors and suppliers, no matter where they are in the supply chain, should be able to reliably receive customer demand signals and translate them into components of the final saleable product.

Standardization of Processes

Another hallmark of a lean supply chain is the standardization of processes. The standardization of processes, a key component of lean manufacturing, enables the possibility for continuous flow to exist within the organization. Flow describes the process by which a product or service is created and then delivered to the customer through the system. Significant elements that might disrupt flow include transportation, work in queue, and batch processing. These challenges increase the time required to launch a product or deliver a service. One approach that shifts the focus from top-down to bottom-up thinking is the "flow" or "value-stream" perspective. By "flow thinking," we mean breaking down traditional hierarchies of departments and functions into their component parts and seeing how they connect to the value chain that starts with suppliers, moves through the company, and finally reaches the customers (Hallam, 2001). For most organizations, the concept of continuous flow describes a way of working that prioritizes overall system efficiency over that of its constituent parts. Flow is enabled when the supply chain standardizes its materials and methods to reduce complexity. To achieve these efficiencies, all parties involved in the supply chain must collaborate and establish standardized processes. These processes will be utilized to deliver products and services that add value and prevent the waste or duplication of efforts. If partners have a thorough understanding of the processes required throughout the supply chain, they will find it easier to pursue the standardization of critical operations and relocate work to the most efficient location. Two of the most critical processes that businesses focus on are planning and production. It is crucial to follow industry standards wherever possible, and those in the supply chain

should do everything they can to help shape organizations that do just that. Product standardization benefits customers by improving the products' functionality and ease of use. However, it diminishes the product's unique identity, which in turn makes other competitive attributes, such as a reliable supply chain, more important.

Supply Chain as a Competitive Weapon

Both Liker (2004) and Taylor and Brunt et al. (2001) provide empirical evidence that lean does, in fact, enhance competitiveness. Benchmarking studies conducted on Japanese companies demonstrated, according to Sheridan (2000), that true lean transformations resulted in four interconnected productivity benefits. According to research by Sohal and Eggleston (1994), 66 percent of the companies surveyed stated that lean methodologies helped them achieve a competitive edge in the market. The most significant improvements were determined to be market competitiveness, customer relationships, and quality standards. Building a reliable supply chain enables the involved businesses to collaborate and provide mutual assistance in their quest for continuous improvement. When combined, these two factors allow even the smallest businesses to enjoy the benefits of lean methodology. Being mentally prepared, accountable, responsible, and having a plan are all crucial elements. Lean supply chains are designed to be agile, responsive, and customer-focused. By eliminating waste, standardizing processes, and fostering collaboration among supply chain partners, organizations can achieve significant improvements in lead times, inventory levels, and overall operational efficiency. This, in turn, translates into cost savings, enhanced customer satisfaction, and a competitive advantage in the marketplace. The transition to a lean supply chain requires a cultural shift within the organization, as well as a commitment to continuous improvement and employee empowerment. It involves breaking down traditional silos and fostering cross-functional collaboration, both internally and externally with suppliers and customers. Effective communication and information sharing are critical to the success of a lean supply chain. By

providing real-time visibility into customer demand and inventory levels, organizations can respond quickly to changes and minimize the need for forecasting and excess inventory. Furthermore, the standardization of processes and materials enables a seamless flow of products and information throughout the supply chain, reducing complexity and facilitating continuous improvement efforts. Standardization also promotes product quality and consistency, enhancing customer satisfaction and loyalty. Ultimately, the lean supply chain represents a strategic weapon in the pursuit of competitive advantage. By aligning the entire supply chain around the principles of waste elimination, continuous flow, and customer focus, organizations can achieve superior operational performance, cost efficiency, and responsiveness to market demands.

Fundamental Obstacles to Implementing Lean Procurement Methodologies

Large-scale manufacturing organizations often encounter several fundamental issues that hinder the adoption of lean procurement practices. Supply chain waste may stem from various sources, such as a lack of systemic thinking, resistance to change, inadequate resources, skill deficiencies, and a failure to recognize waste within the system. This misunderstanding leads many businesses to improperly implement lean principles (Bhasin and Burcher, 2006). Liker (2004), Lee (2003), and Bicheno (2007) all emphasize that the absence of systemic thinking makes effective implementation more challenging. They argue that lean is more than just a set of tools; it encompasses a way of thinking about your organization, your customers, your suppliers, and the processes you employ. The 4P model—which Liker (2004) defines as "philosophy, processes, people and partners, and problem-solving"—lies at the heart of the lean methodology. A common challenge that arises during the implementation of lean is resistance to change, a prevalent issue with most change processes. According to Sohal and Egglestone (1994), every level of an organization encounters resistance, from entry-level employees to middle managers and senior executives. Axelsson et al. (2005) state that purchasing managers face the

inherent challenge of human factors, which hinders the effectiveness of lean implementation. In their view, resistance stems from a lack of clarity, aversion to change, pressure, interest-related obstacles, and the difficulty of acquiring new knowledge. Bhasin and Burcher (2006) emphasize the importance of having a well-defined vision and communicating it effectively to the organization's workforce for successful lean implementation. Several studies have shown that companies struggle to implement lean procurement due to preexisting cultural norms and a lack of buy-in from upper management (2011). The evidence suggests that human factors contribute to nine out of the top ten change-related difficulties. Some individuals who may be perceived as unfavorable are cited by Reps. Payoff (2008), Lee (2007), Vinodh and Balaji (2011), Shook (2010), Cocolicchio (2008), Hines et al. (2008), and Dalai (2010). One of the most fundamental issues with lean implementation, according to Bhasin and Burcher (2006) and Ahlstrom (1997), is the lack of project planning and sequencing. Bhasin and Burcher (2006) argue that the challenge lies not in unfamiliarity with the tools and methodology but rather in coordinating the effort and convincing others to place their trust in them. According to Philip Atkinson's study, most companies fail to foster a culture that can rally around lean and other efficiency-boosting initiatives. He draws a parallel between neglecting to plan for change and formulating a plan to fail. It is crucial for businesses to consider how they can lay the groundwork for change by creating the right culture, environment, and conditions. Another issue is that most companies are unwilling to allocate the additional resources required to implement lean methodologies effectively. Sufficient funding is necessary for coordinated efforts, information and communication technology integration, external consultants, and employee training programs. As employees prepare for the new processes and regulations, it is possible that even company production may be delayed. Pius Achange et al. (2008) state that managers would prefer to avoid spending resources on initiatives they do not perceive as yielding a quick return. Lean methodology cannot be implemented without intellectual capital

and the capacity for continuous improvement and differentiation. The majority of businesses face challenges because they hire incompetent employees who do not support the notion of skill development. Companies often lack transparency in the supply chain regarding the distinction between value and waste. Organizations continue to face the difficulty of balancing value-adding procurement processes with those deemed "necessary waste" as long as all other circumstances remain unchanged. For instance, it may be challenging for companies to determine whether employee development within the organization adds value to the business as a whole.

Lean Procurement Practices

Every organization needs the right people, processes, and tools to keep up with the constant improvement necessary to integrate and synchronize the various links in the supply chain (supplier, logistics, clients) with the customer's interests (Bonavia and Marin, 2006). Building an organization with better procurement processes is an ongoing endeavor. Lean procurement practices aim to ensure timely, high-quality, waste-minimizing supplies, often taught as values. Several lean procurement techniques will be discussed in the following paragraphs. Hines et al. (2008) state that employee involvement and reinforcement are vital for improvement. To ensure a smooth rollout of lean, it's crucial to impress upon those in charge of the implementation that the methodology is based on people, not processes and tools (Shah and Ward, 2003). According to Achange et al. (2006), for employees to excel, the work they do needs to be engaging and fulfilling while also providing opportunities to improve their job-related skills. By "continuous improvement," we mean the never-ending pursuit to enhance design, cost-effectiveness, and quality. The organization will undoubtedly benefit from this approach. A culture of supported improvement that targets the elimination of waste throughout the entire company and involves everyone in a routine manner should have been evident as kaizen in order to further boost performance without incurring significant financial expenditures (Mertins and Jochem, 2001). Implementing kaizen events, or

occasions of continuous improvement, and incremental, steady gains are at the heart of waste reduction efforts. The core principle of continuous improvement is the self-examination of inputs or processes, and the approach prioritizes small, steady improvements over massive leaps. The justification for continuous improvement rests on the following: the identification, mitigation, and elimination of sub-standard processes; the emphasis on consistent, ongoing improvement; and the emphasis on standardization. According to Harland et al. (2007), six-sigma has become the de facto standard for many companies seeking quality improvements, waste reduction, increased customer reliability, and other critical business goals. For the purpose of delivering through process design and improvement initiatives, it organizes a comprehensive, data-driven methodology that is rigorous and systematic. Six Sigma emphasizes incorporating quality into the process instead of relying solely on inspection for quality control. It also alludes to the concept that employees should be accountable for the quality of their own work, eliminating wasteful errors to ensure perfection. To achieve the lowest possible degree of error, processes will likely be characterized and addressed using Six Sigma methodologies, according to Handfield et al. (2009). As part of lean procurement, just-in-time (JIT) ensures that the right quantity of high-quality components is delivered at the right time, at the right place, and at the right price. This is accomplished through collaborative efforts and comprehensive stakeholder involvement. Even when applied in reverse, this technique goes by the moniker "Lean" (Bonavia and Marin, 2006). In addition to being a way of thinking, it provides a framework for organizing and managing the procurement process. Lean procurement relies on the visibility principle. The same logic that applies to customers should also apply to suppliers; both parties should be able to "see" the other's actions. Two of the five powers that are distinct in Womack's concept of competitive advantage are the customers and the suppliers. For a corporation to gain a competitive edge, suppliers are crucial, and Womack (1986) argues that suppliers' impact is substantial. A relationship based on mutual trust

and shared responsibility is essential to the success of any buyer-seller arrangement. Whenever necessary, the buyer contributes both financially and mechanically to help the supplier with some of their operational challenges. Lean companies prioritize enhancing their suppliers' ability to reduce costs and improve quality, as found by Liker and Choi (2006).

