

## Logistics Management and Operations Performance of Oil and Gas Supply Chain: A Review of Literature

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**ABSTRACT:** This study focused on logistics management and operations performance of oil and gas supply chain: A literature review. The study relied on literature review as method and basis for balance of reasoning on the theoretical relationship between the study variables. Logistics management was discussed in terms of warehousing, inventory management, transportation and logistics information system while operational performance was seen through the lenses of cost reduction and lead time. From literature it is evidential that logistics management has significant relationship with operational performance. Based on this, the study concluded that logistics management has significant impact on operational performance of oil and gas supply chain. The study encouraged organizations to seek in-depth knowledge of logistics management in the quest for improved performance in operations. Knowledge of the pivot role of distribution oil and gas firms to deliver cost effective and timely production

**Keywords:** Logistics Management, Operational Performance, Warehousing, Inventory Management, Transportation, Logistics Information System, Cost Reduction Lead Time.

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### 1. Introduction

The oil and gas sector has in no small measure, improved the socio-economic wellbeing of Nigeria. Oil is essential to the lifestyle of Nigerians and the entire humanity, be it directly or indirectly, in so many ways. Eleuzo (2018) says oil remains the lifeline of human's existence since oil and its related products are used practically in every sector of man's daily activity, whether it be domestic appliances, industrial, commercial processes etc. It is noteworthy that without oil, industrial sector cannot function; machines and other automotive equipment cannot operate. This assertion implies that the growth of the Nigerian economic sector depends unavoidably on oil. "Historically, oil exploration in Nigeria dates back to 1903, when the British mineral survey company launched its mineralogical studies in the country". In the year 1914, the British government passed the first mineral oil ordinance (Adati, 2012). Between the year 1903-1914, oil mineral activities in Nigeria witnessed widespread exploration in oil and gas.

Today, Nigeria is regarded as one of the most rapidly developing countries in the history of sub-Saharan Africa due to the influence of oil and gas activities and the development of the oil industry in Nigeria which has also contributed significantly to the socio-economic comfort of Nigerians. According to the National Bureau of Statistics, about 85% of the national income, 90-98% of the export earnings and more than 98% of the foreign

exchange revenues is being generated from the oil sector. (United Nations Report 2006, 2011). Due to the infrastructural and technological developments which has led to globalization, most oil exploration companies and other organizations now adopt practices that can aid their production efficiency and improve their overall supply chain performance. Logistics management is imperative for meeting supply chain demands any country. Most companies now depend on the Internet and explore the novelty of web-based technologies to automate and streamline procurement process (Arzuakyuz & Erman, 2010).

Crude oil is perceived as the most important commodity sellable and demandable in the entire world today and the largest resource for man's energy demand for modern day survival. The oil and gas sector is seen as a major apparatus of economic growth and development globally. It is regarded as an economic player with multiplier effects on education, transportation, tourism, construction among other sectors in the country (Adati, 2012). However, Eluozo (2018) notes that the performance of most oil and gas companies in most developing countries like Nigeria is still staggering. The failure of most of these companies to fully adapt to logistics management changes in their operations has affected the flow and quality of information in their performance.

There is insufficiency of researches that elucidate the strategic imports of logistics management in achieving operations performance. For instance, Ltifi and Jameleddine (2015) investigated the effect of logistics performance on customer satisfaction; Muiga and Patrick (2018) explored transport management and customer satisfaction; Umair, Zhang, Han and Haq (2019) analyzed the impact of logistics management on the customer satisfaction in the retail stores; Ristovska, Kozuharov and Petkovski (2017) analyzed the impact of logistics management practices on company's performance; Bagshaw (2019) studied logistics management from firms' performance perspective. Little or nothing has been done to depict the interactions between logistics management and operations performance in the oil and gas sector thus this creates a gap in the existing literature. The kernel of this paper was therefore, to investigate the theoretical relationship between logistics management and operations performance of oil and gas sector.

## 2. Literature Review

### Concept of Logistics Management

The term logistics comes from French 'logistique', from 'loger' meaning 'to lodge' (Ltifi & Gharbi, 2015). Logistics was used in the military as a word for supply of arms, ammunition, and rations as it moved from a base to a forward position (Rui & Luis, 2014). The Oxford English Dictionary defines logistics as the branch of military science relating to procuring, maintaining and transporting material, personnel and facilities. According to the New Oxford American Dictionary, logistics management refers to the detailed coordination of a complex operation involving many people, facilities, or supplies. The Oxford Dictionary online views logistics management as the detailed organization and implementation of a complex operation. For Council of Supply Chain Management Professionals, logistics management refers to part of supply chain management that plans, implements, and controls the efficient, effective, forward and reverse flow and storage of goods, services and related information, between the point of origin and the point of consumption in order to meet customers' requirements (Kotler & Amstrong, 2011). Logistics management is customer- oriented operations management as it includes all the functions required for distribution of goods.

