

Impact of Transportation System on Logistics and Supply Operations in the Petroleum Downstream Sector in Nigeria

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Abstract: *Logistics and supply operations in the petroleum downstream sector involves the application of transportation system for products to get to the consumers. This study discusses how transportation system impacts logistics and supply chain operations in the petroleum downstream sector in Nigeria. The theory for the study is Resource-Based View theory. Research design was historical and descriptive based on secondary data. The study found out that petroleum industry logistics management involves a lot of activities, which include demand forecasting, facility site selection, procurement management, material management, packaging, warehousing management, inventory management, order processing, logistics communications, transportation management, and reverse logistics. The study concludes that the challenges of the petroleum products logistics and supply chain operations in the Nigeria have also created problems such as increasing cost of product distribution by oil marketing companies and frequent pump price adjustments by the government which oftentimes lead to industrial strikes by trade unions in the downstream sector. The study among other things recommends that the petroleum business operators both private depot owners and marketers should be involved in all segments of the supply value chain like vessels, bulk storage, transportation, and retailing in order to create economies of scale and efficiency in the industry.*

Keywords: Transportation, Logistics, Supply operations, Oil and gas industry, Petroleum downstream

1. Introduction

Transportation occupies one-third of the amount in the logistics costs and transportation systems influence the performance of logistics system hugely. Transporting is required in the whole production procedures, from manufacturing to delivery to the final consumers and returns (Tseng, Yue & Taylor, 2005). Due to the trend of globalization in recent decades, the influence of transportation system on logistics operations cannot be overemphasised. One important element of logistics is transport, which connects the separated activities. In petroleum downstream logistics, transport is required in the whole production procedures, from oil and gas fields, processing and treatment, distribution and delivery to the final consumers who are also referred to as off takers (Yakubu-Wokili, 2011).

The operation of transportation determines the efficiency of moving products. The progress in techniques and management principles improves the moving load, delivery speed, service quality, operation costs, the usage of facilities and energy saving. Transportation takes a crucial part in the manipulation of logistic. Reviewing the current condition, a strong system needs a clear frame of logistics and a proper transport implements and techniques to link the producing procedures (Sreeniv & Srinivas, n.d.).

Transportation is an important aspect in the distribution and retailing of petroleum products. This is because the locations of petroleum products production are usually far from the final consumers (Ikporukpo, 1977). An efficient and effective logistics is a function of how well the transport system is structured considering issues such as precision, cost, just-in-time, frequency, distance and time (Jespersen et al., 2004). Therefore, efficient transportation systems are strategically important for effective distribution and retailing of petroleum products. Transportation is crucial for the distribution and retailing of petroleum products for consumption (Adenigbo, Balogun, Olisa & Arigbede, 2017). The objective of the study is to explain the impact of transportation system in logistics and supply operations in the Nigerian petroleum downstream sector.

2.1. Conceptual Clarifications

2.1.1. Transportation: Transportation is derived from the Latin word 'trans' meaning across and 'portare' meaning to carry. It creates time utility, which is getting a product to a destination on time and space utility which is the optimal utilization of space available for to carry large volumes of goods at a low cost. For instance, if a finished product is not moved to the market at the right time, it ceases to have value. In other words, transportation is basically the movement of goods, people and services as well as information from one location to another (Ajiboye, n.d.). Transportation is the movement of people, goods, services and information from one geographical location to another through a specific mean or means for a particular purpose (Ajiboye, 1995).

2.1.2. Transport Management: Transport management is the technique, practice or science of controlling, planning, developing and maintaining adequate transport services that meet the individual and corporate needs. It is also the process of ensuring that people, freight services and information are delivered to the right place, at the right time and at the right price according to

(Ajiboye, 2007; Nnadi, 2008). The Council of Logistics Management in United States of America (2003) sees transport management as the art of managing inventory in motion for delivery to the right place, at the right time and in the right condition, choosing the right equipment and in the right direction while it encompasses management of inbound and outbound transportation. In broad terms, it also consists of the management of areas such as shipment scheduling, routing, freight cost management, shipment tracking and parcel management in optimal way.

However, Ajiboye (2007) observes that the main objective of transport management is to provide a functional and sustainable transport services for the nation and this has to be done by providing a consistent general approach and realistic guide for the operation of transport sector which is described as the engine of the nation's economic growth and development.