Streamlined Procurement and Enhanced Supply Chain Efficiency

Nonetheless, lean procurement is rapidly becoming a standard procedure for administrative companies and manufacturers alike to gain an edge and, more importantly, endure. The reason for this is that businesses can no longer generate value while simultaneously eliminating waste. A product's lead time is the time it takes from a customer placing an order to receiving payment for that order. Lean is an approach that aims to decrease product flow time by focusing on the movement of information and materials throughout the supply chain (Axelsson, Rozemeijer, and Wynstra, 2005). Organizations are taking this action because they are facing increasing problems with market volatility, long lead times, and forecasting errors. Lean procurement deliveries are efficient and adaptable, making them ideal for a demand-driven supply chain where needs are constantly changing. Extended lead times might damage the current customer relationship and ultimately delegitimize the company, according to Bonavia and Marin (2006). This is in addition to the already high costs associated with production. Improving the effectiveness of supply chain operations is one of the primary goals of implementing lean procedures, which aim to decrease lead time. As a consequence, inventory becomes more stable, production flexibility rises, and the cost of inventory decreases. A rapid flow of information throughout the firm's product supply chain is another benefit of lean procedures, according to Sohal and Egglestone (2004). This allows organizations to respond faster to customer needs rather than to projected forecasts. Inventory levels should fluctuate in sync with changes in consumer demand. This lowers the costs of carrying products and charges levied by authorities.

The traditional paradigm causes a significant amount of money to be invested in manufacturing and shipping the goods. Applying lean principles may help reduce the resources needed to create new products. It becomes easier to incorporate the latest requirements into the product due to the faster time-to-market, according to Esben, Gjerdrum, and Mahad (2011). Lean also promotes the use of low-capital-investment machinery, tools, and equipment. There is less of an initial outlay and greater flexibility as a consequence. Consequently, product life cycles could be more limited. As a result, there is less variation in the cost of items, which contributes to more stable and predictable revenue. The use of lean procurement in the service industry reduces the cost of delivering services. Handfield et al. (2009) state that a responsive and adaptable supply chain can be built using lean procurement strategies. This ensures that the supply chain can handle an influx of unexpectedly high customer orders, but it leaves the business short on inventories when demand drops. Improvements in supply chain efficiency, responsiveness, and speed are all within reach with the help of lean procurement technologies. The lean philosophy accelerates all connections to the degree that it controls the entire supply chain. Over time, a culture that values speed in decision-making and responses becomes the norm. However, this does not mean that decisions are not thoroughly reviewed. A "predisposition for action" clearly becomes the new organizational culture, to put it simply. As opposed to being the standard, a delayed response or complete lack of response becomes the rare exception (Womack and Jones, 2009). It is the buyer's responsibility to manage the material requirements planning (MRP) forecast and communicate the needs to the supplier via various means, such as email, fax, and phone. As far as procurement goes, this is the norm. Traditional methods are too slow and cumbersome to sustain today's demand-driven enterprises (Shah and Ward, 2003). Utilizing customer demand gleaned from point-of-sale systems, a lean supply chain seeks to ensure the continuous flow of commodities through the channel. It is unnecessary to forecast their interest in the items since there is real and

genuine demand for them. A fundamental tenet of lean methodology is the use of a pull system. In particular, a product or service is triggered for replenishment the moment the most recent customer purchases it. Obviously, a third-tier supplier will not give much thought to the end-customer's demand for the finished product. This is because the third-tier supplier is unlikely to provide more than a small portion of the materials used to make the final product, and even more unlikely that they will fully understand the significance of their contribution to the product's structure (Hines and Found, 2008). All suppliers and processors, no matter their position in the supply chain, are expected to receive customer demand signals and strive to translate them into components of the final saleable product under the system outlined by Harland et al. (2007). Mertins and Jochem (2001) assert, with supporting data, that lean is the engine that propels competitiveness. Real lean transformation led to four overlapping productivity improvements, according to Polito and Watson (2006), who cite benchmarking studies conducted on Japanese organizations. Over 66% of the organizations claimed to have gained a competitive edge by using lean methodologies, according to Sohal and Eggleston (2004). The most notable advancements were credited to the market's fierce competition, solid customer relationships, and demanding quality standards. A reliable supply chain allows the component businesses to adhere to each other and organize their continuous improvement efforts. The benefits of lean initiatives can be shared with even the smallest organizations thanks to this synthesis. Thinking, being accountable, being prepared, collaborating, and having a plan for the future are some of the requirements, according to Shah and Ward (2003).

➤ **Challenges Facing Lean Procurement**

Inadequate support from suppliers, transportation organizations, engineers, and upper management, coupled with poor product quality and ineffective communication, can impede the success of lean procurement initiatives. According to research, the most significant challenges include lack of support from suppliers, suppliers with low levels of sophistication,

geographical distance, absence of systemic thinking, resistance to change, lack of resources, skill deficiencies, and failure to recognize waste within the supply chain (Achanga et al., 2006). These issues are of paramount importance. Mertins and Jochem (2001) suggest that, ideally, there should be a single supplier for each material or component. This approach would enable buyers and sellers to establish strong relationships. However, these organizations argue that when some firms engage in sole-source procurement, the risk of supply disruption and non-competitive pricing increases. Consequently, some companies adhere to alternative supply strategies rather than relying on single-source procurement or drastically reducing inventory, as these methods can also be risky. One of the most crucial challenges in multi-sourcing is determining the optimal order quantities or lot sizes. Bhasin and Burcher (2006) state that close collaboration with suppliers is essential for lean procurement to achieve optimal performance levels. Proximity not only facilitates information sharing but also enhances quality levels and helps reduce costs. International vendors face significant challenges in rapidly implementing buyer-coordinated changes to design and quantity due to the vast geographical areas their customers span. Translation issues, cultural differences, and time zone variances are some of the potential problems that can arise in international trade and lead to delays (Bonavia and Marin, 2006). When distance is a factor, the supply chain becomes more complex, and higher levels of buffering are required (Bicheno, 2007). According to Bhasin and Burcher (2006), many companies fail to effectively implement lean because they do not recognize that lean is primarily a process. Ineffective implementation is often caused by a lack of systemic thinking, as stated by Liker (2007). They argue that lean encompasses more than just a set of tools; it involves ways of interacting with customers, suppliers, and colleagues, as well as the processes themselves. Liker (2004) states that the 4P model—which comprises elements like philosophy, problem-solving, process, people, and partners—forms the foundation of lean. Adopting lean also raises concerns about resistance to change, a common issue

with most change processes. According to studies by Sohal and Egglestone (2004), every level of an organization encounters resistance, from entry-level employees to middle managers and senior executives. Bhasin and Burcher (2006) emphasize the importance of clearly communicating a well-defined vision of the company's future state and goals to employees for effective lean implementation. Existing cultural norms and a lack of support from management are responsible for firms' inability to effectively implement lean procurement, according to Saurin et al. (2011). The evidence suggests that human factors contribute to nine out of the top ten change-related obstacles. Examples of these obstacles include negative communication and resistance from employees (Hines et al., 2008). Inadequate planning and sequencing of projects is one of the most fundamental issues that arise during lean implementation, according to Bhasin and Burcher (2006). Bhasin and Burcher (2006) argue that the challenge lies not in unfamiliarity with the tools and methodology but rather in coordinating the effort and convincing others to place their trust in them. Additionally, most companies are unwilling to allocate the additional resources required to effectively implement lean procurement. Resources are needed for employee training programs, external consultants, and information and communication technology integration. If managers do not expect quick returns, they will seek to avoid the wasteful expenditure of resources (Achanga et al., 2008; Liker and Choi, 2006). The reason is that managers prefer to avoid reconciliation, coordination, and related tasks. Lean principles require the utilization of intellectual capital and the capacity for continuous improvement and differentiation for effective implementation. Most companies face challenges because they hire incompetent employees who do not support the notion of skill development. According to Langley et al. (2008), businesses typically lack clarity on the process of distinguishing between value and waste in the supply chain. The practice of balancing value-adding procurement activities with those deemed "necessary waste" poses an ongoing challenge for organizations, given that all other factors remain constant. For instance, it may be difficult for

