

Improvement of Logistics and Supply Chain Management in the Cement Industry in Nigeria

Abimbola O Aniki, Charles Mbohwa, *Member, IAENG*, and Esther T. Akinlabi, *Member, IAENG*

Abstract— Worldwide, Logistics and Supply Chain play important roles and also contribute immensely to the economy of a nation. In this paper, research was conducted to investigate how logistics and supply chains are implemented in cement factories in Nigeria, identify the problem areas and proffer solutions. The study was conducted by administering well-structured questionnaires. According to the investigation, it was confirmed that most of the investigated companies based their logistical system only on road-link transport system for delivering products to their customers or end-users. Furthermore, the survey revealed that 73% of the respondents prefer to continue with the road-link logistics system. Though there is railway infrastructure in the country but due to research finding, the rail system is obsolete due to negligence and poor maintenance on this logistics system. A new railway infrastructure will have to be put in place for effective and efficient operation; and this is going to be costly for individual company to bear.

Keywords - Logistics Management, Supply Chain Management, Transportation.

I. INTRODUCTION

Globally, logistics and supply chain have emerged as momentous growth factors in most nations; these contribute to the economy of a nation. Meanwhile, many researchers give different definitions to logistics and supply chain, according to their own findings. The bulk of the supply-chain management research emanates from the logistics and operation discipline, while some of it comes from information systems and technology, and marketing. Logistics is defined as the art and science of management, engineering and technical activities concerned with the requirement, design, supplying and maintaining resources to support the objectives, plans and operations [1]. Supply chain serves as a link between suppliers and end-users, but the main goal of any supply chain is to deliver the right product, at the right time to the appropriate location.

Logistics and supply chain services; the rate of technological innovation and fluctuation in consumer demand are among the factors that have increased the dynamism of the competitive environment to which organizations must respond. The shortage of logistics and

supply chain expertise also contributes immensely to the growth of logistics in such an area as information system support capabilities [1]–[2]. The lack of logistical expertise has reduced the organization's capacity to conduct their desired processes effectively.

Furthermore, the inadequate logistical infrastructure, combined with unskilled can be blamed for the great loss and damage of goods experienced, especially for perishable products. The challenges however, also generate opportunities for companies with advanced logistical systems and skilled employees, efficient and effective management to grow their market [2]-[4].

Surveying the existing interrelationship between logistics and supply chain management divisions of an organization can help tremendously and contribute a positive input when facing the problem arising in logistics and supply chain in such an organization. This research was conducted, in order to investigate, inquire, and to open up through the survey questionnaire; why other logistical systems have not been actively used in the cement industry in Nigeria. It is expected that the resultant findings of the study are going to be used to address the problem.

II. SUPPLY CHAIN AND LOGISTICS MANAGEMENT

The definitions of supply chain have been widely described and discussed by, amongst others, Christopher [5], Ballou [6], Elram [7], Simchi-levi et al. [8], and The Council of Supply Chain Management Professional (CSCMP) [9]. Information sharing is a key to the effectiveness of supply chain management [10]. However, they all expressed the importance of integration, cooperation and information sharing between organizations in the supply chain network.

Ways to achieve a successful supply chain management could be the following [11]:

1. To manage the resources of supply strategically in order to reduce the total cost of owning materials and services.
2. To pay attention to market signals and align demand planning accordingly, across the supply chain, ensuring consistent forecasts and optimal resource allocation.
3. Customize the logistics network to the service requirements and profitability of customer segments.
4. Segment the customers, based on the service needs of district groups, and adapt the supply chain to serve these segments profitability.
5. Develop a supply chain-wide technology strategy that supports multiple levels of decision making,

Mr Abimbola O. Aniki is a Lecturer at the Department of Mechanical Engineering, Vaal University of Technology, P.M.B X021, Vanderbijlpark.1900, South Africa. Phone: +27 16-950-9158; email abimbolaa@vut.ac.za

Prof C. Mbohwa is a Professor in the Department of Quality and Operations Management, University of Johannesburg, Bunting Road, Johannesburg, South Africa, 2006, e-mail: cmbohwa@uj.ac.za.

Dr E. T. Akinlabi is a Senior Lecturer in the Department of Mechanical Engineering Science, University of Johannesburg, Auckland Park Kingsway Campus, Johannesburg, etakinlabi@uj.ac.za.

and gives a clear view of the flow of products, services and information.

- Adopt channel-spanning performance measures to gauge the collective success in reaching the end-user effectively and efficiently.

Fig. 1 illustrates the outline of logistics and the supply chain for cement production.