2.1.3. Logistics: The Council of Logistics Management (CILM) of United States of America (1998) defines logistics as the process of planning, implementing and controlling the efficient, effective flow of storage of goods, services and related information from point of origin to point of consumption for the purpose of conforming to customer requirements. The Canadian Association of Logistics Management (1998) sees logistics as the process of planning, implementing, and controlling the efficient, cost effective flow and storage of raw materials, in-process inventory, finished goods and related information from point of origin to point of consumption for the purpose of meeting customer requirements. In summary logistics is often referred to as supply chain management and focuses on the management and control of goods between people, companies and organizations.

Council of Logistics Management (1991) defines logistics as part of the supply chain process 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. Tilanus (1997) sees logistics as the process of anticipating customer needs and wants; acquiring the capital, materials, people, technologies, and information necessary to meet those needs and wants; optimising the goods- or service-producing network to fulfil customer requests; and utilizing the network to fulfil customer requests in a timely way.

2.1.4. Supply Chain: The supply chain is defined according to Hugos (2011) as all stages involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturers and suppliers, but also transporters, warehouse, retailers, and customers themselves. Desouza et al., (2003) explain supply chain as a complex network of organisations covering both on the upstream side including tiers of suppliers and on the downstream side including a network of customer companies, retailers, and financial consumers. Dershin (2000) claims that the supply chain is the 'mother of all processes' because of the nature of its size, scope, and complexity, nearly all the processes in the supply chain are not under control.

2.1.6. Supply Chain Management: Supply chain management has been "The delivery of enhanced customer and economic value through synchronised management of the flow of physical goods and associated information from sourcing to consumption" (LaLonde & Innis, 1994, p. 78). According to Supply Chain Resources Cooperative (2017), SCM is the active management of supply chain activities to maximize customer value and achieve a sustainable competitive advantage.

2.1.7. Downstream Operations: This is a term commonly used to refer to the refining of crude oil and the selling and distribution of natural gas and products derived from crude oil. Such products include liquefied petroleum gas (LPG), liquefied natural gas (LNG) gasoline or petrol, jet fuel, diesel oil, other fuel oils, asphalt and petroleum coke (DNV GL, 2017).

2.1.8. Logistics: USAID Deliver Project (2011) defines logistics as: "...the operation component of the supply chain management, including quantification, procurement, inventory management transportation and fleet management, and data collection and reporting". Heskett, Galskowsky, and Ivie (1973) refer to logistics as "...the management of all activities which facilitate movement and the co-ordination of supply and demand in the creation of time and place utility". Meanwhile, Christopher (2011, p. 2) says that logistics is "the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory through the organisation and its marketing channels in such a way that current and future profitability are maximised through the cost-effective fulfilment of orders". Logistics operations are usually related operations that occur within a company boundary whereas the supply chain represents a network of companies (DNV GL, 2017).

2.1.9. Logistics Management: According to the definition of the Council of Supply Management Professionals (2011), logistics management is "...the part of the supply chain management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of goods, services and related information between point of origin and the point of consumption in order to meet customers' requirements." Furthermore, logistics management is an integrating function that coordinates and optimizes all logistics activities, as well as integrates logistics activities with other functions including marketing, sales manufacturing, finance, and information technology (CSCMP, 2011).

2.1.10. Petroleum Downstream: For the purpose of this study, I will define petroleum downstream as the activities which take place between the purchase of crude oil and the use of the oil products by the end consumer. This covers transporting the crude oil,

performing supply and trading activities, refining the crude oil, and distributing and marketing the refined products output. According to Manzano (2005), the downstream portion of the oil and gas industry includes all the key functions, which include crude oil acquisition and transportation, refining, supply and bulk distribution, and marketing (retailing, distribution, and terminals/wholesalers).

2.2. Empirical Review

2.2.1. The Historical Background of Nigerian Petroleum Industry

Nigeria for one is a beneficiary of nature's lavish generosity. We have oil the ever flowing black gold. This natural bounty, like sea "never dries as far as it is maintained and promptly tapped. The country's first barrel of crude oil made its uncertain entry into the world market. It was largely an event unnoticed, but with it, Nigeria put a knife to reap that bound to the stake of the dollars" (Okpai, 1988, p. 1). The petroleum dollar brought from oil came quickly on the level of oil prospecting venture which made its depot in Nigeria in 1956, shortly after the ever flowing black gold was discovered. For the refinement of the oil, the Nigerian petroleum refinery company was gingerly established in 1965 and with pilot agency – the Nigerian National Petroleum Corporation (NNPC) and its auxiliary units founded in Port Harcourt, Kaduna and Warri (Alege, 1996).

