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Challenges and opportunities to conduct a smart Supply Chain management in oil and Gas Industry with a sustainable strategies

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ABSTRACT

The smarter energy supply chain is a management approach for the energy supply chain that is genuinely end-to-end, fully integrated, coordinated, and data-driven. Managing the supply chain as a whole requires time and money to establish the necessary organisational framework, policies, services, and assets. Through the use of intelligent supply chain management, the finest possible lines of communication may be established with distributors and end users. Strategically configuring the relationships between oil and gas firms' various suppliers and customers requires the establishment of boundaries and parameters. Research, discussion, and analysis are conducted through personal interviews and correspondence with oil industry professionals via mail, communication, literature surveys, and journals. Two case studies are considered and discussed to aid in supply chain management for two separate oil sectors.

Important factors in supply chain management include demand management, effective distribution of petroleum products among consumers, improved transportation scheduling, warehouse management, and the quality and timeliness of information provided by supply chain automation. If a supplier continually outperforms the competition, they should be rewarded with favourable status, such as customer loyalty and special treatment.

There is no just-in-time (JIT) in oil and gas exploration and production, which is a major factor in supply-chain management. It's comparable to feeding a small city to supply an offshore platform. That's why it's crucial to always plan ahead for what will be required beyond the obvious basics and regular supply.

Keywords: Energy Supply chain, organisational Infrastructure, demand Management, Upstream, Downstream, Exploration, Strategy

Introduction:
Supply chain management (SCM) is a contraction of the phrases supply, chain, and management. The concept of supply chain management emerged in the early 1980s. Research in supply chain management encompasses the full range of activities and processes involved in the system's planning, coordination, control, operation, and optimisation.

Berry et al. state that the objectives of supply chain management are to "build trust," "exchange market demand information," "create new products," and "narrow the supplier base to a specific OEM." This frees up the administration's resources for developing more substantial, lasting connections with clients.

There exists a network of entities, starting with the suppliers' suppliers and ending with the customers' customers, who are responsible for the production and distribution of products and services (Lee and Ng, 1997).

Transportation both domestically and internationally, inventory visibility and control, materials handling, import and export facilitation, and information technology are all components of the global supply chain that the oil and gas business is a part of. Supply-chain management seeks to maximise customer service while simultaneously minimising associated costs. To better serve its customers, a company forms relationships with its upstream suppliers and its downstream distributors, forming a supply chain.

The energy industry is divided into many subsectors, each of which faces its own unique supply chain challenges. The three segments are shown in Figure -1 below.

• Upstream oil and gas, including discovery, exploitation, and production
The midstream industry, which deals with the storage, wholesale marketing, and transportation of crude oil or other petroleum products (by pipeline, rail, barge, oil tanker, or truck),

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• The downstream sector, which entails the processing and purification of raw natural gas, refinement of petroleum crude oil, and marketing and distribution of goods made from these sources. Figure depicts the various Oil Supply Chain Segments.

Transporting oil, gas, and petrochemicals requires infrastructure like pipelines, ships or tankers, and railroads. Only a handful of countries produce these items, yet they're in high demand everywhere since they power and sustain so many other sectors. It is not uncommon for this industry to have wait periods of several weeks between the shipping point and the location of the end clients. For instance, transporting oil from the Persian Gulf to the United States takes five weeks, and a further three weeks may be needed for processing and delivery (Schwartz, 2000).

Distributed client bases can benefit from the establishment of new manufacturing facilities or distribution centres located closer to these customers in order to cut down on lead times and transportation expenses. Acquisition of such facilities, however, is notoriously costly in the oil and petrochemical industries, and it often results in greater inventory and operating expenses (Hebert, 2004). To quote Red Cavaney, president of the American Petroleum Institute: "most companies are unlikely to undertake the significant investment needed to even begin the process" (Hebert, 2004). Oil and chemical firms are being forced to choose between absorbing the cost rise themselves or passing it on to consumers who are already paying higher costs.

The demand for oil around the world hit 75 million barrels per day by the end of 2004, and it is expected to grow at a rate of 2% per year over the following decade. Energy consumption in China is expected to grow at a rate of 4.5 percent per year between 2005 and 2010, when it will exceed 4 million barrels. Recent political upheaval in the Middle East, the world's largest oil-producing region, has, nevertheless, made reliable supplies of the commodity extremely precarious. Because of this, oil and petrochemical firms have been keeping larger buffer stockpiles and looking for new suppliers (Ikram, 2004).

Logistics costs are estimated to account for between 10 and 20 percent of total revenues (Hamilton, 2003), therefore corporations are always looking for ways to cut back. According to numerous studies (Whitfield, 2004; Lange, 2004; Morton, 2003; Bianchi, 2003; Collins, 1999; Coia, 1999), businesses think that rivalry is fostered not by other businesses but by the supply chain in which they play a role as both customers and vendors.

