COMPARATIVE ANALYSIS OF PETROLEUM PRODUCTS HAULAGE FROM KADUNA REFINERY, KADUNA STATE, NIGERIA

By

[a] Obasanjo, O. T. and [b] Ubogu, A. E.

[a] Department of Geography, Ahmadu Bello University, Zaria, Kaduna state, Nigeria.

[b] Department of Geography, Federal University, Dutsinma ,Katsina state, Nigeria

ABSTRACT

Efficient and effective logistics is a function of how well the transport system is structured, considering issues such as precision, just-in-time, frequency, distance, time and cost which contributes immensely to the growth and prosperity of a nation. This study compares the cost and time of transporting petroleum products by three modes from Kaduna refinery to selected locations in northern Nigeria. Data are obtained from both primary and secondary sources. Data were obtained from tanker drivers using systematic sampling techniques. In all, 182 respondents were sampled. The results indicate that pipeline transport is the most cost-effective mode of hauling petroleum products from the refinery to all the locations under consideration. The result further reveals that there is a statistically significant difference in the cost of petroleum haulage by paired intermodal road-pipeline, t= 4.902, p = 0.004; road-rail, t = 3.815, p = 0.012 and rail-pipeline, 4.744, p = 0.005. Similarly, the time taken to haul petroleum products from the refinery to all the location by paired intermodal rail- road; road- pipeline and rail-pipeline were also statistically significant using student t-test statistics. The adoption of pipeline transport as the major means of transporting petroleum products could save up to 95 percent of the haulage cost compared to road transport, while compared to rail transport; it is up to 40 percent. It is on the basis of this finding that the study recommends an effective improvement and adoption of pipeline transport as the major mode of transporting petroleum products in the region.

Key words: Petroleum products, Haulage, Kaduna refinery, Pipeline, road, rail

INTRODUCTION

Transportation is important in the distribution of petroleum products as the production centres are usually far from consumption areas. A large proportion of the world's refineries are located far from the market. The fluidity of petroleum products makes it amendable to transportation by any agency capable of removing a liquid from one place to another by trucks, railroads, ships and pipeline (Ikporukpo, 1977). According to Coyle *et al* (2003), transport is like a physical tread that connects firms that are geographically dispersed. The transportation link allows the flow of goods between the various fixed points from the points of production to the points of consumption. Ballou (2004) noted that inexpensive, high quality transportation also encourages an indirect form of competition by making goods available to a market that normally could not withstand the high cost of transportation. This is an important factor, especially in determining the affordability of goods and services. In order to develop a good distribution network, transport systems such as modes of transport, delivery operation, and route scheduling are all important factors that need to be considered (Rushton *et al*, 2000). An efficient and effective logistics is a function of how well the transport system is structured, when issues such as precision, just-in-time, frequency, distance and time are considered (Jespersen and Nielsen,

2004). Therefore, transportation decisions such as mode choice decisions are strategically important for effective logistics and supply chain operation.

The various modes of transporting petroleum products complement each other on numerous occasions, although in some cases they stand in competition against each other. The two main modes that are used for long distance transportation of petroleum are pipeline and water transport, while rail and road may become highly advantageous when relatively short distances are involved. Road transport forms the major linkage between the depots and the bulk consumers and retails outlets (filing stations and warehouse) to the petty consumers. The cost per unit of transporting the products by road depends both on the road tanker vehicles in use and the marketers (Oyesiku and Obadimeji, 1998).

Crude petroleum is the most significant mineral resource in Nigeria. It accounts for over 95 percent of export earnings and about 85 percent of government revenues than any other mineral or product. The country's oil reserves as at 2010 was 31 billion barrels (Economic Confidence, 2012), while gas reserves was estimated to be 260 trillion standard cubic feet with the country's oil production put at 2.5 million barrels per day (NNPC, 2012). In Nigeria, about 80% of inter-regional petroleum movements are transported by road and there has been a steady growth in the number of road tanker vehicles. It is estimated that about 5,000 tankers are involved in wet cargo haulage in Nigeria, moving 150 million litres of Premium Motor Spirit (PMS) on Nigerian roads daily. However, bad roads, poor road networks and also various hindrances such as delays at police and customs check points obstructs an effective and efficient logistics (Olagunju, 2011). Since the collapse of the rail system in Nigeria, road haulage has assumed a wider dimension and has become the most utilized way of inter-regional movement of goods and services, which has also led to the inflation of transport cost.