Shell BP a foreign conglomerate blazed the trail among the oil companies in having share in our crude. It has 50% share while Nigeria has 50% other companies like Chevron, Agip, Elf, African Petroleum, Texaco, Total, Unipetrol, Mobil and even individual companies followed suit, albeit on lesser percentages. Many barrels of oil are mined and sold per day getting millions of dollars for country on daily basis. Everyone knows that the nation made huge investment in trying to make petroleum products available everywhere in Nigeria easily and at all time (Alake, 1998).

In the last two decades, petroleum industry has occupied strategic importance in the Nigerian economy accounting for as high as 78 percent of Gross Domestic Product (GDP) and up to 90 percent of the country's total annual revenue and foreign exchange earnings. The petroleum industry can be classified by type of actors or by sector. The actors in the Nigerian industry consist of both private and public organizations. The public actors are the government agents and functionaries such as the Nigerian National Petroleum Corporation (NNPC) and its subsidiaries, the Department of Petroleum Resources (DPR), the Petroleum Products Pricing Regulatory Authority (PPPRA), among others. The private segment consists of both indigenous and foreign actors (Ehinomen & Adeleke, 2012).

2.2.2. Nigerian Downstream Oil and Gas Sector

The Nigerian oil and gas industry consists of the upstream sector, the midstream sector, and the downstream sector (Aminu & Olawore, 2014; NNPC, 2016). The upstream industry is the sector charged with exploration, exploitation, and production of crude oil. The midstream sector is responsible for refining and storage of products. The downstream sector's activities involve marketing, distribution, and transportation of refined petroleum products from the refineries or import jetties to retail outlets or points of consumption (Osuala, 2013).

The downstream industry powers the Nigerian economy through provision of products for transportation and energy, employment generation, and wealth creation (Aminu & Olawore, 2014). Because of mismanagement and misallocation of resources, the Nigerian oil and gas downstream sector has not lived up to expectation (Ambituuni et al., 2014; Gonzalez, 2016; Okwanya et al., 2015). The sector experienced gross inefficiencies, which crippled business development through the nation (Chigbu et al., 2016; Osuala, 2013). Nigerian downstream petroleum inefficiencies include a perennial shortage of refined petroleum products, product diversion, product adulteration, abnormal product subsidy, underutilized refineries, refinery sabotage, pipeline breakage, product theft, corruption, and sharp practices in retail outlets (Adelabu, 2012; Chigbu et al., 2016; Osuala, 2013).

Nigeria has 4 refineries (Port-Harcourt I & II, Kaduna & Warri) with total installed capacity of 445,000 barrels per day including 2 offshore jetties and 4 inland jetties as well as over 90 tank farms with wide-ranging storage capacities being operated by different oil marketing companies to cater for domestic consumption of refined petroleum products (Nigerian House of Representatives [HOR], 2012, p. 51). In addition, there are networks of 5,120 kilometers of pipelines (consisting of multi-product pipelines and crude oil pipelines), 23 strategic depots, and 24 pump stations installed to facilitate petroleum products distribution across the country (Alaba & Agbalajobi, 2014, p.119; Okoli & Orinya 2013, p. 68).

However, the Nigerian petroleum industry is confronted with several challenges. While the upstream sector of the industry faces challenges such as pipeline vandalism and oil exploration disturbances, the downstream sector is equally menaced by lack of maintenance of the refineries resulting in low refining activities for the domestic market, pipeline vandalism, poor maintenance of pipelines and depots, poor transportation infrastructure for the physical distribution of petroleum products to end-users. The challenges in the downstream sector affect the petroleum products supply chain with the resultant effects of perennial shortages of products and the antecedent long queues at retail stations across the country. The scarcity of petroleum products has a long history of supply disruptions (Tanimowo, 2014).