The supply chain is the system via which goods and services are produced, distributed, and consumed. To achieve profit maximisation, a company must optimise its supply chain in such a way that it generates the greatest possible profit while incurring the fewest possible expenses. Each supply chain decision an organisation makes must be weighed against its potential advantages and expenses.

An improved energy supply chain is one that is managed from beginning to end in a way that is highly integrated, coordinated, and data-driven. It takes time and money to build up the systems, procedures, services, and resources needed for effective supply chain management.

Despite the petroleum industry's critical role in our everyday lives and the complexity of its supply chain, it has been largely ignored in the literature on operations and supply chain management. In light of this, the goal of this study is to discuss sustainable approaches to supply chain management in the oil business. This paper will examine a technique that has been mostly ignored by scholars despite saving businesses millions of dollars annually.

Literature Review:

Supply chain management concept by few notable authors are given as :

In any field, the purchasing strategy should be prioritised. According to Trent (1998) and Wisner (2000), supply chain management should prioritise customer satisfaction and purchasing strategies because these factors might impact supply chain networks (Ellram, 1994). They talked about how procurement tactics and supplier choice are intertwined. The manufacturing cycle connects manufacturers to distributors, the replenishment cycle connects distributors to retailers, and the consumer order cycle connects retailers to customers. Both a push and a pull perspective can be seen in the supply chain. The client order cycle is excluded from the pull view, whereas the other three cycles—procurement, production, and replenishment—are all included in the push view.

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Both big producing regions and major consuming regions want energy markets to be stable and predictable (Gawdat Bahgat, 2006).

Management readiness is more important than dedication when it comes to implementing a sustainable supply chain strategy in the oil and gas industry, and among readiness, the management of supply chain operational risk was found to be vital to the sustainability of all supply chain functions with the exception of production management. Supply chain success is attributed in large part to careful supplier and logistical management. In addition, businesses should foster a climate that promotes it (Wan Ahmed et al., 2013).

We identify the most crucial dimensions and attributes of supply chain agility and provide in-depth insights into the characteristics of agility that are most relevant within the oil and gas industry by analysing the entire supply chain in relation to agile practises in key sectors (Yusuf et al., 2014).

Incorporating insights from institutional theory, evolutionary theory, complexity theory, and the literature on organisational learning, innovation, and strategy, this article makes four significant contributions to the study of supply chains.

As a first step, we demonstrate that developing a sustainable supply chain is not an endpoint but rather a process in which trajectory and time are critical factors. We conclude that, like organisations, supply chains are always adapting and learning as they go.

Second, the literature discusses how supply systems based on natural resources are typically more geographically limited and more vulnerable to community demands than other supply chains, despite globalisation being a trend.

Third, the literature on supply chains argues that in developing and emerging economies, where business environments are more volatile and institutional holes generate a higher degree of complexity and unpredictability, supply chains confront additional hurdles to sustainability. The supply chain's ability to adapt and improve as a result of these issues may be hampered.

Furthermore, because of the extreme complexity and uncertainty of the current business climate, focal enterprises play a more crucial role in managing growing ambiguity, promoting supply chain learning, and supporting innovation to boost supply chain sustainable performance. In a survey of the existing research, Bruno Silvestre (2015; emphasis added)
In today's internationally interconnected and fiercely competitive economy, the oil industry performs a unique role. Decision-making in the petroleum industry is difficult because of the interconnected nature of so many processes, from oil extraction through product delivery. As a result, the petroleum supply chain frequently need assistance from decision-making tools. The development of better decision-making aids is a constant focus for businesses. In light of this, this research compiles academic findings on the use of mathematical programming to solve distribution issues encountered by different parties in the downstream oil supply chain (Camilo Lima et al., 2016).

According to the data, there are two distinct kinds of sustainability objectives: strategic objectives (SGO), which are crucial to a company's long-term viability, and functional objectives (FGO), which are directly tied to the firms' operating procedures. According to the analysis, the two most important elements that could alter the goals are stakeholder pressure and economic stability.

The most significant forces that could effect SSCM in the O&G business are economic and political stability, whereas the least significant force is energy transition. Interestingly, practitioners rank regulatory considerations as the third most important external force, while academic specialists ranking them as the second least important (Wan Ahmad, 2017).

Using MICMAC analysis, we were able to isolate the driving and dependant dynamics that make CSFs so crucial to long-term success.According to research by Rakesh D. Raut et al. (2017), "Global Climatic Pressure and Ecological Scarcity of Resources" is the most important factor that can force business to embrace sustainable practises.

Concepts and foundational technologies associated with "Oil & Gas 4.0," such as Big Data and the Industrial Internet of Things (IIoT), are presented. In addition, we will examine common application scenarios in the upstream, midstream, and downstream stages of the oil and gas industry chain by looking at real-world examples including smart oil fields, smart

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pipelines, and smart refineries. The paper concludes that advanced digitalization and data collection are the core of "Oil and Gas 4.0" (Hongfang Lu et al., 2019).

