

# Supply-chain management in the oil industry

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**Abstract.** The logistics network in the oil industry is highly inflexible, which arises from the production capabilities of crude oil suppliers, long transportation lead times, and the limitations of modes of transportation and energy planning and management. The paper considers the key factors for reducing costs and increasing the company's profits in managing supply chains: demand management, efficient distribution of petroleum products among customers, better transportation scheduling, warehouse management, and quality and timeliness of information through the automation of the supply chain. And this principle is carried out within the framework of the logistics concept of supply chain coordination - Supply Chain Management. The paper also considers advantages from implementation of supply-chain management. Implementation of supply-chain management in the oil industry can help to reduce costs, increase the company's profits in managing supply, and manage the planning of deliveries.

## 1 Introduction

Oil is one of the world's most important raw materials. It has been the world's leading source of energy since the mid 1950's. The oil industry is one of the most important components of the world economy and has a significant impact on the development of other industries. This energy source is what fuels cars, provides electricity to heat homes and water, is used in modern medicine, processes extract the chemicals used for household cleaning products, and much more. The oil and gas industry play a critical role in driving the global economy. The products that this industry makes support many other vital industries like the automotive industry and manufacturing industry.

Changes in technology, markets and customer needs affect the competitiveness of companies, which requires continuous restructuring of the strategy and tactics of positioning the oil business. Currently, the main problem facing the oil industry is to minimize the cost of production and supply of finished products to consumers. Effective supply chain management can increase the efficiency and competitiveness of a petrochemical plant and its supply as a whole. In a supply-chain, a company is linked to its upstream suppliers and downstream distributors as materials, information, and capital flow through the supply-chain.

So, the purpose of this article is to investigate the need of supply-chain management in the oil industry. Object of the article is oil industry, and subject is supply chain management system in oil industry.

Article objectives:

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- 1) Describe logistic chain of oil industry and necessity of implementation of supply chain management system
- 2) Describe SCM system and its opportunities
- 3) Show up the efficiency from implementation of supply chain management system in oil industry

The problem of supply chain management is very popular, essentially in oil industry, because despite the importance of supply chain management and its growing complexity, the oil industry is still in the development stage of efficiently managing their supply chains. Supply chain management has received in recent years a great deal of attention by researchers and practitioners. So, there are a lot of literature where considered this problem. Thus, Raed Husain in his article “Supply Chain Management in the Petroleum Industry: Challenges and Opportunities” wrote that more efficient and cost effective supply chain practices in the oil industry represent important factors for maintaining continuous supplies of crude oil, the reduction of lead times and distribution costs. Despite the great challenges in the oil industry’s supply chain, opportunities for improvements and cost savings do exist along the supply chain. Raed Husain wrote that companies in the oil industry took the outsourcing idea a step further to collaborate with competitors and found shared solutions to their supply chain challenges. This form of collaboration is referred to as a systematic cooperative reciprocal barter, or swaps and this can offer companies huge savings and introduce new opportunities [1].

Also, Christopher M. Chima in his article “Supply-Chain Management Issues In The Oil And Gas Industry” wrote about the role of supply-chain management in the oil industry, about strategies for improving supply-chains in the oil industry and showed how improving supply-chain logistics can improve efficiency. Author wrote that the oil industry is involved in a global supply-chain that includes domestic and international transportation, ordering and inventory visibility and control, materials handling and information technology. Thus, the industry offers a classic model for implementing supply-chain management techniques [2].

## 2 Methodology

To better understand the activities through which a firm develops competitive advantage and creates shareholder value, it is useful to separate the business system into a series of value-generating activities referred to as the value chain (Porter, 2004). The value chain displays total value, and consists of value activities and margin. Value activities are physically and technologically distinct activities a firm performs. These are building blocks by which a firm creates a product valuable to its customers. Margin is the difference between total value and the collective cost of performing the value activities. Porter’s Value chain is a model used to study the activities that are performed in the creation of a product or service by an organization. These activities add value and cost in the process of creating products and services. The activities may be classified as primary or secondary depending on whether they are the core business or they are auxiliary functions of the firm. The goal of these activities is to offer the customer a level of value that exceeds the cost of the activities, thereby resulting in a profit margin.