companies to determine whether employee development within the organization adds value to the business as a whole (Kotter, 2007). Another challenge that should be addressed through lean procurement is the lack of proper research. Failure to conduct appropriate research can lead to either underloading or overstocking. In situations where demand is unpredictable, the inability to accurately forecast demand could result in a mismatch between the inventory held by the retailer and the actual customer demand. This mismatch can lead to either excess inventory or stock-outs, both of which are undesirable outcomes. Furthermore, the success of lean procurement initiatives hinges on the ability to foster a culture of continuous improvement and employee empowerment. Resistance to change, lack of management support, and inadequate training can undermine the effectiveness of lean implementation. Organizations must invest in developing the necessary skills and mindset among their workforce, as well as creating an environment that encourages problem-solving and waste elimination. Effective communication and collaboration across the supply chain are also critical for lean procurement success. Geographical distance, cultural differences, and time zone variances can pose significant challenges, particularly when dealing with international suppliers. Overcoming these barriers requires open information sharing, clear communication channels, and a willingness to adapt to the unique needs and circumstances of supply chain partners. Overall, while lean procurement offers numerous benefits in terms of efficiency, cost reduction, and responsiveness, its successful implementation requires a holistic approach that addresses various organizational, cultural, and operational challenges. By recognizing and proactively addressing these challenges, organizations can increase their chances of realizing the full potential of lean procurement methodologies.

Research Gap

Based on the literature review, we can identify the following significant gaps in the research on long-term lean procurement and contract management:

1. The findings of this study are primarily applicable to the oil and gas industry, and their generalizability to other industries may be limited.
2. The questionnaire has been developed based on the findings of the previous study, which may not capture all relevant aspects of lean procurement and contract management.
3. While the main focus of this thesis is on procurement practices in the oil and gas industry in the Middle East and India, there is a need to explore these practices in other regions and geographical contexts.

Connecting the Literature

Inadequate support from suppliers, transportation companies, engineers, and upper management, coupled with poor product quality and ineffective communication, can impede the success of lean procurement initiatives (Achanga et al., 2006). Ideally, there should be a single supplier for each material or component, according to Mertins and Jochem (2001). This approach would strengthen the already excellent relationships between buyers and sellers. However, contrary to what some businesses believe, sole-source procurement does not necessarily increase the risk of supply disruption and non-competitive pricing. Some organizations prefer to have multiple supply strategies in place, as both single-source procurement and drastic inventory reduction can be risky. One of the most contentious aspects of multi-sourcing is determining the optimal order quantities or lot sizes. Bhasin and Burcher (2006) state that close collaboration with suppliers is necessary for lean procurement to achieve optimal performance levels. Proximity not only facilitates information sharing but also enhances quality levels and helps reduce costs. For global suppliers, it is challenging and time-consuming to incorporate coordinated changes in design and volume due to the vast geographical distances involved. Issues related to international communication, including language barriers, cultural differences, and time zone variances, can further create unnecessary delays (Bonavia and Marin, 2006). When distance is a factor, the supply chain becomes more complex, and higher levels of buffering are required

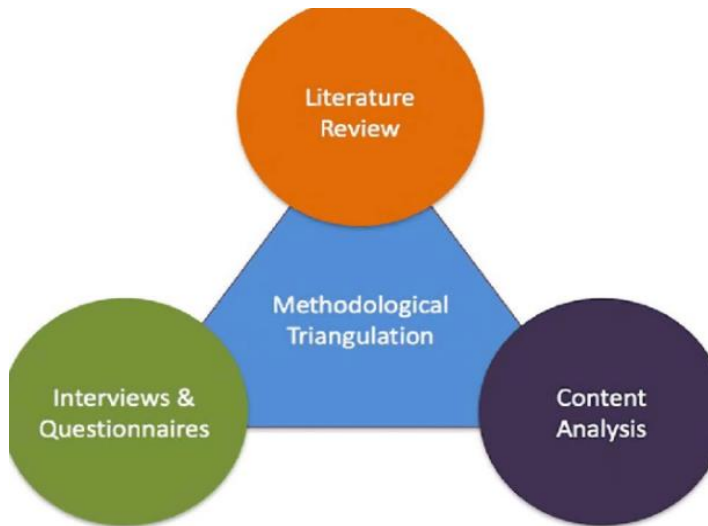
(Bicheno, 2007). Many companies fail to effectively implement lean because they do not recognize that lean is more of a process than a set of tools, according to Bhasin and Burcher (2006). Liker (2007) suggests that a lack of systemic thinking disrupts otherwise successful implementation. They argue that lean encompasses more than just a set of tools; it involves ways of interacting with customers, suppliers, and colleagues, as well as the processes themselves. Resistance to change is a common issue with most change processes, and lean implementation is no exception. According to Sohal and Egglestone (2004), every level of an organization encounters resistance, from entry-level employees to middle managers and senior executives. This involves overcoming various obstacles. Bhasin and Burcher (2006) emphasize the importance of clearly communicating a well-defined vision of the company's future state and goals to employees for effective lean implementation. Organizational culture and a lack of management support are often cited as reasons for the failure of lean procurement adoption (Saurin et al., 2011). The evidence suggests that human factors contribute to nine out of the top ten change-related obstacles, such as negative encounters and resistance from employees (Hines et al., 2008). Inadequate planning and sequencing of projects is one of the most significant challenges that arise during lean implementation, according to Bhasin and Burcher (2006). In most cases, the issue is not a lack of understanding of the tools and the process but rather the challenges of coordinating the effort and convincing others to place their trust in them (Bhasin and Burcher, 2006). Additionally, most companies are unwilling to allocate the additional resources required to effectively implement lean procurement. Resources are needed for employee training programs, external consultants, and information and communication technology (ICT) integration. Achanga et al. (2008) and Liker and Choi (2006) state that managers would prefer not to waste resources, especially if they do not expect to see a quick return on investment. It is also crucial to engage in reconciliation, collaboration, and related activities. Intellectual capital and the capacity for continuous improvement and skill differentiation are essential for the

effective implementation of lean principles. Most companies face challenges because they hire employees with limited knowledge who do not support the notion of enhancing competence (Langley et al., 2008). Additionally, businesses often lack clarity on how to distinguish between value and waste in the supply chain. Firms still face the challenge, if all other factors remain constant, of separating procurement-related processes into "necessary waste" and value-adding activities. According to research by Kotter (2007), companies may have difficulty determining whether promoting employees increases the organization's overall value. Another issue that lean procurement could address is insufficient research. Both underloading and overstocking occur as a consequence of inadequate research. In the event that demand is uncertain, the imperfect ability to forecast demand might cause a discrepancy between the retailer's inventory and the actual customer demand. In such a scenario, the inventory is either underloaded or overstocked relative to the realized demand, leading to wasted output. Underloading increases the likelihood of missed sales, dissatisfied customers, and productivity losses, while overstocking is also undesirable. Overstocking, on the other hand, causes physical holding costs to rise, ties up capital, and accelerates product obsolescence. Furthermore, a shift in customer demand poses a challenge in lean procurement. The supply chain management community is constantly seeking new research, cutting-edge methods, and innovative concepts that can broaden the ways in which supply networks help organizations adapt positively to changing times. Demand-driven businesses should be the primary focus of supply network initiatives. Among industry pioneers, the goal of creating a "demand-driven enterprise" is gaining prominence. It is not enough to simply record customers' past purchases and current demands. Shorter product cycles caused by rapid information flow, an ever-expanding global economy, and rising demands from global business sectors have rendered the classic view of supply and demand inadequate. The research gaps identified highlight the need for further investigation into lean procurement and contract management practices, particularly in the

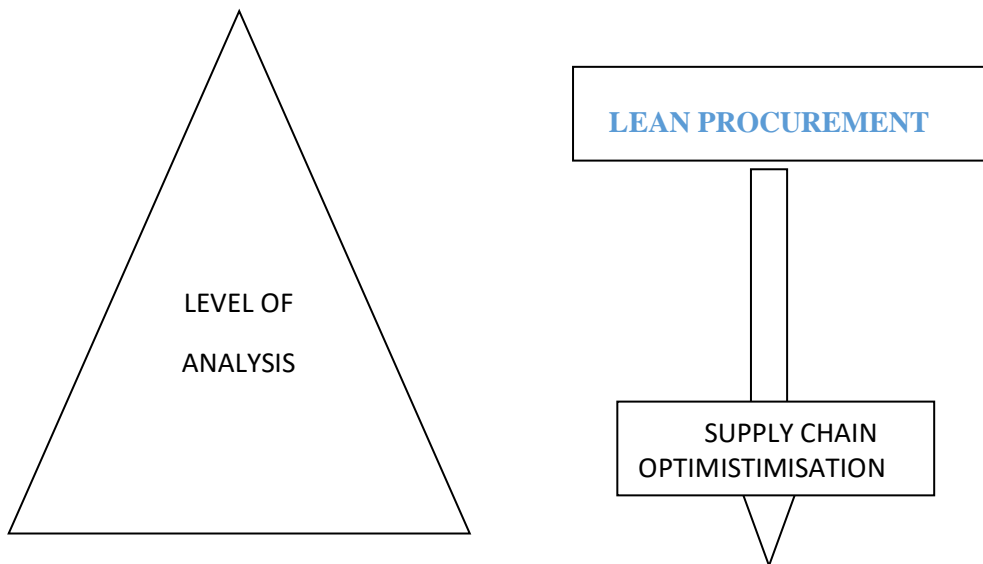
context of the oil and gas industry and across different geographical regions. Additionally, there is a need to develop more comprehensive and industry-specific assessment tools to capture the nuances of lean procurement implementation and its impact on supply chain performance. By addressing these research gaps,

future studies can contribute to a deeper understanding of the challenges, enablers, and best practices associated with lean procurement and contract management, ultimately supporting organizations in their pursuit of operational excellence and competitive advantage.