A firm's internal sustainability skills mitigate the effect of its information environment on its SSCM performance. Stakeholder involvement has also been demonstrated to affect this connection. This study offers advice for businesses that want to improve the sustainability of their supply chains in light of the growing significance of environmental protection, social responsibility, and associated strategic opportunities by examining the factors that affect the evolution of SSCM (Mengfeng Gong et al., 2019).

These are the research questions for which we have to find out the solution in our research work.

a) What are the challenges in supply chain management of oil and gas industry?
b) What kind of opportunities can enhance the sustainability of the oil and gas industry?
c) How can we improve the sustainability of the oil and gas industry by reducing the challenges of supply chain management?
d) How can we improve the relationship between suppliers and customers for a sustainable supply chain?

Research Methodology:

The oil and gas business, both upstream and downstream, have difficulties and opportunities that need to be discussed. The research presented here is grounded in an examination of the Oil and Gas Sector. To complete our study, we corresponded with nearly one hundred executives in the oil and gas industry via email and conducted in-person interviews to gather information about the difficulties faced by these sectors and their ideas for overcoming them through sustainable supply chain management. We also gathered information by doing a literature review and reading relevant articles. The data was thoroughly studied, analysed, and a conclusion was drawn. There will also be a discussion of two case studies to illustrate supply chain management in two distinct oil businesses.

Challenges through Logistical problems in the Supply Chain

Well drilling and production activities in the upstream sector are affected by the following logistical challenges:

A person must stay and work in very difficult conditions due to a lack of food and other resources at the onshore data acquisition sites, which can be anywhere from 200 to 400 kilometres (km) from the nearest city, as depicted in Fig. 2, and at the offshore data acquisition sites, which can be anywhere from 100 to 350 kilometres (km) from the nearest seashore. The data collection process takes roughly 9 months of the calendar year. Managers of data acquisition must coordinate with vendors to ensure timely delivery of operational supplies at acquisition sites. Two separate groups have been dispatched to the Gojalia and Khubal areas of Agartala to collect data; these locations are more than 150–250 kilometres from the city itself and more than 500 kilometres from the Jorhat, Base office. Thus, both onshore and offshore supply chain participants experience difficulties due to the geographic separation of their respective working sites. Figure 5 depicts the ONGC acquisition lines in India.

Most land-based drill sites are located in remote areas, making it difficult to get to the necessary working materials in a timely manner (this can take anything from three days to a week, as shown in Fig. 3). Managers at the drill site must do their part to ensure that materials are delivered on time and that production is not slowed down by unnecessary waiting. The suppliers have valid reasons for the material delays, such as poor road conditions and terrible weather. Delays in material delivery have slowed construction because heavy-duty drill pipes, casing pipes, and drill bits are being shipped from other nations or states. Drill pipes, casing pipes, and drill bits all require weeks or months to get to the correct offshore location, adding to the time needed to get things running smoothly. Nearly 300 km outside of Agartala, Tripura, in the Khubal area, there are more than ten drilling wells. Suppliers and end-users in the supply chain must therefore contend with difficulties stemming from the interior working drillsites' distance, whether onshore and offshore. Figure 6 depicts the isolated setting in which an Indian oil company has set up a drilling rig.

There is no direct facility to supply gas from the drillsite or producing well to storage platforms and storage platforms to refineries, which are similarly far from the drillsite, often being between one hundred and three hundred kilometres (km) away by road. Providing the infrastructure to move gas and oil to storage plants and ultimately to refineries is a long and arduous process that can take years and a significant financial investment. Numerous companies provide the necessary

transportation infrastructure to get petrol and oil to where it needs to go.The same holds true for oil and gas supply chains, from the wellhead to the refinery, and for offshore storage facilities. Supplying oil and gas on time or to market demand is an expensive endeavour, and shipping oil and gas is a significant part of it. Even after 30 years of drilling and finds, several of ONGC's gas wells in Gojalia, Tichna, and Tulamura in Tripura still aren't producing. Therefore, both providers and consumers in the supply chain experience difficulties due to the distance between onshore and offshore producing sites. Figure No. 4 depicts the ONGC manufacturing and processing platform in Mumbai, India.

Due to factors such as long transportation lead times, limited methods of transportation, and the limited production capacity of crude oil providers, logistics networks in the petroleum industry are rigid. As a result, there is a significant obstacle at every node in the network.

Ships, trucks, pipelines, and trains can all be used in the transportation process. It is not uncommon for a single shipment to require the utilisation of more than one mode of transportation to reach its destination. "Few industries handle such complex transportation," says Doug Hausman, a senior manager at the consultancy firm Accenture.

The petroleum and petrochemical sector has always been, and will continue to be, an international one. This means that goods and products are frequently transported between continents.