The downstream sector of the petroleum industry which forms the basis of this study is characterized by such activities as: Gas treatment, crude oil and gas conversion into refined and petrol chemical product, and transportation and distribution of refined products. In the downstream sector, activities are progressively falling within the control of private entrepreneurs, especially the indigenous independent marketers (Ehinomen & Adeleke, 2012).

2.3. Theoretical Review: The Resource - Based View Theory

In the Resource Based View (RBV); only a few scholars have applied the theory in the area of supply chain management as a mean of gaining competitive advantage in their study. Competitive advantages can be achieved through SCM based on RBV theory (Lewis, 2000; Carr & Pearson, 2002). The RBV deals with competitive advantages related to the firm's possession of heterogeneous resources which encompasses financial, physical, human, technological, organizational, and reputational capabilities (Halldorsson, Kotzab & Skjott-Larson, 2007).

The RBV of the firm regards the firm as a collection of resources and capabilities that may culminate in enhanced performance (Barney, 1991). Resources, which may be tangible (e.g., technology) or intangible (e.g., knowledge), and may be combined to create capabilities that determine how firms react to various internal and external threats and opportunities (Wernerfelt, 1984). The RBV theory examines the impact of organization resources and capabilities on competitive advantage that leads to overall organizational performance.

Based on Ray et al.'s (2004) study, the resources and capabilities that are not conditioned into sustaining activities and business processes will not have positive impact on an organizational performance. Capacity and resource management is one of the SCM practices dimension studied in this framework. Baltacioglu, Ada, Kaplan, Yurt, and Kaplan (2007), in their view see capacity and resource management as management capacity and resources of service that are organized effectively and operated efficiently at optimal level.

Therefore, by integrating RBV theory into this study's framework, service SCM practices for petroleum downstream companies should have positive impact on the organizational performance if the resources and capabilities are conditioned into sustaining SCM practices (Okanda, Namusonge, & Waiganjo, 2016).

3. Methodology

The methodology adopted in gathering data for this study was secondary (indirect) sources. Hence, there was an extensive study of textbooks, newspapers, magazines, journals, periodicals, internet and any other documented materials that treat the subject matter of this study or/and other related topics. Adequate research, review and evaluation of literature relevant to and consistent with the topic and objective of this study was adopted to gather data. This is aimed at providing insight to the understanding of the operational terms/concepts and/or keywords of the study, making out what has been done, and areas of attention about the study. A combination of descriptive and narrative research design was used.

4. Results and Discussion

4.1. Logistics Management in the Petroleum Industry

One of the first writers is Sear that focused attention on the logistics in the petroleum industries supply chain, who developed a linear programming model that investigated planning in one downstream company (Sear, 1993). Petroleum industry logistics management involves a lot of activities, which include demand forecasting, facility site selection, procurement, materials management, packaging, warehousing management, inventory management, order processing, logistics communications, transportation management, and reverse logistics. These logistics management activities are involved in the flow of goods and information between place of origin and place of consumption (Ballou, 2004; Murphy & Wood, 2004; Grant, Lambert, Stock & Ellram, 2006; Bowersox, Closs & Cooper, 2007; Pienaar, 2010b).

Petroleum Industry is marked by the huge spatial demand and provide gaps. The mother of all crude merchandise, the crude, happens in abundance within the areas wherever the demand isn't high, so is transported to huge distances where it is refined and converted to consumable products. The logistics cost becomes quite significant.

Logistics is actually the walk property between the Petroleum Products Marketers and therefore the distributor and is accomplished through road. The mode of transportation is flexible to the extent that the supplies can be made in the remotest parts of the country. However, the tank trucks utilized in transportation square measure dedicated to the actual class of merchandise and can't be used for alternative merchandise. The secondary supply involves choice of storage depots for every market, choice of carriers, range of tank trucks, capacities of tank trucks to be narrowed and day to day planning and scheduling. The Petroleum

Products Marketers make contractual planning with the transporters and retailers providing pay in the form of carrying bills and commissions respectively (Ruthramathi, 2019).

While writing on the cost elements of the logistics in the petroleum industry Joshi, Haghnegahdar, Anika, and Singh (2019, p. 4) observe that “the logistics of petroleum products account for a major part of the costs incurred by the oil and gas industries. The products, which are obtained as output from the refineries, have very high transportation cost to reach the service channels before they are available to customers. This results into a high price commodity for the consumers.”