2.5 Literature Triangulation



LEVEL OF ANALYSIS



CHAPTER 3
Research Methodology

3.1. General Description:

Different groups have different ideas on what lean procurement is. Accordingly, every company that adopts lean does it in its own special manner, shaped by the myriad of circumstances and challenges that are unique to that company. Prioritising quality, delivery, and cost during the whole lean adoption process is essential. Making judgements and building trustworthy connections with suppliers are also part of the process.

A high level of cooperation throughout all supply chain partners is required to accomplish lean procurement. Numerous beneficial effects are achieved for the firm when lean is used across the whole project. For the simple reason that it promotes an environment where workers are more invested in finding solutions to problems and generally happier in their jobs. This, in turn, causes a shift in the structure of management culture, which in turn causes a so-

ciety to evolve from one that is rigid and authoritarian to one that can adapt and form groups.

Due to the need for administrative responsibility and consideration, the deployment of lean approaches within the business is not always a smooth path and may on occasion fail. The study's stated goal of demonstrating improved performance seems to be directly related to the adoption of lean procurement practices.

This chapter explains the methodologies that were utilised to get the conclusion drawn from the study's research question. Aside from detailing the study's methodology and the components examined, it gives a thorough account of the population and sample, as well as their portrayal and determination. Research tools, the technique for data collection, and the strategy to data analysis have all been defined. This oil and gas industry's sustainable lean procurement contract management is outlined in the following table:



Research Methodology

3.2. Method Selected:

Quantitative research is one approach to testing objective hypotheses; it entails examining the relationship between several variables. As a result, these variables may be estimated, often with the use of instruments, to make it easier to utilise statistical approaches to deconstruct numerical data. More recently, a report was prepared using a template. A presentation, literature review, hypothesis testing, technique, results, and discussion make up this structure.

Participants in this study on request share the same concerns as qualitative researchers regarding the following: the ability to test hypotheses logically, the ability to control for potential bias, the ability to generalise and replicate the results, and the ability to control for elective or counterfactual clarifications.

This investigation made use of a descriptive research strategy. In a highly structured interview with a human interviewer present, this estimation approach is used to gather information (Council Schindler, 2008). The researcher may get a bird's-eye perspective of the subject at hand by visiting the target population and asking a representative from that group to elaborate on specifics. When the researcher is in a position to take part in such an approach, it is appropriate.

Thus, the overview approach served to describe the oil and gas projects' use of lean procurement and contract processes, their advantages, and the basic limits of implementing these techniques. Consequently, it is often believed to be used in studies of people in their native settings (Saunders and Thornhill, 2003). The study's overarching goal was to ascertain how oil and gas projects are affected by supply chain performance and lean procurement. A case study is an analytical tool that may be used to describe, explore, or logically examine an individual, group, or event. According to Cooper and Schindler (2003), case studies allow for the efficient collection of a large amount of data that would otherwise be difficult or impossible to get via other research approaches. When compared to what can be found via more traditional means of research, the material gathered is usually both more

broad and of considerably deeper value. Due to the in-depth knowledge of the organisation being required to achieve the study's goals, a case study research approach was used. The decision to use the study design was based on this finding.

3.3 Appropriateness:

Quantitative research is a method used in the scientific community to test unbiased theories by examining the relationships between different variables. Consequently, these variables may be regularly estimated using instruments, paving the way for statistical methods to examine numerical data. More recently, a report was prepared using a template. A presentation, literature review, hypothesis testing, technique, results, and discussion make up this structure. Participants in this study on request share the same concerns as qualitative researchers regarding the following: the ability to generalise and reproduce the results; the testing of hypotheses in a logical manner; the inclusion of insurances against tendency; and the control for elective or counterfactual explanations.

Essential to the lean mindset is the belief in a functional society that gets more done with less, eliminates waste, and constantly seeks improvement. No matter whether a firm is in the manufacturing or knowledge-based job sector, implementing Lean requires laying the groundwork socially, creating a conducive work atmosphere, and encouraging cross-departmental cooperation. Therefore, choosing a qualitative research approach for the thesis is obviously the right choice.

Connecting the gaps between qualitative and quantitative approaches to study is the most acceptable course of action.

Difference between quantitative and qualitative research Design

3.4 Research Design:

Research design is crucial because it provides a structure and an element for addressing the research topics. The exploratory research method's foundational idea—research questions—formed the thesis. For example, the study's research questions were crafted to delve into areas where potential wastes may be

concealed and how the Lean mindset could be used to sustainable lean buying. The goal of developing a research design is to provide the study a focused framework that will improve

upon the scattered and potentially problematic information. You can see the thesis's research strategy laid out in the graphic flowchart.

Quantitative	Qualitative
Numbers	Words
Point of view of researcher	Point of view of participants
Researcher distinct	Researcher closed
Theory testing	Theory emergent
Static	Processes
Structure	Unstructured
Generalizing	Context understanding
Hard reliable data	Rich in depth
Macro	Micro
Behaviour	Meaning
Artificial setting	Natural setting

In the flow diagram, the semi-structured interviews that were carried out as part of an oil and gas industry Lean procurement initiative are called a case study. The purpose of this thesis is to investigate the potential applications of Lean principles to procurement in the oil and gas industry, specifically looking at how the Lean methodology varies from manufacturing in this context. The literature will be considered, and interviews will be conducted, as part of this inquiry. Interviews will allow it to identify possible information flow inefficiencies. This will make up a portion of the subject of the research.

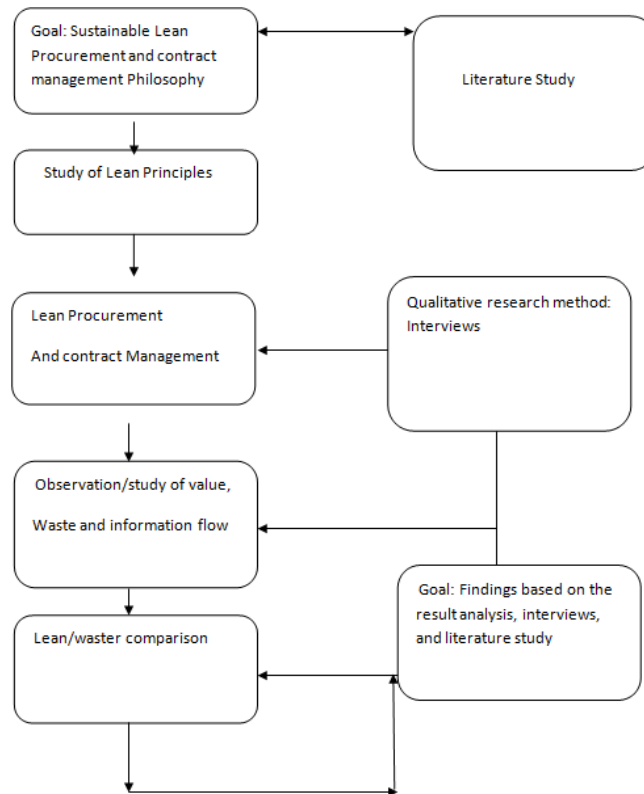
**Research design diagram Process Flow:
3.5. Validity and Reliability**

The reliability and validity of a research are dependent on the exactness and precision of the data correlation with the end. Blumberg et

al. (2005) state that a common definition of validity is the degree to which a measuring device measures the variables that it claims to be able to measure. Robson (2011) states that a survey to ascertain the degree to which a research instrument measures its target constructs is what constitutes validity of the instrument. That is the accuracy level of the findings. It checks whether the findings meet all the criteria of the scientific study process and covers the whole exploratory idea. Zohrabi (2013) argues that reliability, usefulness, and consistency are crucial components of validity that qualitative research relies on. The validity of a study is defined as the extent to which it complies with the standards of the scientific research method in seeking and reporting its findings. According to [Oliver, 2010], it is an essential need for many different kinds of educational possibilities.