The high transportation costs and in-transit stocks, as well as the high inventory holding costs in terms of safety stock at the end customer site, are all a result of the great distances between supply chain partners and the slow means of transportation.

Transport timings are highly unpredictable because of the wide distances between supply chain partners; this is bad for suppliers in terms of service standards and for end customers in terms of safety stock prices.

Lead times from the shipping site to the final customer location are lengthier in this industry because of transportation constraints. As a result, the petroleum sector has significant challenges in adapting to the rising demand for oil and its derivatives while keeping up with the highest standards of service and efficiency.

Other Challenges

Supply chain efficiency in the petroleum business is impacted by several factors, not the least of which is the logistics function. Equally essential are efforts to restructure both organisational structures and cultural norms, as well as information systems and the sharing of relevant data (Ikram, 2004).

As Paratorius, president of BASF's petrochemicals division, puts it, "Manufacturing efficiency alone is no longer enough to ensure competitive advantage" (Whitfield, 2004, p. R12), a company's success hinges on maintaining consistent procedures from the purchase of raw materials to the delivery of finished goods.

When it comes to supply chain integration, businesses are falling behind. As a result of the disruption in the supply chain, the price of crude oil has risen, which has had a knock-on effect on the cost of petrol.

Furthermore, the petroleum business has a globalised supply chain, which necessitates cutting-edge information technology for efficient information transfer due to the complexity of the logistics network in an industry like this. The efficiency of a network's supply chain depends on the quality of the links between companies.

Hull created a data flow diagram (DFD) in 2001 to strengthen the dependability of data transfer along the Alaska North Slope Petroleum supply chain. According to the results, DFDs were helpful in making the organisation aware of the significance of synchronising scheduling and dispatching.

In addition, DFD was used to analyse the flow of data, which increased overall supply chain efficiency and diminished distortions that were rooted in the network's architecture. Further, the created generic DFD can be used as a starting point for modelling any kind of supply chain or logistics operation, whether it be a push, pull, or hybrid of the two (Hull, 2001).

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Due to safety concerns, the petroleum industry also requires cutting-edge IT infrastructure. Oil firms move a lot of dangerous goods, therefore everyone in the supply chain (suppliers, customers, etc.) needs to know where everything is at all times. Accenture's Hausman said that businesses in the chemical industry are thinking about using wireless technology to monitor deliveries.

Attitudes and worries about collaboration and information sharing among supply chain partners are another difficulty in the petroleum sector supply chain. "companies in the oil industry can be cautious about sharing demand and cost information," says Sara Al-Karaz, supply chain director at Equate Petrochemicals (Personal Communication, 23 December 2004). This is despite the fact that collaboration and information sharing are crucial to supply chain efficiency. Opportunities for cost savings may be lost due to the lack of clarity surrounding collaboration and the exchange of demand/cost information.

As a result, the petroleum business needs a new mentality in collaboration, even if that means collaborating with competitors, in order to improve supply chain efficiency. "Chemical manufacturers and LSPs need to work with their competitors and other operators in the supply chain," said Phil Browitt, CEO of logistics firm Agility. "So collaboration, information sharing, and asset optimisation require the greatest change in mindset." While the acquisition of cutting-edge IT is essential, it will only go so far without accompanying cultural shifts.

Opportunities in Supply Chain and Swap Practices

Oil and petrochemical firms increasingly outsource logistics to manage supply chains and cut expenses. Companies are increasingly using third-party logistics providers to oversee their supply chains as outsourcing becomes more common.

To outsource logistics functions, however, petroleum corporations have taken the concept one step further by forming alliances and working together with competitors. Systematic cooperative reciprocal barter (sometimes "swapping" or "exchange") of goods, assets, market shares, or even entire businesses between competitors is the term for this type of cooperation.

Despite the obvious gains that businesses have seen from adopting this practise, there remains no standard method for doing so. The literature on operations management doesn't talk about this much. There is currently no standard practise for determining when a company should try to make a swap choice. Two international petrochemical companies have been working on competitive swaps for several years, but the only methods they utilise are the judgmental approach and spreadsheets, according to interviews with supply chain directors. It's not wise to rely solely on judgemental approaches, despite the fact that they may increase precision in many decision-making difficulties. The best solution is not a given if only this method is used.

The goal of any good supply chain strategy is to maximise the company's ability to deliver on its value proposition to customers.

Strategic Elements in Supply Chain Management

Industry framework (market), company value proposition (competitive positioning), internal processes (supply chain), and managerial focus (linkage between supply chain processes and business strategy) all interact to shape a company's supply chain strategy. These four components are crucial.

a) Institutional structure An "industry framework" is the network of suppliers, customers, innovations in technology, and macroeconomic forces that shape competition in any given market. In this model, there are four interconnected factors that determine how the supply chain is structured:

1) Production efficiency and product cost are primarily determined by the degree to which demand fluctuates (demand profile), which in turn impacts the consistency and stability of the workload of manufacturing assets.