Oil logistics include transportation of crude oil from the production sites to refineries as well as transportation and distribution of oil products to the customers. Oil tankers serve the majority of the international trade of crude oil and oil products while pipelines are mostly used for domestic transportation. Rail and trucks are also used for short-distance oil transportation. Larger tankers usually carry crude oil while smaller tankers carry refined petroleum products. Oil tankers are mainly equipped with diesel propulsion. Large tankers use less fuel per km, hence emit less CO₂ compared to smaller tankers. As for pipeline transportation, crude oil is usually piped to refineries and oil products to large customers and distributors. The energy required for pipeline transportation depends inter alia on volumes, pipeline diameter and oil quality. Oil can be stored in land-based tanks and on-board oil tankers for either energy security reasons and profit purposes, the latter based on short-term variations of the oil price (IEA ETSAP, 2011).

Oil logistics includes typically transportation of crude oil from the production sites to refineries as well as transportation and distribution of oil products to markets and customers. Oil logistics accounted for between 5% and 10% of the oil market value in 2005 (Logistics Insights Asia, 2008). However, its share of the total oil market declines with increasing oil prices. Technologies for “open-sea” transportation include oil tankers and pipelines, while land transportation is mainly based on pipelines, trains and trucks (for distribution). The majority of international trade is based on open-sea transportation by tankers while pipelines are more used for domestic transportation. The international trade of oil has increased significantly during the last decades and in 2009 has reached the level of 52,930 kilo barrels per day (kb/d). The Middle East was the largest exporting region, with 18,425 kb/d, i.e. 16,510 kb/d of crude oil and 1915 kb/d of oil products (BP Statistical Review of World Energy, June 2010).

In natural gas logistics - Quantity (volume) and distance are key elements to determine the most suitable and profitable transportation technology for natural gas. For larger volumes pipeline transport is profitable for short to medium distances and liquefied natural gas (LNG) – which has 600 times smaller volume compared to natural gas in gaseous phase - is profitable for larger distances. Several competing technologies including electricity production and compressed natural gas are suitable for small volumes. The LNG technology includes natural gas liquefaction, shipping by fleets, and regasification of natural gas at the receiving terminals. The natural gas is then delivered onshore by e.g. pipelines and distribution networks. The cost of the liquefaction plant has decreased significantly during the past decades due to improved technology and increased plant size. LNG fleets are traditionally fuelled with heavy fuel oil, however diesel propulsion has become more common during the past years. Natural gas can be stored underground and on-board LNG fleets for either energy security and commercial purposes ((IEA ETSAP, 2011).

5. Conclusion and Recommendations

The challenges of the petroleum products logistics and supply chain operations in the Nigeria have also created problems such as increasing cost of product distribution by oil marketing companies and frequent pump price adjustments by the government which oftentimes lead to industrial strikes by trade unions in the downstream sector. The supply and distribution chain thus presents a problem of product availability to consumers. This study therefore, recommends that oil and gas products marketing companies should strengthen their integrated logistics and supply management coupled with effective transportation system through training and retraining on regular basis of their personnel. They should also respond to technological changes in supply chain for effective and timely delivery of products.

It is further recommended that the petroleum business operators both private depot owners and marketers should be involved in all segments of the supply value chain like vessels, bulk storage, transportation, and retailing in order to create economies of scale and efficiency in the industry.

References

Adelabu, N. S. (2012). The political economy of oil deregulation in Nigeria’s fourth republic: Prospects and challenges. *Journal of Emerging Trends in Educational Research and Policy Studies*, 3, 193-198. Retrieved from www.jeteraps.scholarlinkresearch.org