The working society and the authoritative structure differ from one organisation to another, and the lean style of thinking is highly dependent on it. Making broad assumptions based on a single link is challenging since the example studied in one relationship could not

be identical to the example studied in another association. The flexibility of the Lean technique to adjust to different situations is one of its strongest points. The thesis might show a lot of similarities to other Lean evaluations, but it could also show a lot of distinctions.



3.6 Sampling Method:

➤ **Sample and Sampling Technique:**

A twenty percent representative sample of the population was selected using a stratified random sampling technique for this study. A sample size of 20% is enough to provide a representative sample of the population under study, according to Cooper and Schindler (2003). First, the complete population is divided into many subgroups or layers. Then, the last step is for the researcher to randomly choose the participants from each level. Stratified sampling, a kind of probability sampling, is shown below. Another thing to think about is that the researcher actively sought for pioneers inside the groups within the divisions. Senior executives from many oil and gas firms made up the study sample.

Deemed accordingly Choosing a representative sample from middle- and Indian-based oil and gas project companies

The Middle East is home to several prominent figures in the oil and gas industry, including oil and gas suppliers, EPC project managers, and public oil organisations. Both short-term and long-term goals should be considered while working on a project. In order to make progress on projects, oil and gas companies focus on both short-term and long-term objectives. Several studies have shown that meeting short-term goals in terms of time, money, and quality constitutes a successful project (e.g., Baccarini, 1999).

However, there are many who think that the project's success is defined by the sum of the end-clients' expectations, which are related

to the reliability of the final product and the response time (e.g., the lengthy goals) (e.g., Wateridge, 1995).

By adhering to the previously stated criteria, a project is considered a success from the moment the owner transfers control to the end customer, all the way through the execution phase. But the last term, which talks about "product achievement," encompasses the

whole project life cycle, from the proposal to the activity. Importantly, the "operator" here refers to the owner, and it's the end-client in the oil and gas industry—the major topic of this article—who is liable for the office's operation and maintenance (O&M). Both the oil and gas offices and the bulk of the investments in them are owned by the Abu Dhabi government.

Sample table:

S. No	Interview of Executives (Departments)	Target Populations	Sample size 20%
1	SCM- managers	35	7
2	Procurement Engineers	37	7
3	Procurement HOD	31	6
4	Procurement Buyers	27	5
5	Engineering Department –lead	30	6
6	Logistics Executives	25	5
	Total	185	37

3.7 Data Collection:

Establishing a standard for data recording is the first step in gathering information; defining the research's scope and limitations through enrollment and sampling; gathering data from interviews, visual materials, archives, and unstructured or semi-structured observations; and finally, establishing a standard for data recording. Here are the four main kinds of data collection methods used in qualitative research, along with the pros and cons of each:

Researchers engage in qualitative observation when they take field notes on people's actions and behaviours at the study site. At this very second, the researcher is keeping tabs on everything.

In a similar vein, qualitative viewers may engage in activities ranging from being an observer to fully participating. In most cases, researchers will ask participants broad, open-ended questions to elicit honest responses. This kind of observation is known as an open-ended observation.

The researcher may do qualitative interviews in a number of ways, including face-to-face meetings, phone interviews, or centre gatherings with six to eight respondents each meeting. The goal of these interviews is to get the participants to share their thoughts and

opinions via a series of short, usually unstructured questions. While carrying out the research method, the agent may capture qualitative data. We took into consideration the importance of minimising the risk of making an estimate mistake while we were developing the questionnaire. The six main factors that contribute to the overall estimate error are as follows, according to Biemer and Lyberg (2003): the interviewer, the respondent, the data collection method, the questionnaire, the interview setting, and the coding system. Consequently, we stand out since we can formulate our own questions and gather data directly as interviewers. We started by working with word-for-word responses instead of closed-ended questions. Additionally, we aimed to achieve the following two goals with the design of our questionnaire: The interview questions should all relate to the overarching research issue our thesis is trying to answer, and they should convey the request's meaning in a way that is consistent with our study's objectives.

Public records include things like newspapers, meeting minutes, and government reports; private archives contain things like personal journals, letters, and messages. Another way to classify qualitative data is by the types of media and digital sources from

which it originates, including social media content. Photos, crafts, recordings, key website pages, texts, IMs, social media messages, or any other kind of audio might all serve to convey this information. to creatively collect data that falls under the umbrella of visual ethnography (Pink, 2001) and may include first-hand experiences, graphic representations, and digital records (Clandinin, 2007).

Hierarchical and focused on constant improvement, lean is a way of life. It entails modifying the organisation via basic visual communication and adjusting innovation to suit the demands of people and processes. In order to collect the data, a semi-structured interviewing strategy is used.

3.7 Data Analysis:

➤ Data Analysis:

Statistical programming (Statistical Package for the Social Sciences, version 20) was used to translate, code, and incorporate the data obtained throughout the study into the statistical analysis. Mathematical coding of numerical data, including apparent and ordinal data, was a crucial part of this. A qualitative analysis was conducted on the primary purpose since it was the responsibility of the researcher to determine the perspectives of the respondents. The next stage was to identify the independent factors that were linked to the

dependent variable, which was the completion of oil and gas project procurement objectives. The data was partitioned using a multitude of linear regression statistical approaches to do this.

Descriptive statistics, such as percentages, frequency tables, and frequency dispersions, were used to summarise and compare the variables of the controlled surveys. $Y = \beta_0 + \beta_1 X_1 + \epsilon$ was the particular regression model used in this research.

When the value of β_0 remains constant, it signifies that the supply chain's performance is Y. The regression coefficient β_1 is considered significant according to the lean procurement technique.

The third objective of the research was examined and assessed using the use of descriptive statistics, such as the mean and standard deviation.

3.8 Summary:

This section will discuss the research's intended translations, as well as the data analysis and its outcomes. The objectives of this study were to find out how oil and gas projects use sustainable lean procurement and contract management, to look at how various oil and gas supply chains relate to lean procurement and supply chain performance, and to list all the problems with these methods.

CHAPTER 4
Data Presentation

4.1 Purpose of Research:

➤ **Introduction**

The chapter delves into data analysis, study findings, and the desired insights. There were three main objectives of the study:

1. Find out what Middle Eastern oil and gas companies and their suppliers use for lean procurement.
2. Find out how the oil and gas industry's supply chain performs in relation to lean procurement.
3. Find out what obstacles oil and gas companies encounter when trying to implement lean procurement.

Thus, the purpose of this research is to identify the lean procurement processes in the oil and gas business by collecting responses to the given questions.

about sustainable lean procurement and contract management approaches, I have a query about their use in the oil and gas business.

1. How can the effectiveness of the oil and gas supply chain be influenced by effective procurement practices?
2. Is there anything unique about lean procurement that would make it problematic to implement in the gas and oil sector?

4.2 Research Method:

➤ **Quantitative:**

One way to learn about and understand the weight that people give to a social or human issue is via qualitative research. Research entails the following steps: the formulation of research questions and methods, data collection (usually within the member's immediate environment), inductive analysis (which moves from specific to general issues), and the researcher's interpretation of the results.

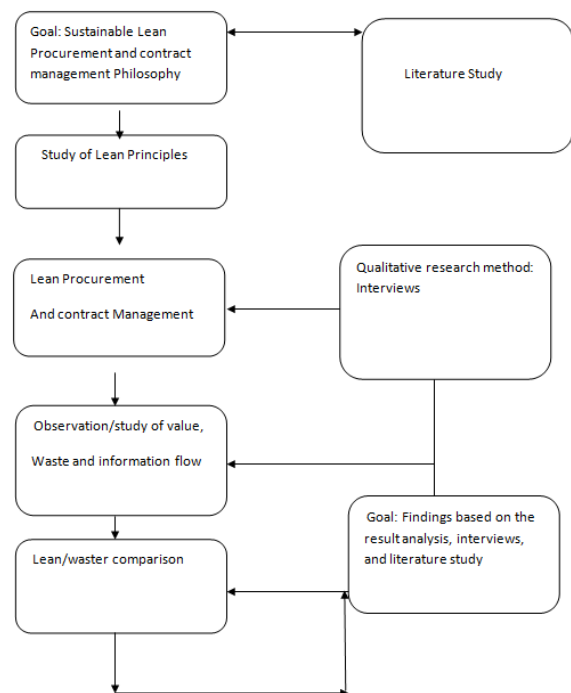
A versatile structure was used in the most recent study. All parties involved in this request share a perspective that values inductive reasoning, personal interpretation, and the importance of being transparent about a condition's complexities.

Questionnaires were used to collect the primary data. The study quantitative data was analysed using the Statistical Package for the Social Sciences (SPSS) version 20 for both descriptive and inferential statistical purposes.

Descriptive statistics include information such as means, standard deviations, frequencies, and percentages. Charts, outlines, and tables were then used to present the information. Integrating the outcomes of processing qualitative data into the composition structure was achieved via the use of content analysis. Additionally, regression analysis was used to determine the association between supply chain performance and lean procurement.