2) The price of the middleman in a market. According to Marshall Fisher, the costs of market intermediation arise from the gap between supply and demand. Demand predictability and market intermediation costs are being impacted by shorter product life cycles as a result of the rapid pace of change in technology, fashion, and consumer goods trends.

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(3) In markets where sales and asset utilisation have a strong relationship, asset costs have a significant impact on overall expenses.

a) Specialised Appeal Second, the organization's competitive location in the supply chain must be understood in order to develop a distinct value proposition. The terms "Order Qualifier" and "Order Winner," coined by Alex and Terry Hill in 1995, are helpful here.

b) Management Focus: Maintaining coherence between supply chain execution and a company's USP requires intense concentration on this single issue.

c) Internal Processes: The fourth element, internal processes, provides guidance to make sure all the moving parts of the supply chain (buying, making, and shipping) work together as they should. Asset utilisation and decoupling point placement are two particularly crucial aspects of this component. The decoupling point occurs in the value chain when a product is differentiated based on the needs of a specific set of buyers. These two criteria are extremely intertwined, and they outweigh any others:

(1) High asset utilisation is required by business models in which the cost of assets is disproportionate to the overall cost or by low-cost proprietary value propositions; and (2) the decoupling point is the location at which the value chain is no longer connected to the cost of assets. Decoupling should occur at the final stage of the transition, or at the output of the most economically significant industrial assets.

(2) The process is "push" up until the decoupling point, which implies that the prediction is used to evenly distribute work, that production cycles are often longer to boost efficiency, and that asset utilisation is high.

Considerations

Experts in the oil and gas industry are concerned about a future supply shortage. Even though new frontiers like oil shale and oil sands are not profitable at current prices, there is still a great deal of opportunity due to known reserves, the increasing potential for recovery from existing fields thanks to new technologies, the possibility of further discoveries, and the expansion into new regions. Shortages are not caused by a lack of resources.

Most studies in this field have concluded that there are sufficient reserves to maintain the status quo in output for the next half century. So, the biggest problem in the oil and gas sector isn't finding new places to drill, but rather turning existing deposits into usable product and getting it to customers as cheaply as feasible.

The oil and gas industry stands to gain the most from improved supply chain efficiency. Everything from gloves to pipes and valves and cranes and chemicals and cement and steel and drilling rigs is shipped in this sector. Furthermore, few companies require the daily, frequent, domestic, international, land, and sea transportation of such a wide variety of items in such big amounts.

Most tasks and procedures in exploration and production are routine. Numerous oil and gas wells are drilled by companies every year. More than 45 distinct services are needed to drill and complete a single well, hence drilling contractors are essential.

One major worry for the future of oil and gas production is that present oil and gas businesses have been compelled to reduce capital expenditures due to low oil prices.

Second, the global natural gas market will contract dramatically as a result of the fall in crude oil prices, which will have a disproportionately negative impact on the natural gas economy.

Since then, several foreign unconventional oil and gas businesses have failed, and China's stance on the resource has shifted.

Forth, there are many more factors that have contributed to the oil and gas M&A market's slow growth.

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Fifth, the decline in oil prices has come at a time when China's natural gas industry is expanding quickly, presenting both obstacles and opportunities for its reorganisation (yijun liu & Li Ma et al., 2016).

The IEA predicts that North America will soon own the world's largest unconventional oil and natural gas storage. Unconventional oil reserves in North America are twice as large as those in the Middle East, according to industry experts. As a result, North America is rapidly rising to prominence in the oil industry's shifting global landscape.

When considering whether or not to implement vertical integration in the oil and gas business, it is important to decide which processes should be handled in-house and which should be contracted out. In vertical integration, one company merges with those it supplies or competes with for supplies or finished goods. Industries where one company's outputs are used as inputs by another, such as the oil and gas industry, benefit greatly from vertical integration. In the same way that what is discovered is used in manufacturing. Oil refineries use their output as an input in oil refinement, and refineries use their output as an input in oil marketers. That's why vertical integration works so well in the oil and gas sector.

Supply chain performance can be enhanced through constant analysis and, if necessary, the adoption of new configurations and coordination strategies. It has been proposed that the problem of demand unpredictability being amplified by the supply chain can be mitigated by the use of information exchange and shorter lead times to run the supply chain more coherently. The net result of such a change is a reduction in expenses farther up the supply chain.

Researchers in the field of operations management have, in the past, taken an analytical approach that aimed to boost the efficiency of individual links in the supply chain rather than the network as a whole. Focusing on one method over another is an economic decision motivated by the desire to maximise gain while minimising outlay. Here, we test the hypothesis that the whole is greater than the sum of its parts.

It is recommended to manage the supply chain as a unified whole in order to maximise customer satisfaction while minimising expenses (Forrester: 1958, 1961). This has the potential to significantly cut costs by removing burdensome applications and regulations from the supply chain. By lowering the burden, system integration helps cut costs.