The Council of Logistics Management say that logistics management includes the integrated planning, control, realization, and monitoring of all internal and network-wide materials, parts, and product flows, including the necessary information flow, in industrial and trading companies along the complete value- added chain (and product life cycle) for the purpose of conforming to customer requirements. From the above definitions it can be said that, logistics is the process of planning, implementing, and controlling the effective and efficient flow of goods and services from the point of origin to the point of consumption. Logistics management is the thus the management of the flow of resources from the point of origin to the point of consumption in order to meet some requirements of customers or corporations. The resources managed in logistics can include

physical items, such as food, materials, equipment, liquids, and staff, as well as abstract items, such as time, information, particles, and energy (Kotler, 2000).

Logistics management usually involves the integration of information flow, material handling, production, packaging, inventory, transportation, warehousing, and often security (Gebresenbet & Bosona, 2012). The complexity of logistics can be modeled, analyzed, visualized, and optimized by dedicated simulation software. In business, logistics strategy gives an edge to companies. Businesses are able to reduce cost considerably and speed up deliveries to customers. Distribution can be analyzed in two ways- physical distribution and channels of distribution. Physical distribution refers to the process of moving goods from factory to points of purchase (Ristovska, Kozuharov & Petkovski, 2017). It includes location of plants and warehousing, transportation mode, inventory and packing. The systems concept of physical distribution establishes firm linkages among these component activities.

### **Logistics Management Indicators**

The major logistics and distribution responsibilities include warehousing, inventory management, transportation and logistics information management (Cecilia, 2010).

**Warehousing:** The production of goods happens much earlier than their consumption, as such, the production and consumption cycles are not in synchrony with each other. Owing to this, it becomes necessary for the organization to store the goods until the time that they are ready to be sold. Storage of goods helps organizations to overcome the differences in the needed quantity and timing, ensuring that the products are available just when the consumers need them. It is here that organizations look at the warehousing function (Umair, Zhang, Han & Haq, 2019). As part of the warehousing function, organizations need to decide on how many and what type of warehouses it needs and where.

Generally organizations can opt for two types of warehouses as named below.

- a. **Storage Warehouses:** These are simple warehouses that engage only in storage of goods for moderate to long periods.
- b. **Distribution Centers:** These are warehouses that are designed to move goods rather than only store them. They are highly automated systems. The warehouse has inbuilt automated systems to receive goods from various suppliers, take orders, fill the orders and deliver the goods. As such they perform functions other than just storage of goods (Cecilia, 2010).

**Inventory Management:** Inventory management according to Kotler (2000), involves maintaining sufficient inventory or stocks to suit the customer requirements. Here, there is a trade-off between maintaining too little and too much inventory. With too little stock, there is a risk that the organization may not have the desired goods when the customer needs it. On the other hand, too much stock results in very high inventory carrying costs and stock obsolescence. As such both these aspects need to be delicately balanced. Many organizations today have reduced their inventory carrying costs by adopting just- in-time logistics systems which enable the organization to carry stocks for as little as 3 to 5 days of operations. New stock arrives just when needed, rather than being in the warehouse for a long time. This system however, requires accurate forecasting along with fast, frequent and flexible delivery schedules.

Organizations today are trying to look at new ways of making the inventory management system more efficient by leveraging technology. Use of Radio Frequency Identity (RFID) tags or smart tags embedded in the products has made tracking products very easy. Soon the entire supply chain will be automated and at any given point in time the organization would be able to know where exactly a product is located, "Smart shelves" would not only prompt the time for re-order but also do the reordering automatically.

**Transportation:** This is yet another important aspect of the Marketing Logistics function. Choice of the transportation or carrier not only affect the final price of the product, but also determines the delivery

performance and the condition of the goods on arrival ultimately affecting the customer satisfaction (Cecilia, 2010). In shipping goods, the main modes of transportation that are available to the organizations include

- i. Road Transport.
- ii. Rail Transport.
- iii. Water Transport.
- iv. Air Transport.