- Adenigbo, J. A., Balogun, T. G., Olisa, T., & Arigbode, O. O. (2017). Transportation Challenges of Retailing Petroleum Products in Akure, Nigeria. *JORIND* 15(1) June. Retrieved from www.transcampus.org/journal; www.ajol.info/journals/jorind
- Ajiboye, A. O. (n.d.). Transport and Logistics Management Education in Nigeria: An Enlightenment and Education Approach
- Ajiboye, A. O. (1995). Transportation and distribution of agricultural products: A case study of kolanut production in Remo land, Ogun State. Unpublished M.Sc Thesis, Centre for Transport Studies, Ogun State University, Ago Iwoye.
- Ajiboye, A. O. (2007). Opportunities and challenges in the field of transport and logistics management in Nigeria. In Nnadi, K. U., & Ogwude I. C. (Eds). *Transport in Nigeria - Economics, Management Policy*. Owerri: Reliable Publishers. Pp 49-73.
- Alaba, O. C., & Agbalajobi, S. A. (2014). Evaluation of private refineries and depots in distribution of petroleum products in Nigeria. Retrieved from: http://iet-journals.org/archive/2014/feb_vol_4_no_2/193621372781651.pdf
- Alake, D. (Tuesday, 19th March, 1998) fuel scarcity the shame of a nation, Lagos: National concord
- Alege, G. O. (1996). Petroleum products marketing in Nigeria. Lagos: NNPC Journals
- Ambituuni, A., Amezaga, J., & Emeseh, E. (2014). Analysis of safety and environmental regulations for downstream petroleum industry operations in Nigeria: Problems and prospects. *Environmental Development*, 9, 43-60. doi:10.1016/j.envdev.2013.12.002
- Aminu, S. A., & Olawore, O. P. (2014). Empirical investigation of challenges of distribution of premium motor spirit (PMS) in federal capital territory (FCT), Abuja and environs, Nigeria. *International Journal of Management Sciences and Humanities*, 2(2); 11-38.
- Baltacioglu, T., Ada, E., Kaplan, M. D., Yurt, O., & Kaplan, Y. C. (2007). A new framework for service supply chains. *The Service Industries Journal*, 27(2), 105-124.
- Ballou, R. H. (2004). *Business logistics/supply chain management* (5th edition). Upper Saddle River: Pearson Prentice Hall.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17, 99-120. doi:10.1177/014920639101700108
- Bowersox, D. J., Closs, D. J., & Cooper, M. B. (2007). *Supply chain logistics management* (2nd edition). New York: McGraw-Hill.
- BP Statistical Review of World Energy, June 2010.
- Carr, A., & Pearson, J. (2002). The Impact of Purchasing and Supplier Involvement on Strategic Purchasing and its Impact on a Firm's Performance. *International Journal of Operations & Production Management*. 22(9/10):32-53
- Chigbu, U. S., Ubah, C. P., & Chigbu, E. E. (2016). Deregulation of the petroleum downstream sector and Nigerian economy: An econometric investigation. *International Journal of Business and Applied Social Science*, 2 (9), 16-27. Retrieved from www.ijbassnet.com
- Council of Logistics Management (1991). Definition of Logistics. Retrieved from <http://www.cscmp.org/>.
- CILM (1998). Opportunities in logistics management: A publication of the council of logistics management of United States of America. Retrieved from <http://www.clm1.org/mission.html>.
- Dershin, H. (2000). Business process design-completing the DNA. *Supply Chain Management Review* 4 (2), pp. 74 – 82.
- Desouza, K., Chattaraj, A., & Kraft, G. (2003). Supply chain perspective to knowledge management: research propositions. *Journal of Knowledge Management* 7 (3), 129 -138.
- DNV GL (2017). Evaluation of the effect of different logistic conditions applied to oil supply chain. *Whitepaper on Transport Logistics*
- Ehinomen, C., & Adeleke, A. (2012). An assessment of the distribution of petroleum products in Nigeria. *E3 Journal of Business Management and Economics*, Vol. 3(6). pp. 232-241, June. Retrieved from <http://www.e3journals.org>
- Gonzalez, A. (2016). Poverty, oil and corruption: The need for a quad-sector development partnership (QSDP) in Nigeria's Niger Delta. *Development Policy Review*. 34, 509-538. doi: 10.1111/dpr.12164
- Grant, D. B., Lambert, D. M., Stock, J. R., & Ellram, L. M. (2006). *The fundamentals of logistics management* (European edition). Berkshire: McGraw-Hill.
- Halldorsson, A., Kotzab, J., & Skjøtt-Larsen, T. (2007). Compliment Theory of Supply Chain Management. *International Journal of Supply Chain Management*. 12(4):284-296.
- Hugos, M. H. (2011). *Essentials of Logistics and Supply Chain Management*. 3rd ed. s.l.: John Wiley & Sons.
- Ikporukpo, C. O. (1977). Spatial structure and efficiency in physical distribution system: a case study of the Nigerian Gasoline Industry, Unpublished Ph.D Thesis; University of Ibadan, Ibadan.
- IEA ETSAP (2011). Oil and Natural Gas Logistics. *Technology Brief P03*, 201. Retrieved from www.etsap.org
- Jespersen, P. H., & Nielsen, L. D. (2004). Logistics and transport-a conceptual model. *World Transport Policy and Practice*, vol.10, no.3, 6-11.
- Lewis, M. (2000). Lean Production and Sustainable Competitive Advantage. *International Journal of Operations & Production Management*. 20(8):59-78.