Decisions made by oil and gas companies must be incorporated into those made by customers and suppliers as part of effective supply chain management. The company is managing the relationships in this process. In order to coordinate the supply chain efficiently, it is necessary to have positive connections with both customers and suppliers. The supplier-customer relationship is often adversarial, with the two sides bound by a legally binding contract with a set of agreed-upon terms and conditions. Instead, businesses can forge strategic partnerships with their suppliers over the long run. Oil and gas operations and their suppliers often work together on projects.

Case Study

Several case studies can be found in the literature that show how a fully integrated supply chain management programme has increased operational efficiencies at oil and gas businesses, leading to decreased cost per well. E&P Infrastructure claims:

ONGC's Cluster-7 includes the offshore fields B-192, B-45, and WO-24, all of which are located on the Mumbai High - Deep Continental Shelf in the Bombay offshore Basin. These fields are typically located 80–88 m below the surface around 210 kilometres west of Mumbai City. While both B-45 and WO-24 are gas fields, B-192 is an oil and gas field. These areas are extremely out of the way and on the outskirts of civilization. Production managers face a difficult task in turning these wells into profitable production operations. In November of 2014, the FPSO was deployed to the field. There is a constant need for divers, and good weather is essential, for the highly technical and hard operations of positioning the FPSO at place, installing it, and linking it up with underwater systems". Well fluid could be flown into the FPSO for the first time on February 26, 2015, after it was rendered operational despite the record-breakingly harsh winter of 2014. Cluster fields output increased from 7,500 BOPD without FPSO to more over 14,000 BOPD once FPSO was brought online. The ONGC processing infrastructure is seen in Fig. 6.

In the past year, ONGC has increased oil output from its Western Offshore fields by 7–8 percent because to numerous technological inputs. The outcomes have given us faith that much more output growth is feasible.

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Both on land and at sea, our country produces crude oil. Arunachal Pradesh, Nagaland, Tamil Nadu, Gujarat, and Andhra Pradesh all have onshore fields. The crude oil field located on land is owned jointly by OIL and ONGC. Bombay High is home to offshore fields managed by ONGC and its joint ventures.

Assam, Gujarat, Tamil Nadu, Andhra Pradesh, and Rajasthan all have onshore natural gas fields, while the western part of the Bombay High has offshore natural gas fields. In India's oil and gas industry, state-owned companies have a hefty share of the market. In terms of oil and gas output, ONGC accounts for a disproportionately large percentage. The public sector enterprise Oil India Limited is the industry's number two player. Together, these businesses control more than 70% of the industry.

The remaining percentage is held by several private oil and gas companies. The major petroleum companies in India are ONGC, OIL, HPCL, IOCL,BPCL, GAIL, Reliance petrochemicals, Essar Oil ltd, Adani Gas, Cairn Energy, and BP. The demand for oil and gas logistical infrastructure, including drilling rigs, seismic survey equipment, and pipelines, has expanded in the Indian petroleum industry. Due to its lower capital costs compared to other Asian countries, India is likewise rising as a potential refining centre. The energy, power, and fertiliser industries all contribute to the country's oil and gas needs.

The supply chain manager helped ConocoPhillips meet the project's essential logistical needs by training and managing the workforce and the efforts of many local service suppliers.

CONCLUSIONS.

Boundaries and criteria determining the interactions between customers and suppliers must be developed as part of an oil and gas company's supply chain building strategy. Although oil development, exploration, and production are inextricably linked processes, these activities are often handled separately.

Supply chain management is the practise of arranging a company's resources in such a way as to maximise its interactions with its distributors and end customers. This is done in order to do things like respond quickly to requests and orders, plan deliveries so that demand is never unmet, build lasting relationships with distributors, and expand the sales network. Key elements in managing the supply chain that we consider in this paper to reduce costs and increase company profits are demand management, efficient distribution of petroleum products among customers, improved transportation scheduling, warehouse management, and supply chain automation for information quality and timeliness. The logistics idea of supply chain coordination, known as supply chain management, is then used to put these concepts into practise.

Efficient supply chain management is reported to have reduced procurement and implementation costs by 10-20% in both scenarios.

In the oil business, supply chain management is fraught with high levels of uncertainty. Long lead times, inefficient logistics management, and a lack of available stock are just a few of the problems that can arise. Due to the enormous capital expenditure, supply chain activities should be very effective and efficient, with an emphasis on cost-effective practises.

Profit maximisation and satisfied customers both benefit from a well-rounded strategy. In addition to maximising revenues, optimisation entails the efficient administration of all available assets. When it comes to accomplishing the petroleum industry's primary aims and objectives, supply chain optimisation plays a crucial role. Gaining a competitive edge and increasing earnings can be accomplished in part through satisfied customers. Profitability can only be improved by optimising the supply chain to reduce costs.