However, several studies (Nnadi, 2006; Nnadi and Cmilt, 2007 Abdulmalik and Omokoghio, 2009) on petroleum products movement have been conducted from different dimension. For instance, the works of Nnadi, (2006) and Nnadi and Cmilt, (2007) provided an econometric analysis of domestic transportation of refined petroleum products by concluding that rail, road and pipeline are basically of equal inportance in the carriage of white products. Similarly, the study of Onwioduokit and Adenuga (2000) outlined the implications of urbanization on the distribution of petroleum products in Nigeria. Such factors include gross domestic product (GDP), proportion of urban population, contribution and contribution of services to GDP. Abdulmalik and Omokoghio, (2009) identified the factor of short deliveries as a constraint in the transportation of petroleum products using road haulage system.

As is the case elsewhere, for instance, the United States of America, the pipeline is by far the most important mode of domestic transportation of both crude and refined petroleum products. According to the American Association of Oil pipelines (AOPL) (1998), of a total oil transport of 6,400 billion board miles (BBM), rail account for 2%, trucks 3%, water carriers 27% and pipelines 68%. The distribution is attributed to comparative cost economics of each mode. AOPL states that oil pipeline shipments account for more than 17% of the total freight moved nationally in the US but less than 2% of the national freight cost. To further highlight the advantages of the pipeline in domestic oil transportation, it is estimated that if each truck holds 200 barrels and can travel 500 miles a day, it would take a fleet of 3000 trucks, with a truck arriving and unloading every 2 minute, to replace a 150,000 barrel per day, 1000 mile pipeline (Tyndall, *et al*, 1998).

An efficient transport ought to have the capacity to carry high quantities of products over a period of time. Overall, the capacity of a given mode of transport determines the multiplying

result of product quantity it can carry based on time. Timeliness is a major determinant of an efficient transport system that improves profits; product quality and delivery time as well as reduce inventory level and cost. Timeliness ensures that a product gets to the right place at the right time. A good measure of safety in transport system is the degree to which transport mode is involved in accident. A reliable and efficient transport system is as good as the safety it provides to products that it handles. Examining the costs implications for infrastructural and service provision of transport modes, it is obvious that the cost of construction, maintenance and operation of pipeline transport is cheaper than rail and road transport. In spite of this advantage, pipeline system has not been adopted in hauling petroleum products to major towns and cities in northern Nigeria in particular and Nigeria in general.

Unfortunately, road transport dominates the haulage of petroleum products in Nigeria. One of the major aspect that has been missing from the studies in Nigeria earlier mentioned has been the neglect of cost and time involved in the transportation of petroleum products by road, rail and pipeline. Indeed, a comparative analysis of cost and time of transporting petroleum products has received only limited coverage in the works often cited on petroleum products transportation. The fundamental purpose of this paper is to comparatively analyze the cost and time involved in the transportation of petroleum products from Kaduna refinery to six locations in northern Nigeria linked by three modes of transportation. The objectives of this study are to determine and compare the difference in costs and time taken to haul petroleum products from the refinery to the six locations in northern Nigeria by road, rail and pipeline. It is also to compare the intermodal paired road-rail, road-pipeline and rail-pipeline costs and time of transporting petroleum products from the refinery to the selected locations.

MATERIALS AND METHODS

This study is based on primary source of data through the administration of questionnaire. Questionnaire was used to elicit the information required for the study. The total number of registered tankers that convey petroleum products from KRPC as at the time of conducting this study (May-August, 2012) is 1712 trucks. On the average, about 158 tankers are supplied with petroleum products per day. The study then adopted Yamane (1967) formulae to determine the sample size. The formula is given as:

$$n = \frac{N}{1 + N(e)^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where n = sample size

N = population size

E = level of precision (0.07)

The sample size obtained was to 182 truck drivers. Thereafter, systematic sampling technique was employed to select every seventh truck as they wait to be cleared for loading. Apart from descriptive statistics, the student t-test was used to test the significant level of difference in the cost of transporting petroleum products by rail, road and pipeline.