The target demographic for this research consisted of the many oil and organisations that hold executive positions in oil and gas businesses based in the Middle East. Stratified random sampling was used to choose a 20% representative sample of the population for this investigation. The research drew from a variety of official and unofficial resources. Sources for secondary data included financial summaries and yearly reports from oil and gas magazines. Questionnaires were used to collect the primary data.

Research design diagram Process Flow:



4.3 Data Collection & Distillation:

The study sample included 37 Chiefs from oil and gas companies in India and the Middle East. These Chiefs worked for various vendors, including the Procurement department and the Supply chain office. Only 35 of the 37 pioneers who were part of the group actually completed and sent in the questionnaires. This pertains to a response rate that is addressed at 94.59%.

This is in line with the argument put up by Mugenda and Mugenda (2003), who state that a response rate of 60% is excellent, 70% or more is exceptional, and 50% is sufficient for

analysis and disclosure. We may infer information on the relationship between lean procurement and supply chain performance from the replies because of the high response rate in this research. In addition to basic demographic information, this survey also sought out respondents' orientation and length of service in the industry.

In addition, 40% of the participants said they had worked for oil and gas companies for over fifteen years, 31% for six to nine years, 20% for less than two, and 8% for more than ten.

Sample Table

S. No	Interview of Executives (Departments)	Target Populations	Sample size 20%
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2	Procurement Engineers	37	7
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4	Procurement Buyers	27	5
5	Engineering Department –lead	30	6
6	Logistics Executives	25	5
	Total	185	37

4.3.1 Sustainable Lean Procurement and contract Practices used by oil and gas:

The primary goal of this research was to gather information on the various lean procurement programmes in the oil and gas industry.

A number of lean procurement strategies were listed, and respondents were asked to

rate how much their organisation employed each one from one to five. A score of one indicated absolutely no extent, a score of two indicated a moderate amount, a score of four indicated a significant amount, and a score of five indicated an extremely huge extent. The results are shown in the table below:

Description of variables	Mean	Std. Deviation
Employee engagement in lean process	4.314	0.852
Buyer Supplier-firm relationship contract management	4.142	0.915
Pull system methodology	4.157	1.210
Total Quality management	4.328	0.952
Continuous improvement	4.300	0.819
Use of e-procurement	4.342	1.491
Value stream mapping	3.542	0.957
Practice of lean thinking	4.015	0.934
Use of Kanban system to control movement of m materials	3.45	0.743
Employees free to bring lean procurement cultural change	3.215	0.791
No inspection of procured products	2.81	1.417
Compensation for employees practicing lean	2.61	1.407
Firm practices JIT	2.64	0.688

➤ **Results Analysis:**

Overall, the respondents showed that their connection was a sustainable lean procurement process that included the growth and devotion of representatives, with a mean score of 4.314 and a standard deviation of 0.852. The findings here corroborate the claim put forward by Hines et al. (2008), who suggest that workers' connection and strengthening is a crucial prerequisite for progress.

The association's use of supplier-firm relationship contracts as a sustainable lean procurement technique across the organisation was also proven by the respondents, who averaged 4.142 and had a standard deviation of 0.915. An important part of lean procurement is the perceivability technique. Everyone involved, from customers to suppliers, should be able to "see" what the other is doing.

Also suggesting that the respondents' association was using the pull method as a lean procurement strategy was a standard deviation of 1.210 and a mean score of 4.157. It was the case for the vast majority of survey takers. The results of this research support the arguments put up by Bonavia and Marin (2006), who said that just-in-time (JIT) procurement enables the timely and cost-effective provision of exactly the correct quantity of high-quality components. To get this done, everyone on staff has to pitch in and work together.

Additionally, with an average score of 4.328 and a standard deviation of 0.952, most cases demonstrated that the respondents' association associated comprehensive quality management as a lean procurement approach.

The majority of respondents demonstrated that their association was actively using continuous improvement as a lean procurement technique, with a mean score of 4.300 and a standard deviation of 0.819. Consistent with the definition of continuous improvement offered by Mertins and Jochem (2001), this research confirms the need of always striving for excellence in design skills, cost delivery, and quality. Kaizen, an essential component of CI, must be evident as a company-wide culture of 33-supported improvement that aims to eliminate waste and routinely incorporates all workers to

advance activities without racking up astronomical price tags. The majority of respondents also said that e-procurement was a lean procurement technique in their connection, with an average score of 4.342 and a standard deviation of 1.491.

Keeping an eye on the MRP number and communicating with suppliers via email, fax, and phone are traditional techniques of procurement. These traditional approaches are too sluggish and wasteful to handle the demand-driven initiatives that are prevalent in today's society, argue Shah and Ward (2003). Finally, the participants demonstrated that value stream mapping was mostly used as a lean procurement approach by their organisation, with an average score of 3.542 and a standard deviation of 0.957.

With a mean score of 3.45 and a standard deviation of 0.743, the findings demonstrated that the respondents' organisation was using the Kanban method to regulate product development as a lean procurement strategy.

Moreover, respondents demonstrated that their association was utilising Remuneration for representatives rehearsing lean as a lean procurement strategy to a lower level, with a mean score of 2.61 and a standard deviation of 1.407. It seems that personnel need something more noticeable to inspire them.

It is evident that numerous oil and gas companies were implementing sustainable lean procurement practices such as e-procurement, TQM, continuous improvement, worker association and strengthening, supplier-firm relationships, a pull system, and 5S (sort, fix, sparkle, standardise, and support).

4.3.2 The Link Between Supply Chain Performance and Lean Procurement

The study also aimed to find out if sustainable procurement practices in the oil and gas industry are associated with better supply chain performance via the use of lean procurement. The survey asked participants to rate how much they agreed with several claims about sustainable lean procurement and supply chain performance on a scale from 1 to 5.

➤ **What follows are the results:**

Lean Procurement's Impact on Supply Chain Efficiency

Description of variables	Mean	Std. Deviation
Lean procurement deliveries are flexible and lean to meet changing demand in a demand driven supply chain	4.371	1.113
Lean helps to minimize new product development time and expense	4.371	1.190
Lean Procurement reduces lead time	4.314	1.345
More adaptability and lower initial cost to recover are outcomes of Lean's advocacy of less capital-intensive machinery, tools, and fixtures.	4.257	1.120
Lean procurement drastically reduces the cost of production disruptions	4.200	.994
Minimising waste is the goal of Lean Procurement.	4.114	1.182
A supply chain may become more responsive, efficient, and speedy with the help of lean procurement techniques.	4.114	1.254

➤ **Results Analysis:**

The findings demonstrated that the participants acknowledged the adaptability of lean procurement conveyances and its use to meet evolving demands in an interest-driven supply chain. There was a 1.113 standard deviation and a mean score of 4.371. In this case, the results back up the assertion made by Bonavia and Marin (2006) that interest-driven supply chains may efficiently and adaptably use lean procurement conveyances. Furthermore, with a mean score of 4.371 and a standard deviation of 1.190, the respondents were in agreement that lean aids in reducing the time and money needed for the development of new goods. This study's findings corroborate those of Esben, Gjerdrum, and Mahad (2011), who argued that lean methodology aids in cutting down on resources needed to develop new goods. This makes it easy to include the most current specifications into the product and speeds up the process of getting the product to customers.

Lean procurement shortens the time required for lead time analysis, according to the respondents (mean score 4.314, standard deviation 1.345). A product's lead time is the time it takes from a client placing an order to receiving payment for that order. Businesses are facing increasing difficulties with market unpredictability, long lead times, and gauging errors, according to Axelsson, Rozemeijer, and Wynstra (2005). Lean aims to reduce this time by focusing on the flow of information and materials throughout the supply chain.

Lean advocates for the use of less capital-intensive equipment, gadgets, and apparatuses,

according to the respondents (mean score: 4.257, standard deviation: 1.12). A lower initial cost to recuperate and greater flexibility are the outcomes of this. According to earlier studies done by Esben, Gjerdrum, and Mahad (2011), lean methodology also encourages the use of less capital-intensive equipment, devices, and installations. A lower initial cost to recuperate and greater flexibility are the outcomes of this. Respondents agreed (mean score: 4.200, standard deviation: 0.994) that lean procurement lowers the cost of production disruption. In addition to the obvious cost of interrupting production, Bonavia and Marin (2006) state that long lead times might damage relationships with current customers and even discredit the company altogether. Also, with an average score of 4.114 and a standard deviation of 1.182, the respondents were in agreement that lean procurement decreases waste. Conclusion: respondents agreed (mean=4.114, standard deviation=1.254) that lean procurement methods allow a supply chain to be more efficient, faster, and more responsive. According to the numbers, lean procurement conveyances are flexible, and lean is used to meet the ever-changing demands of an interest-driven supply chain. Additionally, lean aids in cutting down on the time and money needed to create new goods, speeds up the completion of leads, and promotes the use of capital-efficient machinery, instruments, and apparatuses. Because of this, there is more leeway and reduced early expenditures to recover. In addition to making a supply chain more efficient, quicker, and more responsive,

lean procurement lowers the cost of interrupting production and decreases waste. You may get these advantages by using lean procurement practices.