The petroleum industry places a premium on accurate demand forecasting as part of its supply chain management. The forecasting of product demand must be precise. Predictions can be made with a high degree of accuracy using mathematical models and time-series forecasting techniques. Petroleum products start off as crude oil. Therefore, the LPP model should be used to choose crude oil. Vessel scheduling calls on cutting-edge simulation technology.

In order to effectively plan for inbound, internal, and outward logistics, three distinct planning models are required. The importance of IT in supply chain operations cannot be overstated. The petroleum sector is globally impacted by changes

in demand and prices. The economic and political policies of the government also play a role. For the petroleum sector to increase productivity and profitability, vertical integration of the supply chain is essential.

Implications:

According to the principles of strategic sourcing, suppliers who regularly deliver high-quality results should be rewarded with favoured treatment from buyers. Therefore, choosing a group of high-quality suppliers is one method to strengthen the supply chain.

One of the most crucial aspects of oil and gas supply chain management is the fact that JIT is not used in exploration and production. Offshore platforms, in instance, have as much infrastructure as a medium-sized city. That's why it's crucial to always look ahead and prepare for demands that aren't part of the typical schedule or supply.

One oil business, for instance, uses the services of more than 400 contractors and suppliers to maintain 12 offshore rigs. With the help of supply chain management, all of these providers can be brought together in one convenient spot. Much unnecessary expenditure and effort can be avoided in this manner.

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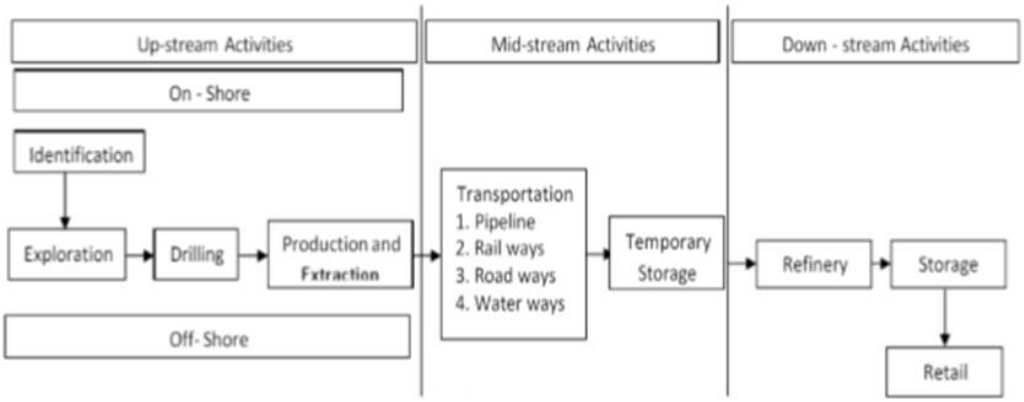

Fig-1: Various Segments Of Oil and Gas Supply Chain

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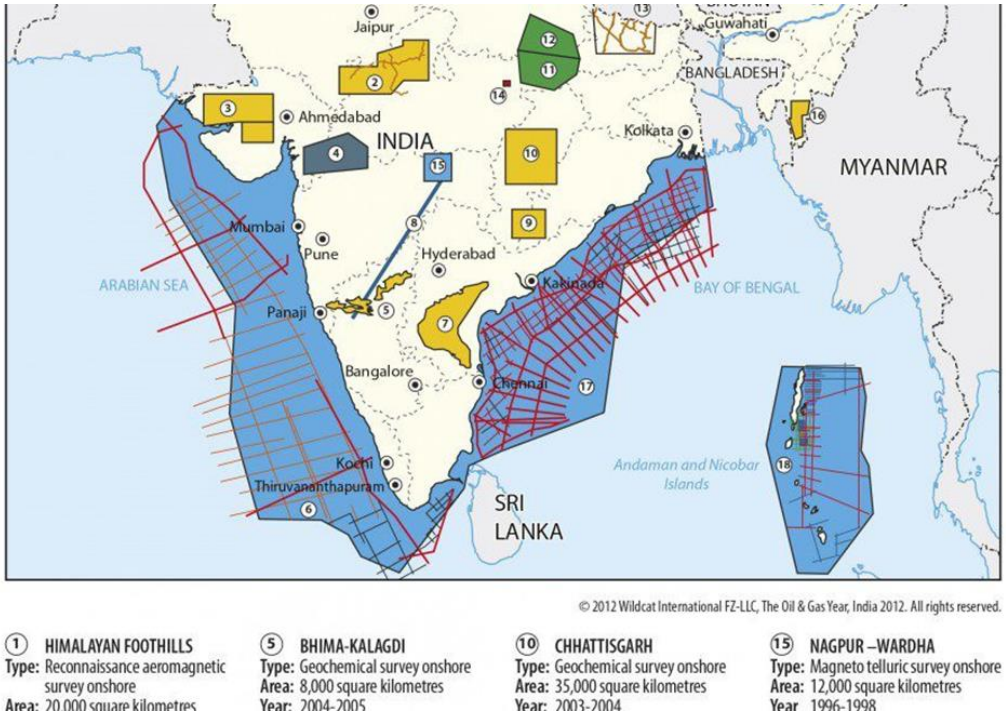