The study area is the Kaduna Refinery and Petrochemical Company which covers northern Nigeria in the supply of petroleum products. The northern part is the largest of the major regional unit in the country based on landmass and its great economic potentials. It covers about 60 percent of the total area of Nigeria with about 19 states. The size of the area makes the distribution of petroleum products a logistical challenge despite the region's transportation system which includes a network of road, rail and pipeline system purely dedicated to petroleum

products. Determining the variation in costs and time is important in the determination of the best mode suitable for petroleum products distribution from the refinery. Due to the comparative nature of this study, it was observed that only six locations are connected by the three modes of transport - road, rail and pipeline network which was used for this analysis.

RESULTS AND DISCUSSION OF FINDINGS

The cost of transporting commodities has a direct bearing on the distance to be covered. Table 1 shows the distance of six locations by rail, road and pipeline transport. The impact of distance on cost is such that total transport cost per kilometre generally falls as journey distance increases. As a result, increase in journey distance will result in less than proportional increase in the total transport cost per vehicle load. Brown and Allen (1998) have argued that as trip length increases, larger and faster roads will generally be used by the truck driver and therefore, the average speed will increase. Another reason for the variation in costs per litre/km is economics of scale which reduces transport costs on heavily used routes (Bradford and Kent, 1979). From Table 1, it can be deduced that pipeline transport distance is shorter than the other two modes while rail transport for three locations such as Kano, Kaura-Namoda and Gusau covers relatively longer distances. In spite of the distances, the cost of transporting petroleum products comparatively by rail and road reveals that the movement of petroleum product by rail is quite cheaper in terms of cost difference (see Table 2). Also, the distance of pipeline transport from KRPC to Gusau is 260 km while that of rail and road is 273 km and 231 km respectively, yet the cost and time of transportation to this location is cheaper and faster despite the distance. Distance is one of the major determinants of transport costs; the farther the location (distance) the higher the cost of transportation.

Table 1: Distance by road, rail and pipeline transport

From KRPC to	Distance by road (km)	Distance by rail (km)	Distance by pipeline (km)
Zaria	100	99	83
Funtua	143	167	126
Jos	310	264	166
Kano	292	339	223
Kaura-Namoda	279	320	262
Gusau	231	273	260

Source: Authors' Computation, 2012

Similarly, Table 2 shows the cost involved by road, rail and pipeline to move 33,000 liters of petroleum products from Kaduna refinery to six locations in northern Nigeria. A careful examination of Table 2 reveals that on the average, as much as ₦ 100,000 is needed to transport petroleum product by road to Jos, ₦ 54,885.60 by rail and ₦ 28,073.92 by pipeline. Also the cost of transporting petroleum product from origin to Zaria by road was ₦ 30,000; rail cost ₦ 20,582.10 while pipeline cost ₦ 14,036.96. This reveals that there is a difference in the cost of transporting petroleum products from the refinery to these locations by the three modes of transport. The result also indicates that road is more expensive when compared with rail.

Indeed, when comparing the costs of transporting petroleum products by the different modes of transportation, it can be observed that pipeline transport is the most cost effective mode of transporting petroleum products. This is followed by rail. It is important to note that thousands of Naira could be saved if pipeline transport is adequately employed in the movement of

petroleum products. In order to determine the significant difference in transportation costs, student t-test was used.

Table 2: Cost of transporting 33,000 litres of petroleum products by road, rail and pipeline transport in Naira

From KRPC to	Cost by Road	Cost by Rail	Cost by Pipeline
Zaria	30,000	20,582.10	14,036.96
Funtua	45,000	34,719.30	21,309.12
Jos	100,000	54,885.60	28,073.92
Kano	90,000	70,478.10	37,713.96
Kaura-Namoda	120,000	66,528	44,309.44
Gusau	100,000	56,756.70	43,971.20

Source: Authors' Computation, 2012.

The student *t-test* values as shown in Table 3 indicates that the calculated *t-test* for all the compared means were significant. For instance, the combination of road-pipeline costs shows a t-test value of 4.902, $p. = 0.004$, while rail-pipeline shows a *t-test* value of 4.744, $p = 0.005$ and road-rail indicates a *t*-value of 3.815, $p. = 0.012$. This implies that there is a significant difference in the costs of transporting petroleum products by road, rail and pipeline.

Table 3: Student *t-test* statistics of paired intermodal costs of transporting petroleum products.