Many organizations also use intermodal transport systems, which is a combination of two or more modes of transport. “Piggyback” is the use of rail and trucks, “fishy back” (the use of water and trucks), “train ship” (water and rail), and “air truck” (air and truck) are all used together (Barcik & Jakubiec, 2013). Combining modes of transport helps organizations to maximize on the benefits offered by both the modes. While choosing the mode of transportation, the organization needs to look at speed of delivery, dependability, cost and availability (Cecilia, 2010).

**Logistics Information Management:** Information is a vital aspect of logistics management. Information can be shared as well as managed through a number of sources like the email, telephone or even through electronic data interchange (EDI) which is the computerized exchange of data between organizations (Barcik & Jakubiec, 2013). Here, the organization is connected to the suppliers through computer networks and change in the inventory levels of the organization can be checked by the supplier who can then replenish the stocks (Gregory, Gundlach, Bolumole, Eltantawy & Robert, 2006). Many organizations have their suppliers to generate orders and arrange deliveries for their customers. Such systems are also known as Vendor Managed Inventory (VMI) system or Continuous Inventory Replenishment System. (CIRS).

### **Operational Performance**

Due to the competitive and dynamic nature of today’s business environment, firms compare their performance against rivals. Since successful development of any organization in the present day world is conditioned by flexible reaction on different requirements, it has become necessary to evaluate business performance and try to increase it. Performance in this sense means a business parameter that defines the size, strength, activity, proactiveness, competitive aggressiveness, autonomy and success of an organization (Cooper, Lambert & Pagh, 2013). According to Fugate, Mentzer and Stank (2010), performance is a word that indicates an economy, industry or company’s ability to achieve certain results comparable, on the basis of certain given criteria with the results of other units which are expressible in positive terms. The Oxford learners Dictionary (2010) define performance as an act of performing; of doing something using Knowledge as distinct from merely possessing it and any recognized achievement. Performance can refer to either the ‘ends’ (results) or the ‘means’ (actions) that gave birth to the ends. Business Performance helps firms in determining the relationship between organizations’ marketing activities and its performance. Business performance is significant to business as it seeks to ensure what the customers’ desires are and then directs resources towards fulfilling those needs. Ogonu and Mac-Kingsley (2016) emphasize that business performance embraces a broad spectrum of activities ranging from effectiveness of firms in achieving their goals. The management literature describes business performance as the extent to which business actions have helped the company to achieve its business goals (Wu, Melnyk & Flynn, 2010).

Zhang and Dhaliwal (2009) consider operational performance as the critical evaluation of the business mix of an organization. From customers’ perspective, operational performance measures the degree of success recorded by organizations throughout the entire distribution operations process. Success in achieving operations performance is mainly attributed to top managers in any organization. According to Ogonu and Mac-Kingsley (2016), identifying factors and its impact on the value of performance is an important tool of the management oriented on the growth of company value. Simply put, operational performance relates to success and result of an organization’s operations process, basically measured mainly in terms of costs, quality, flexibility, and delivery (Oyerogba, Olaleye & Solomon, 2014).

**Cost Reduction:** The success of any organization largely depends on how strategically cost is managed compared with that of competitors. It certainly provides competitive advantage which is essential in this hyper competitive market or business world. Cost reduction is a planned positive approach to reduce expenditure. It is a corrective function by continuous process of analysis of costs, functions, etc. for further economy in application of factors of production. The concept of cost reduction is to be understood as the achievement of real and permanent reduction in the unit cost of goods manufactured or services rendered without impairing their suitability for the use intended or diminution in the quality of the product (Cooper, Lambert & Pagh, 2013). Cost reduction according to Oyerogba, Olaleye and Solomon (2014), implies reducing cost associated with production or other cost activities without affecting the quality of product or service as well as activities. Through cost reduction procedures or techniques help managers to reduce cost leading to operational performance.

Adeniji (2000) see cost reduction as a planned positive approach to reduce expenditure. It implies the reduction in unit cost of goods or services without impairing suitability for the use intended. Cost reduction as: (a) Unit cost reduction by expenditure in expect of a given volume of output, and/or Unit cost reduction by an increase in productivity (i.e. an increase in output yield or rate of output) for a given expenditure (Oyerogba, Olaleye & Solomon, 2014). In the views of Basi, (2013), cost reduction is the process whereby permanent savings are made without any reduction in the quantity and/or usefulness of the products. It can be seen as a development attitude of mind, which poses a challenge to all standards with a view to their improvement. Cost reduction scheme should aim specific efforts to reduce costs through improved methods, approaches, work arrangement and reviews.