- Logistics Insights Asia (2008). Oil and gas logistics. Retrieved from [http://www.logasiamag.com /article-987-oilgaslogistics-LogisticsAsia.html](http://www.logasiamag.com/article-987-oilgaslogistics-LogisticsAsia.html)
- Manzano, F. S. (2005). Supply Chain Practices in the Petroleum Downstream. M.Engr., Thesis to the Engineering Systems Division, Massachusetts Institute of Technology.
- Murphy, P. R., & Wood, D. F. (2004). Contemporary logistics (8th edition). Upper Saddle River: Pearson Prentice Hall.
- Nnadi, K. U. (2008). A travelogue of human capital development in the transport and logistics industry. A paper presented at a National Workshop on Train the Trainers in Transport and Logistics Industry, organized by CILT at Precious Palm Royal Hotel Benin between 18th and 19th June.
- Nigeria, House of Representatives. (2012). Report of the ad-hoc committee to verify and determine the actual subsidy requirements and monitor the implementation of the subsidy regime in Nigeria: Resolution no. (HR.1/2012). Retrieved from <http://www.channelstv.com/2012/04/21/full-report-of-the-ad-hoc-committee-on-the-subsidy-regime-in-nigeria>
- Nigerian National Petroleum Corporation (NNPC) (2016). Profile/products. Retrieved from www.nnpcgroup.com
- Okanda, S., Namusonge, G. S., & Waiganjo, E. (2016). Inventory Management Practice and the Performance of the Unit of Vaccines and Immunizations in the Ministry Health, Kenya. *International Journal of Academic Research in Business and Social Sciences*, Vol. 6, No. 7.
- Okoli, A. I., & Orinya, S. (2013). Oil pipeline vandalism and Nigeria's national security. Retrieved from: https://globaljournals.org/GJHSS_Volume13/7-Oil-Pipeline-Vandalism-and-Nigerias.pdf
- Okwanya, I., Moses, O., & Pristine, J. M. (2015). An Assessment of the impact of petroleum subsidy on consumer price index in Nigeria. *Global Journal of Interdisciplinary Social Sciences*, 4(1), 36-39. Retrieved from www.gifre.org
- Osuala, U. S. (2013). The sublimeness of sleaze in the NNPC in the fourth republic, 1999–2007: A historical conspectus. *Journal of Culture, Society and Development*, 2, 52-59. Retrieved from www.iiste.org/journals/index.php/JCSD Supply Management, 11(1); 1-13.
- Pienaar, W. J. (1998). Report to Petronet on the development of a defensible pricing mechanism. Contract report produced for Petronet. Stellenbosch: Department of Logistics, Stellenbosch University.
- Ruthramathi, R. (2019). Logistics in Petroleum Industry: Overview and Challenges. *Journal of Emerging Technologies and Innovative Research (JETIR)*, April, Volume 6, Issue 4. Retrieved from www.jetir.org
- Tanimowo, O. (2014). An assessment of downstream petroleum supply chain effectiveness: a case of petroleum products supply and distribution in Nigeria.
- Tilanus, B. (1997). Information Systems in Logistics and Transportation. Elsevier Science Ltd., UK.
- Tseng, Y., Yue, W. L., & Taylor, M. A. P. (2005). The Role of Transportation in Logistics Chain *Proceedings of the Eastern Asia Society for Transportation Studies*, Vol. 5, pp. 1657 - 1672.
- Sear, T. (1993). Logistics planning in the downstream oil industry. *Journal of the Operational Research Society*, 44(1), 9-17.
- Sreenivs, M., & Srinivas, T. (n.d.). The Role of Transportation in Logistics
- Yakubu-Wokili, H. (2011). The Relevance of Transport in Gas Logistics in Nigeria. 2011 *International Conference on Environment and BioScience IPCBEE* Vol.2.