	Paired differences					
	Mean	**Std. Deviation**	***t-test***	**df**	**Sig.**	**Interpretation**
Road and Pipeline	49265.007	24615.977	4.902	5	0.004	Statistically significant
Rail and Pipeline	19089.690	9856.894	4.744	5	0.005	Statistically significant
Road and Rail	30175.317	19374.558	3.815	5	0.012	Statistically significant

Source: Authors' Computation, 2012

Furthermore, the efficiency and cost-effectiveness of a transport system can be attributed to its timeliness. In comparing the time taken to move petroleum products from Kaduna refinery by road, rail and pipeline, the results reveals that pipeline transport takes lesser time to move petroleum products. Table 4 shows the time taken by these modes of transport in moving petroleum product from origin to destination. On the average, transporting petroleum products from Kaduna to Kaura-namoda takes 570 minutes by road, 305 minutes by rail and 126 minutes by pipeline. This is not surprising as stoppages and other logistical problems such as bad road, mechanical problem and delay at security check points are common with road transport. The minutes spent by one mode of transport when compared with other modes reveals that 179 minutes will be saved if petroleum products are moved by pipeline as against rail. Similarly, 444 minutes will be saved if pipeline is used when compared to road transport. In other words, higher quantity can be transported within a short time when pipeline means is adopted in hauling petroleum products.

Indeed, as indicated in Table 4, the time taken by road transport to get to Jos is about 2 to 3 times higher than the time taken by pipeline and rail transport to move the same quantity of

petroleum product. From the result, the temporal variation in time could be saved when pipeline is fully maximized in the transportation of petroleum products from the refinery to the nearest depot while road can be used to complement it. Furthermore, pipeline can sustain the movement of petroleum products throughout the day without hindrance. A cursory examination of the student-t test result of the temporal dimension of transporting petroleum products (Table 5) shows similarity to the costs. This is because the compared mean's *t-test* is statistically significant, t value is 3.382, p.<0.020 for road – rail time. The time difference is also significant for rail-pipeline transport with t-value 5.491, p.<0.003 and road-rail transport with t-value 5.358, p<0.003, at 5 degree of freedom and at 0.05 level of confidence. This also implies that there is a significant variation in the time taken to transport petroleum products.

Table 4: Time taken to transport 33,000 litres of petroleum products by different modes of transport

From KRPC to	Time by Road (Minutes)	Time by Rail (Minutes)	Time by Pipeline (Minutes)
Zaria	150	100	40
Funtua	270	158	61
Jos	510	317	80
Kano	330	326	107
Kaura-Namoda	570	305	126
Gusau	450	265	125

Source: Authors' Computation, 2012

Comparing road, rail and pipeline transportation of petroleum products, it can be deduced that pipeline transport in the movement of petroleum product is most-cost effective, considering the distance, cost and time it takes to transport 33,000 litres. From the study, it was discovered that pipeline transport have higher volume capacity to move these products than rail and road transport while rail tankers also have about 2,000 litres capacity higher than road tankers and have higher capacity to move more than one truck at the same time unlike the road tankers. For the pipeline to serve optimally, it needs storage infrastructure in the form of depots and associated array of equipment such as pumps, valves, loading arms and meters as well as generators. Besides, these must be maintained at the highest level of repairs to ensure hitch-free distribution. For instance, while a truck will take about three days from Lagos to Kano, the pipeline can carry higher volumes through the same distance within five hours. Though, rail system can carry higher volumes at 300km/day (Higher Speed Trains), speeds of 100 – 150km/hour or 3000km/day is obtainable by pipelines since they operate for 24 hours per day (Ntiense, 2006).

Pipeline transport has been particularly attractive for the uninterrupted movement of liquid and gas, because of its relative cheapness. This low cost of moving crude products, as an advantage, is only shared by pipeline, with super tankers. Thus, the economics of scale are particularly evident in pipeline transport, for cost falls sharply with increasing capacities of pipes.

Table 5: Student-t test statistics of paired modal time in the transportation of petroleum products.

	Paired differences					
	Mean	**Std. deviation**	**T**	**df**	**Sig. (2-tailed)**	**Interpretation**
Road and Rail	134.833	97.651	3.382	5	0.020	Statistically significant
Rail and Pipeline	155.333	69.296	5.491	5	0.003	Statistically significant
Road and Pipeline	290.167	132.658	5.358	5	0.003	Statistically significant

Source: Authors' Computation, 2012

The possibility of moving solids in suspension or in capsules and even unsuspended solids through pneumatic pressure has made pipeline transport more attractive. In spite of this, the traditional role of pipeline as the conveyance of liquid and gas continues to predominate (Ikporukpo, 1995).