Porter (1985) Primary activities are directly concerned with the creation or delivery of a product or service and can be grouped into five main areas. These are; inbound logistics, operations, outbound logistics, marketing and sales and service [3].

Porter Five Pushes analyze

### 1. Obstacles to Entrants

The easier it is good for new companies to enter the industry, the greater cutthroat competition you will see. Factors that can limit the threat of new entrants are known as barriers to entry. So, there are thousands of oil and oil services companies throughout the

world, but the obstacles to go into this industry are enough to scare away all however the serious companies. Obstacles can vary with regards to the section of the market where the company is situated. For example, some types of pumping vehicles needed at well sites cost more than \$1 million each. Other areas of the engine oil business require highly specialized workers to use the equipment and to make key drilling decisions. Companies in companies such as these have higher barriers to entry than ones that are simply offering drilling services or support services. Having sufficient cash is another hurdle - a corporation had better have profound pockets to defend myself against the existing olive oil companies.

#### 2. Supplier Power

This is how much pressure suppliers can put on a business. If one company has a big enough impact to influence a company's margins and quantities, then it keeps substantial power. While there are many oil companies on the globe, much of the coal and oil business is dominated by a tiny handful of powerful companies. The huge amounts of capital investment tend to weed out a lot of the suppliers of rigs, pipeline, refining, etc. There isn't a lot of cut-throat competition between them, nevertheless they do have significant power over smaller drilling and support companies

#### 3. Buyer power

This is how much pressure customers can place on a business. If one customer has a huge enough impact to have an effect on a company's margins and quantities, then the customer hold considerable power. The balance of ability is shifting toward buyers. Oil is a commodity and one company's olive oil or oil drilling services are not that much not the same as another's. This leads clients to seek lower prices and better agreement terms.

#### 4. Availability of Substitutes.

What is the chance that someone will switch to a competitive product or service? If the expense of turning is low, then this poses a serious threat. Here are a few factors that make a difference the risk of substitutes: the main issue is the similarity of substitutes; if substitutes are similar, it can be viewed in the same light as a new entrant.

Substitutes for the engine oil industry generally speaking include alternate fuels such as coal, gas, solar powered energy, wind ability, hydroelectricity and even nuclear energy. Remember, oil can be used for more than simply jogging our vehicles, additionally it is used in plastics and other materials. When inspecting an energy company it is extremely important to have a close look at the specific area where the company is functioning. Also, companies offering more obscure or specific services such as seismic drilling or directional drilling tools are much more likely to endure the threat of substitutes.

#### 5. Competitive Rivalry.

This details the depth of competition between existing companies within an industry. Highly competitive sectors generally earn low returns because the expense of competition is high. An extremely competitive market might derive from: many players around the same size; there is no dominant firm; little differentiation between competitors' products and services [4].

Ultimately, Michael porter five causes are very helpful to evaluate the oil industry. The proper business manager wanting to develop an advantage over rival businesses can use this model to better understand the essential oil industry context in which the firm operates.

### **3 Necessity of the supply-chain management in the oil industry**

The steadily increasing global demand for oil and its derivatives such as petrochemicals has enabled companies providing these products to reach more customers and increase their market share and profitability. This boom in global demand along with the ease of international trade and the inflexibility involved in the petroleum industry's supply chain has made its management more complex and more challenging. Despite the importance of supply

chain management and its growing complexity, the petroleum industry is still in the development stage of efficiently managing their supply chains. In fact, according to Steve Welsh, a managing director of the College of Petroleum and Energy Studies at the University of Oxford, the oil and petrochemical industry's insight into the supply chain is still in its infancy. However, even with the inflexibility and complexity involved in the industry's supply chain, there is a lot of room for improvement and cost reduction, specifically in its logistics area. Werner Paratorius, president of BASF's petrochemicals division said "Supply chain management is the backbone of a business where logistics costs can be greater than manufacturing costs" [1].