Fig-2: Data acquisition sites and Lines of ONGC in India

Figure-3: Drilling Rig site of Oil Company in India

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Fig-4: Production and processing Plateform in Mumbai High,ONGC

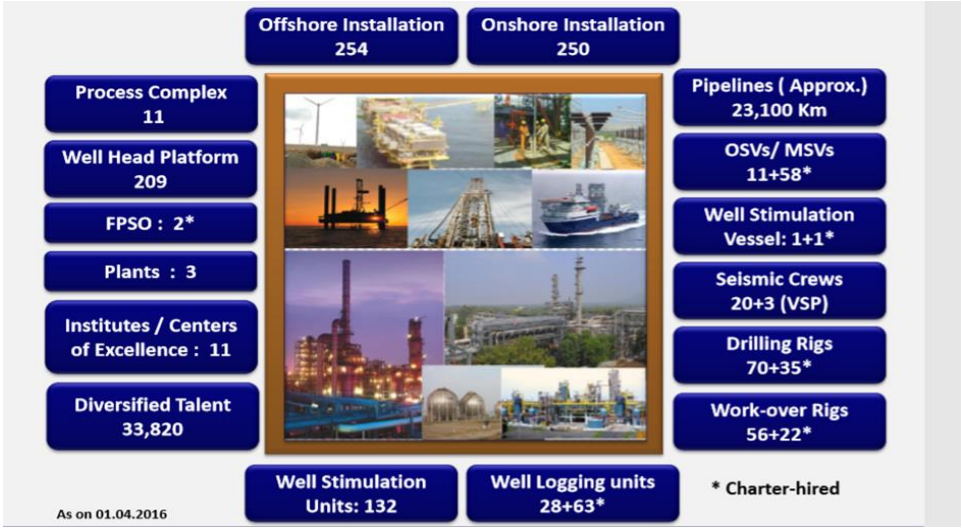

Fig-5: ONGC Infrastructure for E& P Group

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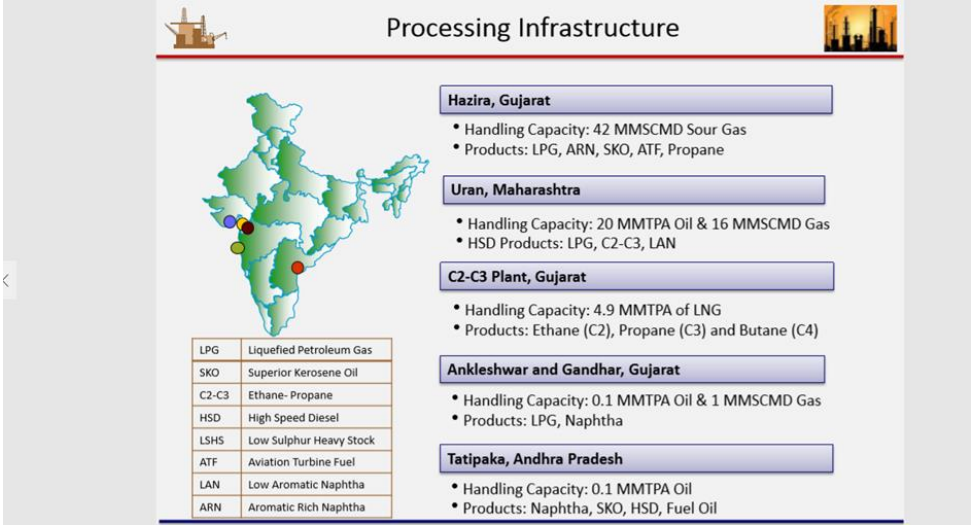

Fig-6 ONGC processing Infrastructure

Authors	Definition of supply chain	Findings
Ellaram, (1991)	Integrated approach of material flow and information flow to satisfy the customer needs without waste.	Focus on waste reduction technique of JIT
Lee and Billington, (1992)	Production and distribution process of goods with customer satisfaction.	Focus on customer satisfaction
Christopher, (1998)	The management of relationship with supplier and customer by providing good quality of product in less capital investment.	Customer relationship and cost reduction techniques.
Cooper, (1993)	The management of total movement of distribution channel from supplier to customer.	Focus on integrated approach within supply chain.
Berry *et al.*, (1994)	Supply chain deals with information sharing, new product development and maintaining long term relationship	Relationship management to achieve the objectives of supply chain.
Patricia *et al.*, (1996)	Starts with supplier and finishes with customers.	Focus on supplier-customer value chain and relationship.

Table 1.1: Supply chain concept by researchers