POLICY IMPLICATION

Although, government over the years has shown considerable effort in the smooth flow of petroleum products from the refinery to the final consumers at a minimized cost, there is need to put in place policies that reduce the over reliance on road transport as the most prominently used mode of petroleum products haulage. There is need for appropriate transport coordination policies to be put in place to ensure each mode performs that function that it is best suited for. By so doing, each mode of transport will be allocated its share of petroleum products haulage. The re-occurring challenges posed by the present use of road system of transporting petroleum products is associated with destruction of lives and properties arising from accidents, environmental pollution by tankers, short deliveries, empty returns, high cost of transportation, delay in delivery and diversion, to mention but a few, constitute a menace to the effective distribution of petroleum products. Furthermore, with the increasing rate of the cost of transporting petroleum products by road, there is need to prioritize the palliatives often put in place by successive administration of the country to reduce the costs of transporting petroleum products.

The present haulage cost of petroleum products by various modes can be traced to certain political and remote causes that had helped to hinder the implementation of a reliable transport mode in the transportation of petroleum products in terms of safety and capacity. It is also significant to note that the two most cost-effective modes for long distance haulage of petroleum products in Nigeria have been neglected and left to rot. There is the need to up-grade the nations' transport infrastructure such as rail, water and pipeline so that the country can take advantage of an integrated multimodal transport system. Indeed, the rail network of the country characterized by single lane and narrow gauge are apparently old and obsolete. Furthermore, as a result of poor funding, a dilapidated infrastructure, poor rolling stock as well as and old wagons and trains, rail transport system in Nigeria has inadvertently lost its share of traffic in the haulage business. As regards pipelines, its network needs to be expanded to connect most of the urban centres in northern Nigeria in view of its relative advantage.

The policy implications of this study is that rate regulation, restrictive licensing for tanker owners, distance regulation, effective usage of the cost effective mode and transport coordination by mode of transport will ensure the transportation of petroleum products at a minimized cost to various destinations across northern Nigeria.There is no doubt that effective and reliable distribution of petroleum products cannot be sustained unless the usage of other modes of transportation is made adequately functional in the movement of petroleum products.However, for long haulage of petroleum products, there is the need for the country to increase the pipeline networks and depots across northern Nigeria. Also, government should refurbish, re-equip and modernize the rail transport systems in order to handle petroleum products destined to the service areas of the refineries. Pipeline and rail haulage by their nature of operation are not subject to too many constraints of smooth flow of petroleum products compared to road haulage. Indeed, shifting substantial amount of petroleum products haulage share to pipeline will ultimately reduce the cost of transportation. However, this can be complemented by rail and road for relatively short distances to reduce the menace it causes to the society.

RECOMMENDATIONS AND CONCLUSION

This study has identified the most cost-effective mode of transporting petroleum products. The result indicates that the cost and time involved in transporting petroleum product by pipeline is much cheaper and faster than rail and road transport, also in terms of safety and maintenance. The principal advantages of pipeline transportation are loss in transit is less in pipeline transportation as compared to other modes; pipeline offers large-scale economies of scale in transportation of liquid petroleum products; environmental impact during construction, operation and maintenance is negligible and reversible which is environment friendly; it can be used to transport multiple products; pipeline transportation is flexible, as the volume transported can be increased/decreased quickly and at negligible cost and operation/maintenance costs are relatively lower. Therefore, as far as the pipeline transportation is concerned, once the pipeline is depreciated, the cost of transportation is only its operation cost, that is, virtually negligible and substantially lower than the corresponding costs for transportation through alternate modes. It is therefore recommended that where pipeline, rail and road transport systems have comparative advantage, they should be used to haul petroleum products from the refinery to the hinterland.

REFERENCES

Abdulmalik A. and Omokoghio M. (2009), "Short Delivery of Petroleum Products at Retail locations in Kaduna Region", *Journal of Logistics and Transport*, Vol. 1, No.2, 2009, pp 108 – 119.

Adesanya, A. (1998) "Transport Development", in Phillips A.O and Titiola, S.T (eds) *Nigeria in 2010*, Nigeria Institute of Social and Economic Research (NISER) Ibadan pp. 181 – 193.