The level of supply of consumers with petroleum products plays a particularly important role, since it affects the economic health of the main industries and agriculture, as well as the population. At the same time, the large volumes of resources used, the wide range of petroleum products, the complexity and breadth of communications determine the importance of coordinating the procurement, storage and supply of petroleum products, tracking the product promotion process and the quality of delivery and transportation planning, taking into account the amount of funding required for this.

In recent times, there have been concerns and many have argued that the oil and gas industry may have entered an era of very scarce resources. In reality however, the resources are not the cause of supply constraints, given the enormous potential still available including, currently known and booked reserves, the increasing scope for recovery from existing fields with new technologies, further potential discoveries, and the new frontier of vast oil sands and oil shale reserves that are in the money at today's prices.

Essentially, according to a good majority of the industry's research, we have enough resources left to sustain current production levels for at least the next 50 years. Therefore, the main challenge facing the oil and gas industry is not the availability of oil and gas resources, but putting these reserves into production and delivering the final products to consumers at the minimum cost possible. Thus, a solid supply-chain management program will enhance this goal [2].

Because of the oil industry is global, such commodities as oil, gas, and petrochemicals require specific modes of transportation such as pipe-lines, vessels or tankers, and railroads. These commodities are produced in specific and limited regions of the world, yet they are demanded all over the globe since they represent an essential source of energy and raw material for a large number of other industries. Several weeks lead-time from the shipping point to the final customers' location is very common in this type of industry. For example, it takes five weeks for the Persian Gulf's oil to make its way to the United States and up to another three weeks for it to be processed and delivered (Schwartz, 2000).

The great distances between supply chain partners present a high variability of transportation times that can hurt suppliers in terms of service levels and final customers in terms of safety stock costs. Also, as the transportation process is carried out either by ships, trucks, pipelines, or railroads, in many instances, a shipment has to exploit multiple transportation modes before reaching the final customer's location.

Such constraints on transportation modes in this type of industry induce long lead times from the shipping point to the final customers' location compared to other industries. Hence, considering the amount of inflexibility involved, meeting the broadening prospect of oil demand and its derivatives while maintaining high service-levels and efficiency is a major challenge in the petroleum industry.

Opening new production sites or distribution centers closer to dispersed customers is one way to reduce the lead time and transportation costs. However, the acquisition of such facilities in the oil and petrochemical industries, if feasible, is typically very costly and often results in higher inventory and operating costs (Hebert, 2004). Red Cavaney, president of the American Petroleum Institute, said "Most companies are unlikely to undertake the significant

investment needed to even begin the process” (Hebert, 2004) These factors are pushing oil and petrochemicals companies to either absorb the increase in costs or pass the costs on to customers who are already facing increasing prices.

Companies therefore have recognized that improved supply chain efficiencies represent a huge area for cost savings, specifically in the logistics area. Also, companies believe that the supply chain in which they participate as customers and suppliers is what creates competition rather than individual companies [1].

Thus, the key factors for reducing costs and increasing the company's profits in managing supply chains are demand management, efficient distribution of petroleum products among customers, better transportation scheduling, warehouse management, and quality and timeliness of information. But the real effectiveness of supply chain management is to manage these factors, not separately, but as a whole process, which is possible precisely through the automation of the supply chain.

## **4 Features of logistics and SCM in the oil industry**

Logistics is used to denote the science of transport planning, its management and control. This also includes warehousing and any types of intangible and material operations that take place before the moment when the goods or a particular resource will be delivered to the desired point. In the framework of the above process, various logistical operations related to the management of warehousing, stocks, transport, personnel are carried out. In fact, logistics is needed in order to effectively manage various material flows.