In planning for cost reduction, Adeniji (2000) noted that cost reduction exercises are planned campaigns to cut expenditure that should preferably be continuous, long-term campaigns, so that short term cost reductions are seen as reversed and forgotten. Generally, cost reduction relates to existing product and the attempt to manufacture at a lower cost through minimizing the material used, changing the design or formula to facilitate manufacture, changing tolerance methods and so on (Basi, 2013). In the opinion of Barcik and Jakubiec (2013), cost reduction tends to find ways to achieve a given result through improved design, better method, and new layout incentive hence, cost results in the establishment of new standards. Cost reduction looks at a department wherein cost incurred aid change its physical features to make it function more efficiently. New material may be installed in a section or department to reduce scrap; employees may be trained more intensively to reduce idle units. These changes in physical working condition, which improve departmental efficiency, are then shown back in a lower cost standard for the department. It means that cost reduction is the term used to describe the planned and positive approach to the improvement of efficiency (Gaurav, Jain, Kapoor & Nateriya, 2013).

Lawal (2017) defined cost reduction as the achievement of real and permanent reduction in the unit cost of goods manufactured or services rendered without damaging the ability of the product to serve the purpose for which it was intended. According to Gaurav, Jain, Kapoor and Nateriya (2013), cost reduction is the way toward searching for, finding and expelling baseless costs from a business to build the benefit without negatively affecting item quality". The concept of continuously searching for new ways and avenue of reducing costs needs to be constantly promoted at all levels of an enterprise, which signifies that the enterprise has a strategic approach to this issue (Figar & Ivanoic, 2015). Cost reduction strategies such as value engineering and value analysis, tight budgetary control (budget discipline), target costing and life cycle costing can be adopted by manufacturing companies to reduce the material cost, labour cost and productivity cost attributed to logistics

Cost reduction is a continuous process of examining critically all elements of cost and each aspect of the business with a view to improving business efficiency. Cost reduction is the process of cutting down costs incurred by an organization for the purpose of making profit. It starts when cost control ends and considers that no cost is at its optimum level. Adeniji (2000) states that cost reduction starts with an assumption that

current cost levels or planned cost levels are too high despite the fact that cost control may be good and organization experiencing high efficiency levels

**Lead Time:** Time is a fundamental phenomenon or unit of measurement. It measures an event or process in seconds, minutes, hours, days, weeks, months or years. Time is therefore a basic and a key measurement of efficiency in almost every organization. The understanding of time by mankind makes it a common unit of measurement and a key performance indicator for every organization (Ramachandran & Neelakrishnan, 2017). Time can be seen as a measure of resources that run the process (Alexander & Wang, 2018). It is also an indicator of resource utilization. According to Lawal (2017), time can be estimated as the effective use of equipment and labor measured in machine hours and man hours respectively (Christopher, 2010). Time has also been suggested to be related to resource saturation when likened with the overall resource availability (Ramachandran & Neelakrishnan, 2017).

In recent times, service providers have focused on time as the basis of competitive advantage to gain customer satisfaction. Organizations are therefore cautioned to minimize the idle times in their operation as a way of improving productivity of available resources. This consequently signifies the significance of lead time or the total order cycle time in organizations nowadays (Christopher, 2010). Lead time is also known as total order cycle time or order to delivery cycle time and has been explained by various authors to mean the time existed from when a customer order is received until the delivery of such customer order (Christopher, 2010). The customer order in question can be a service, raw material, finished goods, or works. According to Lawal (2017), lead time is the amount of time between the placement of an order and the receipts of the goods ordered. It depends on the nature of the product e.g. whether it is made to order or if it is from the shelf product. Lead time also depends on planning and supply chain management, logistics services and of course distance to customers and suppliers.

The lead time is the measure of speed for delivering services. Lead time may be defined as the time elapsed between the initiation and execution of a process. A more conventional definition of lead time in the realm of a service industry is the time from the moment the customer demands a service to the moment it is received by the customer (Christopher, 2010). Figar and Ivanovic (2015) define lead-time as simply, the time between order placement and receipt of the shipment. Adeniji (2000) gives a more detailed explanation of lead-time as the time involved in customer order preparation by the customer, sending/ order communication or placement, order receipt by supplier or provider, order preparation by supplier or provider, shipment, and customer receipt and verification of the receipt as against the placement. In relating Adeniji's definition to the service organization, lead time can be said to consist of the time any customer requires a service and places a request for a service to the service provider, the time spent by the officers at the organization in working on the request, availing necessary resources required to provide the service, and the time spent on any other activity to get the customer request delivered.