Akpoghomeh, O.S (2002) "Transport and Communication" in Africa Atlas of Nigeria. Les Editions J.A., 57 bis. Rue d'Autenil. 750 16 Paris – France. pp 106 -109.

Anonymous (2010), "Transportation and Logistics", http://www.officeworks.net/infozone /whitepapers/Transportation%20and%20Logistics.pdf. Access Date 13/02/2010.

AOPL (1998), "American Association of Oil Pipelines", Annual report and Accounts.

Ballou. R. (2004), "*Business Logistics/Supply Chain management*", 5th ed. New Jersey, Pearson Education Inc.

Bradford, M.G. and Kenk, W.A. (1979), "Human Geography: Theories and their Applications", Oxford University Press, pp 87 – 128.

Brown, M. and Allen, J. (1998), "Logistics of food transportation" in Heap, R., Kierstan, M. and Ford, G. (eds), Food Transportation, published by Springer, Blackie Academy and Professionals, pp. 22 – 49.

Coyle, J., Bardi. E and Langley. C. (2003), "*The management of Business logistics: A supply chain perspective*". 7th ed. Canada, Thomson Learning.

Economic Confidence (2012), "Nigeria's oil reserve to dry in 2040", (http://economicconfidence.net/news/news/national-news/iss-economic-confidential).

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.

Ikporukpo, C. O. (1995), "Pipeline Transportation in Nigeria: Trends and patterns". *Journal of Transport Studies*, 1(1); 5 – 16.

Ikporukpo, C. O. and Filani, M. O (2000), "Transport coordination in Nigeria: trends and issues", *The Nigerian Geographical Journal*, New Series 3 and 4 29 – 42.

Jespersen, P.H. and Nielsen, L.D. (2004), "Logistics and transport-a conceptual model". World Transport Policy and Practice, vol.10, no.3, 6-11

Mesaf Management Service (2002): "Petroleum Equalization Fund: Training of New Staff in Uniform Pricing Mechanism", Abuja, Nigeria, PEF(M)B.

Metra Consulting (1986), "Nigeria: The business future", 4th edition, London, Metra Consulting.

Milidiu. R, santos Liporace. F and Lucena. C. (2004), "Pipe world: Planning transportation of petroleum Derivatives", *Journal of Transport Geography* 12, pp 185 – 190.

MITI (2002) Master plan for an integrated Transportation infrastructure, published by the Federal Ministry of Transport, Abuja.

NNPC (2012) : Oil production, NNPC business (www.ncpcgroup.com/NNPCBusiness/Upstreamventure/oilproduction.aspx)

Nnadi, U.K (2006), "The economics of zerorization in road transportation of petroleum products in Nigeria", *Journal of Science Technology Research*, No. 3, pp 12 -17.

Nnadi U.K and Cmilt D. (2007), "Econometric Analysis of Domestic Transportation of Refined Petroleum Products in Nigeria", *International Journal of Soft Computing* 2(1),pp 146-9.

Ntiense, A.I (2006), "A study of the suitability of the pipelines network for the transportation of petroleum products in Nigeria", an unpublished research project submitted to NITT, Zaria.

Olagunju, K. (2011), "Articulated Lorries management in Nigeria: Road Safety Perspective", a paper presented at the Road Safety forum, organized by the International Road Safety Organisation; at Ladi Kwali Hall, Sheraton Hotel & Towers, Abuja, 6th May, 2011.

Oyesiku, O. K and Obadimeji, O. A (1998), "Factors of demand of freight transport in the Nigerian Petroleum Industry: Evidence from the Lagos area", *Journal of Transport studies,* Vol. 2, No.1, pp 45 – 61.

Rushton, A., Oxley, J., Croucher, P. (2000), "*The Handbook of Logistics and Distribution Management*", 2nd ed. London, Kogan Page.

Tyndall, G., Gopal, C., Partsch, W. and Kamauff, J. (1998), "*Super-Charging Supply Chains: New Ways to Increase Value Through Global Operation Excellence",* 1st ed. New York, NY, John Wiley & Sons.

Ubogu, A. E., (2010), "An analysis of the problems associated with unimodal transportation of port-hinterland freight in Nigeria", Unpublished Ph.D Thesis; Department of Geography, Ahmadu Bello University, Zaria.