Supply chain logistics software or supply chain management software (SCM software) is highly valuable to operational managers. The purpose of logistics platforms is to maximize customer value, while achieving a sustainable competitive advantage in the most effective ways possible. These tools support good transportation, warehousing, inventory, and logistics network design to efficiently link the flow of products, data, and finances. Most organizations today cannot do without a solid SCM solution, so to get you up to speed, here are the top must-have features of a solid software.

The need to improve efficiency and competitiveness predetermines the reduction of costs, the cost of oil production and refining. Work on the objects of mining and processing associated also with stringent requirements for safety and environmental requirements. That is why the organization of logistics in the oil and gas industry requires a complex, special approach to building the supply chain. The process of movement of goods from the initial to the end point must be strictly controlled to reduce costs. They arise at all stages of the movement of the material flow - during the procurement, transportation, storage, distribution to end users. Logistics implies an integrated approach to solving problems from the standpoint of identifying costs and reducing them in conjunction with all logistical links - from supply to distribution.

Nowadays, logistics is used as a strategic weapon in a competitive market, since it ensures the search for new sources of increase in the efficiency of enterprises, expands the areas for finding reserves outside production, optimizing the interaction of the constituent elements of the enterprise resource potential. The oil and gas industry passes through various loads and divisions of the industry involved in the supply, transportation, storage and distribution, dealing with materials that are in three phases: gaseous, liquid and solid.

The implementation of the logistics concept aims at reducing the time losses of the production cycle and the timing of orders, stocks of materials and finished products, enhances innovation processes and compliance with contractual obligations, while strengthening the integration of all material flows in the production process. To fully reflect information at all hierarchical levels of the logistics management process, an effective operational

communication system is needed, reflecting the movement of material flows from the conclusion of a contract with a supplier to the moment of consumption of the final product.

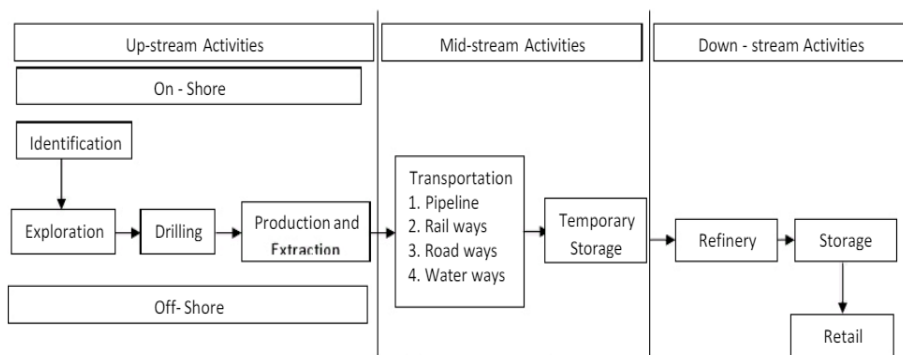
Logistic activities use warehouses or transshipment facilities to constitute logistic networks, which enable the regional consolidation of transports for different customers and from different suppliers. Through freight consolidation, the utilization of the means of transportation can be increased, and therefore, overall transportation distance as well as CO<sub>2</sub> emissions can be reduced [5,6].

In relation to above, there is a need to build a very sophisticated supply chain that can create smooth flow of information, goods and services from inbound and outbound for the purposes of achieving high customer service delivery resulting into high performance results. The main objective of supply chain management (SCM) is to stimulate sales, minimize costs and take full advantage of business assets by refining collaboration and communication between all the actors creating the supply chain. This gives a clear description of real business gains as results of interdependence amongst firms characterized by increased trade in transitional goods or services and technical know-how as well as production network. The supply chain management is a decision process that not only integrates all of its participants but also helps to coordinate the basic flows: products/services, information and funds [7].

## 5 The oil supply chain

According to Christopher M. Chima [2] “Supply chain management in a Petroleum industry is the configuration, coordination and continuous improvement of sequentially organized operations involved in upstream, midstream and downstream.” [8] So, the oil supply chain has three functional segments namely the Upstream, Midstream and Downstream (Fig.1).