These findings demonstrate in no uncertain terms the adaptability of lean procurement conveyances and their use to meet evolving demands in an interest-driven supply chain. Additionally, lean aids in cutting down on the time and money needed to create new goods, speeds up the completion of leads, and promotes the use of capital-efficient machinery, instruments, and apparatuses. Because of this, there is more leeway and reduced early expenditures to recover. In addition to making a supply chain more efficient, quicker, and more responsive, lean procurement lowers the cost of interrupting production and decreases waste. You may

get these advantages by using lean procurement practices.

4.3.3 Benefits of Implementing Lean Procurement Methodologies:

The benefits of lean procurement practices, which are being considered by oil and gas companies, were listed and ranked in this table. A total of 39 components, or explanatory factors, were recognised as possible benefits that may result from implementing lean procurement strategies in order to address the second research question. Everyone who filled out the survey gave careful consideration to each of the questions and rated their level of agreement with each one using a Likert scale from five (very high) to one (very low).

Description of variables	Mean Std.	Deviation
Flexible and responsive supply chain	4.2	0.553
Smooth information flow	4.09	0.473
Efficient and faster supply chain	3.98	0.59
Customers loyal to firm products	3.95	0.48
Prompt payment for procured items	3.93	0.545
Coordination of continuous improvement	3.91	0.64
Limited waiting hours for procured materials	3.91	0.64
On time response to demand	3.89	0.493
Demand driven supply chain	3.89	0.895
Strong supply chain	3.89	0.65
Procurement of defect free materials	3.82	0.815
Increase in productivity	3.86	0.51
Customers happy with firm products	3.86	0.594
Procurement of only required materials	3.86	0.852
Lean produces strategic advantage to the firm	3.86	0.824
Customer signals important in product development	3.8	0.701
Firm meets all customer demands	3.77	0.605
Prompt demand signal reception by suppliers	3.7	1.025
Employee understanding of processes	3.7	1.002
Pulling of products in real time orders	3.61	0.618
Continuous product flow in the supply chain	3.59	0.497
Horizontal thinking by firm	3.57	0.501
Flexible and fast delivery of procured items	3.36	0.718
Use of 5s to reduce waste	3.27	0.694
Uninterrupted product movement to customers	3.23	0.424
Reduction of inventory carrying and admin, costs	3.2	1.047
Use of less capital-intensive machinery	2.89	0.868
Less procurement logistics	2.82	1.263
Maintaining of order to make	2.73	0.758

Description of variables	Mean Std.	Deviation
Direct procurement into production department	2.66	0.888
Practice of postponement and customization	2.61	0.784
Direct transportation to designated places	2.59	0.972
Use of visual signal for material movement	2.59	0.726
No storage space for raw materials	2.57	0.759
No safety stock maintained	2.36	1.014
No keeping of inventory	2.32	1.006
No mass production	1.86	0.462
Less time spent on new product development	1.8	0.553
Focus on system efficiency	3.39	0.493

➤ **Results Analysis:**

From the result showed in above Table under, a phenomenal degree (mean > 3.5, ~ 4 with basic standard deviation), there are 22 benefits to the execution of lean acquisition philosophies going from versatile and responsive store network, smooth data stream, compelling and speedier production network, clients devoted to firm items, brief portion for gained things, coordination of steady improvement, restricted hanging tight hours for acquired materials, on time reaction to ask for, demand driven inventory network, strong inventory network, extension in efficiency, clients happy with affiliation's items, obtainment of just required materials, lean produces advantage to the firm, acquirement of deformation free materials, client signals critical in item advancement, firm satisfies all of affiliation's necessities, brief interest signal get-together by providers, laborer perception of cycles, pulling of items logically orchestrates, constant item stream in the production network and level thinking by firm.

The benefits of the use lean obtainment philosophies from the examination were requested into six sections: removal of waste in all acquirement cycles, reduce lead time, diminish stock, decline cost, further created purchaser faithfulness, and further created demand the executives.

The foremost inspiration driving lean is to discard the loss in every movement of work processes in the undertakings, to grow client esteem while restricting waste. This can rapidly be portrayed as making more incentive for clients with less resources.

The saying "lean" suggests an orderly philosophy of perceiving and taking out all waste (non-esteem added exercises) through unending improvement by streaming the item at the draw of the client in journey for perfection. Decreased lead time emphasis is on the responsiveness to client's solicitation. Diminished lead time for the data sources going into the item made packs the presentation cycle achieving common client care and simultaneously decreased generally stock levels.

Client demands for a serious degree of assembling responsiveness and lessened lead-times. Diminished stock as a benefit of lean obtainment system recommends that numerous associations today produce clearly into trailers and stay aware of no other finished items stock.

Each quality appraisal and checks are performed inside the interaction, as opposed to after creation are done. Lean practices moreover help with restricting new item improvement time and cost as such decreasing expense. Customer tendencies and assortment experience in this present circumstance.

Expenses ought to be restricted, yet not to the inconvenience of what more refined buyers by and according to popular demand. Further created purchaser dedication as one of the benefits of lean acquisition procedures includes that lean advances restricting new item improvement time and cost.

This passes the item on to publicize speedier, simplifying it to integrate current necessities into the item to meet purchaser reliability and further created demand the board endeavors to have items traversed the channel using client interest from point of proposition frameworks continuously. This restricts the need to

guess interest, given the genuine and certified interest for the item These results are in accordance with the discoveries of Liker (2004), Lean Endeavor Association (2009, Philips and Nystuen (2002), Meier (2001) Karlsson and Ahlstrom (1996) and Worthington (1998) which show that the incline method for managing supervising exercises is laid out on doing

the clear things capability, on consistently improving and (in particular) on squeezing out squander continually. Lean obtainment philosophy is transforming into a strategy technique for securing high ground and regardless, for perseverance since adding esteem and killing waste is right now not an opportunities for associations.

4.3.4 Obstacles to Long-Term Lean Procurement Success: The study also sought to understand the challenges faced in lean procurement

Description of Variables	Mean Std.	Deviation
Insufficient funding	1.493 - 3.057	N/A
Inadequate research results in stock issues	N/A	2.685
The number 278	N/A	278
Missing knowledge and experience	1.625% - 2.577	N/A
Unaffected by alteration	1.310 - 2.600	N/A
Negligible preparation	1 399% - 2.571	N/A
Lack of support from stakeholders	1.008 - 2.428	N/A
Customer demand shift of 2,400	N/A	1.116
Doubts around supply chain waste definition	~2.085 - ~1.172	N/A

➤ **Result Analysis**

With a normal of 3.057 and a standard deviation of 1.493, the information uncovered that the oil and gas industry was defying the issue of fairly insufficient resources. The survey takers gave proof of this.

Further, with a mean score of 2.857 and a standard deviation of 1.115, the respondents likewise showed that the oil and gas industry was adapting to a moderate level of correspondence issues.

Respondents likewise showed that the oil and gas industry was attempting to tackle the issue of deficient exploration, which causes under-stacking or overloading to a little degree, with a mean score of 2.685 and a standard deviation of 1.278.

With a mean score of 2.657 and a standard deviation of 1.625, the respondents likewise showed that the oil and gas business was encountering an exceptionally minor trouble with a deficiency of capacities and skill.

Besides, the 38 study takers showed that their organization was experiencing impressive resistance to change, with a mean score of 2.600 and a standard deviation of 1.310.

Their affiliation was managing a somewhat minor level of loss of presence of mind, as

indicated by the respondents (mean of 2.571, standard deviation of 1.399). The main difficulties that emerge while endeavouring to carry out lean, as indicated by Achanga et al. (2006), incorporate providers not giving help, low degrees of provider intricacy, land distance, absence of framework thinking, protection from change, absence of foreknowledge, inadequate resources, absence of capacities and inclination, and indistinct inventory network squander.

Providers, transportation gatherings, architects, and upper administration were undeniably seen to offer insufficient help to the respondents' organizations, as shown by the mean score of 2.428 and standard deviation of 1.008. Achanga et al. (2006) tracked down that providers, transportation associations, designers, and upper administration are not generally important for lean obtainment projects to be successful. Moreover, these rollouts might find success in any event, when correspondence is missing and item quality is low.

Further, the answers showed that their organization was managing the Development of clients solicitation to a minuscule degree, with a standard deviation of 1.116 and a mean of 2.400.

At long last, with a mean of 2.085 and a standard deviation of 1.172, the respondents showed that their association was adapting to a deficient degree of lucidity about the waste brought about by the store network.

The outcomes show that the oil and gas industry confronted a few deterrents in finishing their ventures. Issues emerged because of deficient assets, unfortunate coordination, insufficient review that caused either under-or over-

loading, an absence of capability and skill, protection from change, and an inability to prepare. Moreover, the information show that oil and gas organizations were managing 39 providers, transportation associations, designers, and upper administration who were not assisting; clients' requests were changing; and there was just a low degree of clearness in regards to the waste that was occurring all through the production network.