Responding to customers' needs on time (with quality, variety and price) is great gain to any organization. A service provider must concentrate on speed (responsiveness) whilst paying close attention to its consequential effects as the basis of competitive advantage. This is so because organizations' innovation, variety and price without timely responsiveness may not necessarily satisfy customers as many services are time based (Christopher, 2010). Lawal expressed that when a company sincerely manages time with continued improvement in service or product quality motive, the principal advantage is mostly shorter cycle time, reduction and faster inventory or service times. Lower overhead cost usually follows, as the cost of dealing with breakdown and delays begins to go down. The consequential effect of lead time management can be rewarding in a form of time reduction, cost reduction and product or service quality which ultimately leads to customer satisfaction (Christopher, 2010).

### **3. Empirical Review**

Logistics distribution and management are important components of supply chain management and they lead to firms overall performance. Ltifi and Jameleddine (2015) investigated the effect of logistics performance on customer satisfaction in the retail store and the results from that study also showed that there is positive relationship between logistics performance and customer satisfaction. Ogonu and Mac-Kingsley (2016) found that inventory management has a strong positive relation with the satisfaction of the customers in the retail super market of Nigeria. Muiga and Patrick (2018) confirmed that there is a positive relationship between transport management and the customer satisfaction. Umair, Zhang, Han and Haq (2019) analyzed the impact of logistics management on the customer satisfaction in the retail stores, in twin Cities of Islamabad and Rawalpindi. The study applied all statistical analysis of correlation and regression. The sample size was 200, and the study was conducted in the twin cities of Islamabad and Rawalpindi. Results of the result indicated the existence of significant and positive relationship between logistics management and customer satisfaction. Ristovska, Kozuharov and Petkovski (2017) analyzed the impact of logistics management practices on company's performance. The study indicators include transportation, warehousing, packaging, inventory and information management, efficiency, effectiveness and cost reduction. The empirical research was conducted on a sample of eighty examinees from eighty different companies in the Republic of Macedonia. The general hypothesis was fully validated and proven by the survey results. Adequate inventory, storage, warehousing, transport and information management were key targets for logistics managers in order to reduce the overall costs of the company. Findings included the confirmation of the necessity of logistics managers to optimally manage all logistics activities in order to gain increased business efficiency, effectiveness and reduced cost. Bagshaw (2019) studied logistics management from firms' performance perspective. This study empirically looked at the relationship between logistics management and performance of 122 selected firms across Rivers State, Nigeria. It focused on logistics management (using the dimension of transportation and physical distribution) on on-time delivery and sales growth. The research framework was examined by empirical analysis of primary data collected through the use of questionnaire, through descriptive research survey method. The outcome of the analysis revealed significant relationship between logistics management and firms' performance.

### **4. Discussions from Literature**

From the literature review, it is evident that logistics and distribution management systems play key role in firms' operational performance. This deduction draws strength from the empirical findings of several studies relating to our study variables. The deduction confirms with the empirical findings of Ltifi and Jameleddine (2015) which investigated the effect of logistics performance on customer satisfaction in the retail store and found that there is positive relationship between logistics performance and customer satisfaction. Also, the deduction agree with the empirical study by Ogonu and Mac-Kingsley (2016) which found that inventory management has a strong positive relation with the satisfaction of the customers in the retail super market of Nigeria. The assertion marries with Patrick (2016) which confirmed that there is a positive relationship between transport management and the customer satisfaction. Further, in line with this study deduction are Umair, Zhang, Han and Haq (2019) which indicated the existence of significant and positive relationship between logistics management and customer satisfaction; Ristovska, Kozuharov and Petkovski (2017) which confirmed the necessity of logistics managers to optimally manage all logistics activities in order to gain increased business efficiency, effectiveness and reduced cost and Bagshaw (2019) which revealed significant relationship between logistics management and firms' performance.

### **5. Conclusion and Recommendations**

The role of logistics and distribution management systems in improving operational performance among supply chains cannot be over emphasized and is backed with sufficient empirical literature. This study carefully reviewed literature on the subject matter of logistics and distribution management. From the literature, it is evidential that logistics and distribution management systems are fundamentals for improved operational performance regardless of any industry. Based on the reviewed literature, this study concludes that logistics

management has significant impact on operational performance of oil exploration companies in Rivers State. Based on this conclusion, this paper encourages oil exploration companies to seek in-depth knowledge of logistics management in the quest for improved performance in operations. Knowledge of the pivot role of distribution management can help oil exploration companies in their delivery of cost effective and timely production.

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