"Upstream" and "downstream" are general business terms referring to an oil or gas company's location in the supply chain. The closer to the end user a function or firm is, the further downstream it is said to be. Raw material extraction or production are elements of the supply chain considered to be upstream. The upstream companies identify oil and natural gas deposits and engage in the extraction of these resources from underground. These firms are often called exploration and production companies. Refiners represent the downstream element of the oil and gas supply chain [7].



**Fig. 1.** Various Segments Of Oil Supply Chain [9].

The upstream segment of the oil and gas business is also known as the exploration and production (E&P) sector because it encompasses activities related to searching for, recovering and producing crude oil and natural gas. Upstream oil and gas operations identify deposits, drill wells, and recover raw materials from underground. This sector also includes related services, such as rig operations, feasibility studies, machinery rental and extraction chemical supply. This stream has the following activities involved:

- Exploration: Aerial survey, seismic, geophysical and geological operations
- Appraisal Drilling: Drilling of wild cat wells / test wells
- Production and extraction
- De-commissioning and Rehabilitation

The upstream oil segment is all about wells: where to locate them; how deep and how far to drill them; and how to design, construct, operate and manage them to deliver the greatest possible return on investment with the lightest, safest and smallest operational footprint.

Midstream involves infrastructure used in transporting crude oil and petroleum products. As its name implies, the midstream oil and gas segment encompasses facilities and processes that sit between the upstream and downstream oil and gas segments. Activities can include processing, storage and transportation of crude oil and natural gas.

In most cases, oil and gas reserves are not located in the same geographic location as refining assets and major consumption regions. Transportation is a big part of midstream activities and can include using pipelines, trucking fleets, tanker ships, and rail cars.

However, the main focus of the midstream sector is the gathering system. Gathering systems are oil and natural gas storage areas where hydrocarbons from the oil are held until they can be transported to the refinery, where they are turned into marketable products.

So, midstream activities include:

- Transportation
- Storage

Processing, transporting and selling refined products made from crude oil is the business of the downstream segment of the oil and gas industry. The downstream industry provides thousands of products to end-user customers around the globe. Many products are familiar such as gasoline, diesel, jet fuel, heating oil and asphalt for roads. Others are not as familiar such as lubricants, synthetic rubber, plastics, fertilizers and pesticides.

The downstream segment is a margin business. Margin is defined as the difference between the price realized for the products produced from the crude oil and the cost of the crude delivered to the refinery. Downstream operations include refineries and marketing. These services turn crude oil into usable products such as gasoline, fuel oils, and petroleum-based products. Marketing services help move the finished products from energy companies to retailers or end users.

Downstream activities include:

- Refining and processing of crude and gas
- Supply and trading
- Marketing and Distribution [9]

So, take into account the structure of oil industry, we can say that it is complex and requires strict control and right planning that include:

1. Availability of right information at right time for various stakeholders
2. Integrating supply chain with vendors and suppliers for each organization involved in the process
3. Enterprise Business Solutions to manage multi-modal transportation, resource tracking, logistics, and cost tracking
4. Availability of new customized IT solutions, and off-the-shelf solutions from vendors
5. Studying the demand and offer on the market products that best meet the needs of customers
6. Planning deliveries in such a way that the goods “do not lie behind” or, conversely, there is no unsatisfied demand for goods.

Today, information technology is of paramount importance for the operation of an uninterrupted information flow, given the complexity of supply management in the oil industry. To optimize the system of supply of petroleum products, it is necessary to take into account all links of the logistics chain of product promotion from oil refineries to commercial

intermediaries selling petroleum products to specific consumers. Creating a network of effective communications between organizations, consisting of producers of petroleum products, trading firms, intermediaries, and financial structures, takes place within the framework of joint supply chains, while logistics companies are a complex unifying link. These principles are carried out within the framework of the logistics concept of supply chain coordination - Supply Chain Management.