4.3.5 Supply Chain Performance

Furthermore, the study's overarching objective was to learn how well oil and gas companies' supply chains used sustainable procurement practices.

Description	Mean Std.	Deviation
customer satisfaction	4.142	1.191
cost and flexibility	4.257	1.093
lead time	4.314	1.157
waste reduction	4.228	1.262
product development time and expense	4.257	1.220

The respondents accepted the waste decrease drives were powerful, as shown by a mean score of 4.228 and a standard deviation of 1.262 for their organization.

At long last, with a mean score of 4.142 and a standard deviation of 1.191, the respondents were satisfied with the level of consumer loyalty they got from their association.

Results showed that coming up next were thought of as agreeable: cost-viability and flexibility, speed and cost of item creation, decrease of waste, and client satisfaction.

4.3.6 Regression Analysis

Prescient Displaying Exploration additionally utilized multivariate relapse investigation to find out the idea of the connection between inventory network execution and lean acquirement, two ward factors.

The particular relapse model utilized in this study was $Y = \beta_0 + \beta_1 X_1 + \epsilon$. X_1 represents lean acquirement, Y for inventory network execution, β_0 for steady, β_1 for relapse coefficient, and ϵ for blunder term.

Model Summary:

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.823 a	.678	.668	.65698

a. Predictors: (Constant), Lean Procurement

The R2 result demonstrated that the independent variables, which included lean procurement among them, could account for 66.8 percent of the supply chain performance. Since other factors were not included in this analysis, it follows that other factors do impact the supply chain performance of Oil and gas Industry Limited.

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4.3.7 ANOVA

Table: ANOVA

S. No	Model	Sum of Squares	df	Mean Square	f	Sig
1	Regression	29.980	1	29.980	69.459	.000b
2	Residual	14.244	33	432		
	Total	44.224	34			

Subordinate Variable: Store network execution

b. Predictors: (Constant), Lean Procurement

4.3.8 Coefficients

Model		Unstandardized		Standardized T	Sig.
		Coefficients			
		B	Std. Error	Beta	
1	(Constant)	2.228	.784	-2.842	.008
	Lean Procurement	1.539	.185	.823	.000

Subordinate Variable: Store network execution

The condition for Y is $2.228 + 1.539 * 1 + 0.65698$.

Taking a gander at the relapse condition, we can see that if the free factor (lean obtainment) remains something similar, the oil and gas industry's production network execution will be 2.228 units. Coefficient 1.539 (p-value = 0.000) shows that Oil and gas Industry Limited's supply chain performance is positively and significantly correlated with lean procurement. It seems from the given data that this link does in fact exist. Oil and Gulf Industry Limited's supply chain performance would be enhanced by 1.539% with only one unit more lean procurement, according to this analysis.

The study sample included 37 Chiefs from oil and gas companies in India and the Middle East. These Chiefs worked for various vendors, including the Procurement department and the

Supply chain office. Only 35 of the 37 pioneers who were part of the group actually completed and sent in the questionnaires. This pertains to a response rate that is addressed at 94.59%.

This is in line with the argument put up by Mugenda and Mugenda (2003), who state that a response rate of 60% is excellent, 70% or more is exceptional, and 50% is sufficient for analysis and disclosure. We may infer information on the relationship between lean procurement and supply chain performance from the replies because of the high response rate in this research. In addition to basic demographic information, this survey also sought out respondents' orientation and length of service in the industry. In addition, 40% of the participants said they had worked for oil and gas companies for over fifteen years, 31% for six to nine years, 20% for less than two, and 8% for more than ten.

CHAPTER 5

Summary, Conclusions And Recommendations

5.1 Introduction

In this chapter, we will review the key findings, draw some conclusions, provide a recommendation, go over the difficulties we encountered, and offer some recommendations for future research. In reaching their results and offering their suggestions, the researchers primarily focused on resolving the initial study questions. Seeing if supported lean acquisition further develops production network execution was the main impetus for this review.

5.2 Summary of the Findings

The consequences of this study showed that delegates' feedback and backing were valuable to the oil and gas industry in general. To push the reason ahead, it is important to incorporate agents and to support their perspectives. Besides, the review showed that the organization utilized a provider firm connection and a draw system.

The Right at-Time (JIT) way to deal with buying ensures that the specific measure of superior grade, definitively put, moderately evaluated parts is provided. There was likewise definitive proof from the review that Oil and Gas Industry Restricted utilized CQM and CPI.

In Oil and gas Industry Restricted, kaizen — a piece of ceaseless improvement — should be noticeable as a culture of upheld improvement focusing on garbage removal. Everybody in this culture ought to be engaged with a typical technique to further develop work much more without burning through a lot of cash. As a lean obtainment cycle, Oil and gas Industry Restricted was found to utilize e-acquisition and the 5S strategy (sort, fix, shimmer, normalize, and support).

The consequences of this study showed that lean obtainment transports are versatile, and that lean is applied to satisfy the unique requirements of a store network driven by interests. Lean procedure helps decline the time and cash expected to make new merchandise, as per the review. This considers a quicker item send off, which thus makes it a lot less complex to integrate client criticism and new details.

Lean acquisition likewise decreases lead time, as indicated by the report. The expression "lead time" depicts the term it takes for shoppers to go from making an item request to really paying for it. Because of the way that organizations are confronting expanding challenges with market unpredictability, long lead times, and mix-up location, lean focuses on the development of information and materials all through the inventory network to accelerate the progression of items. Furthermore, the study's findings showed that lean methodology encourages the use of low-capital-investment equipment, installations, and machines. A lower initial cost to recuperate and greater flexibility are the outcomes of this. Using lean procurement decreases the cost of interrupting production, according to the study. Lean procurement also leads to less waste, according to the findings. In addition to improving supply chain efficiency, research shows that lean procurement practices also make it feasible to increase speed and responsiveness.

The study's results showed that oil and gas companies struggle with under- or over-loading due to poor communication and research, as well as with a lack of skills and knowledge, resistance to change, and, to a lesser degree, a lack of imagination. The survey also revealed that oil and gas companies were trying to fix the issue of inadequate research, which causes a small amount of under- or overstocking. The poll found that suppliers, transportation groups, engineers, and upper management all provided just a moderate amount of support to the oil and gas sector. Similarly, the study indicated that there was no demand movement for oil and gas goods from customers.

5.3 Conclusions

Lean procurement is positively and critically associated with supply chain performance, according to this study's results. Additionally, the study indicated that the oil and gas sector made use of lean procurement strategies including electronic procurement, 5S, comprehensive quality management, continuous improvement, supplier-company interaction, electronic procurement, the pull system, and electronic procurement. Furthermore, the

study presupposes that lean procurement delivery methods are adaptable, and that lean is often used to meet evolving needs in an interest-driven demand chain. Similarly, lean aids in cutting down on the time and resources needed to develop new goods, speeds up the completion of projects, and encourages the use of instruments, equipment, and installations that need less initial investment. Because of this, there is more leeway and reduced early expenditures to recover. To top it all off, lean procurement makes a supply chain more efficient, quicker, and more responsive while decreasing the cost of production disruptions and waste. These advantages are made possible by lean procurement strategies.

5.4 Recommendations

It is critical for oil and gas companies worldwide to hire professionals with the necessary knowledge of lean procurement methods so that they can make informed decisions when purchasing supplies. So, this will help them when they try to not make decisions that might make it hard for it to work.

It is imperative that businesses find strategies to enhance just-in-time procurement and other lean procurement techniques. Possible means of accomplishing this objective include increasing the number of suppliers and maintaining and improving the existing infrastructure. It is also the responsibility of the implementation bodies to come up with plans to advance electronic procurement. It is expected to achieve this objective by the steady enhancement of information, communication, and innovation.

Oil and gas firms would do well to steer clear of lean procurement strategies that aim to eliminate waste throughout the telecom industry. Such approaches are fraught with difficulties, so it's important that they examine and avoid these hurdles.

5.5 Limitations of the Study

Since the remarks obtained from oil and gas industry pioneers were limited in scope, the investigation could only draw tight conclusions. This means that the findings cannot be applied to other organisations in other sectors, such as

those involved in manufacturing or providing assistance.

Another obstacle that had to be surmounted was the arrangement of the questions. Originally intended to be a practical method of data collection, this strategy included sending out questionnaires and waiting for prompt responses. For this reason, we were unable to confirm that we had control over the respondents since we waited a day before collecting and discarding the surveys.

Nevertheless, the absence of accessible assets was still another constraint. From that point on, the study's length and the number of participants were both dictated by the limitations.

5.6 Suggestions for further research

Finding out how Oil and Gas Industry Limited's supply chain performed in relation to lean procurement was, in a nutshell, the goal of this study. It will be crucial to finish research that incorporates a range of connections from other regions outside of India and the Middle East if we want to know whether our conclusions are comparable or different from other studies.

To find out how lean procurement methods are comparable or different in another country, it will be important to compare them in two sub-locales: the created world and the generating sub-locale. Moreover, research on the connection between lean obtainment and store network execution in different Center Eastern and Indian firms must be finished.

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