Supply Chain Management means the formation of such a sales network, in which necessary goods will be delivered to the right place at the right time with the least cost. The concept of Supply Chain Management is aimed at creating optimal channels of interaction with distributors and end users, especially:

- study the demand and offer on the market products that best meet the needs of customers;
- quickly process orders and requests;
- plan deliveries in such a way that the goods “do not lie behind” or, conversely, there is no unsatisfied demand for goods;
- create long-term relationships with distributors and constantly expand sales network.

Supply-chain management (SCM) can be defined as the configuration, coordination and continuous improvement of a sequentially organized set of operations. The goal of supply-chain management is to provide maximum customer service at the lowest cost possible. A customer is anyone who uses the output of a process. Therefore, the customer’s customer is important to any organization that is focused on customer service.

Today, there are more opportunities for coordinating activities across a supply-chain even in such complex operations as oil, because of improving information systems and communication technologies. Integrating operations management with other functions of the operation allows all functions to be involved in the supply-chain management decisions [11].

Effective SCM will lead to a to provide the essential level of customer service to a specific segment and improving customer service through increased product availability and reduced order cycle time; engage in information exchange (forecasting techniques, inventory management, delivery) and structural collaboration (just-in-time system, outsourcing, vendor-managed inventory and co-locating plants); relationships with downstream supply chain partners to create end-customer value and maximize benefits and minimize costs along the supply chain. Thus, the nature of SCM becomes visible to participating companies with successful implementation in the ever-changing global environment of the business world. Risks abound, and it greatly affects the decision-making processes of the business management [7].

According to the largest analytical companies (AMR Research, Forrester Research), thanks to the SCM company receive the following competitive advantages:

- increase in profits from 5% to 15%;
- reducing the cost and time of order processing from 20% to 40%;
- reduction in time to entry the market from 15% to 30%;
- reduction in procurement costs from 5% to 15%;
- reduction of warehouse stocks from 20% to 40%;
- reduction of production costs from 5% to 15% [12].

For example, Toyota’s improvement in its supply chain benefits the automaker in many ways. So, inventory levels at parts distribution centers have decreased by 53 % from stocking levels in the1980s. Since 1994, the inventory turn of parts in the average dealership has increased from 3.7 to 5.7 Also, from 1997 to 2000 alone, supplier on-time delivery increased from 76 % to 93 % [13].



## 6 Conclusion

In the article was showed that oil industry is one of the most important and significant industries nowadays. Oil industry is global, and such commodities as oil, petrochemicals require specific modes of transportation such as pipe-lines, vessels or tankers, and railroads. These commodities are produced in specific and limited regions of the world, yet they are demanded all over the globe since they represent an essential source of energy and raw material for a large number of other industries. And the main challenge facing the oil industry is not the availability of oil resources, but putting these reserves into production and delivering the final products to consumers at the minimum cost possible. Therefore, oil industry is still in the development stage of efficiently managing their supply chains, despite of importance of supply-chain management.

According to the problem of logistics processes in oil industry, in the article was considered also the key factors for reducing costs and increasing the company's profits in managing supply chains: demand management, efficient distribution of petroleum products among customers, better transportation scheduling, warehouse management, and quality and timeliness of information. But the real effectiveness of supply chain management is to manage these factors, not separately, but as a whole process, which is possible precisely through the automation of the supply chain. And this principle is carried out within the framework of the logistics concept of supply chain coordination - Supply Chain Management.

The concept of Supply Chain Management is aimed at creating optimal channels of interaction with distributors and end users, especially: study the demand and offer on the market products that best meet the needs of customers; quickly process orders and requests; plan deliveries in such a way that the goods “do not lie behind” or, conversely, there is no unsatisfied demand for goods; create long-term relationships with distributors and constantly expand sales network.

In the article also considered advantages from implementation of supply-chain management. It is increase in profits, reducing the cost and time of order processing, reduction in time to entry the market, reduction in procurement costs, reduction of warehouse stocks, reduction of production costs and etc.

So, as a result of the work, we can say that implementation of supply-chain management in the oil industry can help to reduce costs, increase the company's profits in managing supply and manage the planning of deliveries.

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