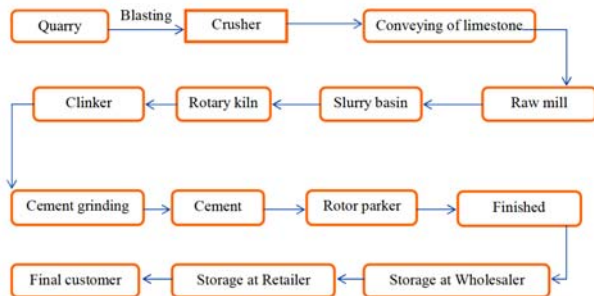


Fig. 1. Supply chain for cement production [12]

Transportation plays an important role in both moving purchased goods from suppliers to the buying organization, and moving finished goods to the customers. More so, due to the important role that it plays in the supply chain. It is an obvious fact that products are rarely produced and consumed in the same location, as such; transportation is a significant component of the costs that most supply chains incur [13]. Transport is typically regarded as a non-value adding activity in the supply chain, although the challenges make the assumption that it plays an essential role in the supply chain; and if managed accordingly, it can allow supply chains to work more effectively and efficiently. Basically, there are different modes of transportation; but this research focuses on the major transport modes used in transporting materials to the required sites for use, namely: road, air, water, pipeline, and rail. Road transport system is the most realistic and very common means of transportation in the cement industry in Nigeria. However, the road transportation in Nigeria is characterised with a lot of delays which results from heavy traffic, accidents and breakdowns on the way. An efficient and effective transportation system is needed for commerce to function in any industrialized society. Meanwhile, the products purchased by the customer have little value for them until they are moved to the customer's point of consumption [14]. Therefore, a more efficient system is desirable in Nigeria. A summary of the costs and the relative operating characteristics of the different transport modes are here presented [15]

A. Road, relative costs and operating mode

Although the fixed cost is very low, since the physical transport infrastructure, such as the motorway are in place through public funding, the variable cost is medium in terms of rising cost of fuel, cost of maintenance and the increasing use of road and congestion charges. In respect of operating characteristics, the road as a mode of transport scores favourably on speed, availability, dependability and frequency; but it does not fare so well on capability, due to the limited capacity on weight and volume. Uniquely among transport modes, it can allow direct access to consignor and consignee sites.

B. Rail, relative costs and operating mode

The fixed costs of rail system are high; while the variable cost is relatively low. The fixed costs are high, due to the expensive equipment requirements, such as the locomotives, wagons, tracks and facilities, such as freight terminals. On relative operating characteristics, rail is considered good on speed, dependability and especially the capability to move larger quantities of freight.

C. Air, relative costs and operating mode

Fixed costs are on the lower side; but there are high variable costs that include fuel, maintenance, security requirements etc. The main advantages of air is speed; but it is however limited in uplift capacity. Similarly, other modes of transport are required to take freight to and from the airports; thus air cannot directly link the individual consignor and consignee.

D. Water, relative costs as well as the operating mode

The fixed costs of using water as a means of transport system are on the medium side, this includes vessels, handling equipment and terminals. Variable costs are low, due to the economies of scale that can be enjoyed from carrying large volumes of freight. This is the main advantage of the water mode, together with its capability to transport large volumes of freight like air; but it cannot offer consignor-to-consignee connectivity, and vessels are sometimes limited in terms of what ports they can use. It is also quite a slow mode.

E. Pipeline, relative costs and operating mode

Fixed costs are high, due to rights of way, construction and installation, but the variable cost is relatively low; and generally, this encompasses routine maintenance and ongoing inspection/security. On operational characteristics, the dependability is excellent; but this mode can only be used in very limited situations and prone to the danger of bunkering.

There are some circumstances due to poor infrastructure that will not allow some of the modes of transport to be realistic, such as air, water, and pipeline. But in an advanced country, it may be used effectively and efficiently in transporting the material and the finished articles [13].

Moreover, the logistic and supply chain system in the cement industry in Nigeria being investigated does not only apply to the raw material supply alone; but there is a poor supply of the finished product as well, to transport the finished product from the cement factories in the Western part of Nigeria to the Northern part. This is very difficult, due to the poor transportation infrastructure. There is no availability of body of water for shipping, a poor pipeline transportation system. There is also the landing problem for cargo planes due to the unavailability of airports in the end users cities. The railway infrastructures are dilapidated due to poor maintenance, as such, all focus is on road transportation system and even the road facilities are not in good state.

III. METHODOLOGY

A descriptive research method was adopted in this research by using a well-structured questionnaire for data collection. It was designed to find the solution to the existing problems in the aspect of logistics and supply chain in the cement manufacturing industry in Nigeria.

The questionnaire consisted of four sections:

- Section 1: provided the demographic details about the respondents.
- Section 2: addressed the organisational information of the cement manufacturing industries.
- Section 3: is focused on questions about the collaborative work in the cement manufacturing industry with regard to logistics and supply chain management.
- Section 4: addressed the effectiveness, performance and information distribution in the logistics environment.

The collected data was analysed using statistical analysis software package (SPSS) and also, Microsoft Excel Ranking function was used to compute the rank of mean scores of responses. This was based on the percentage responses to the 5-point Likert-type scale. The ranking enabled the importance of individual statements, problems, parameters and key performance indicators to be evaluated relative to each other.

IV. RESULTS AND DISCUSSION

A response rate of 25% was achieved in this study. The results showed that most of the respondents were highly educated; 6.7% held a diploma, 60% held a bachelor's degree and 33.3% had postgraduate qualifications. The responses from different departments were impressive, and those who had knowledge about the logistics issue answered the questionnaires. It was found that the respondents were 26 years and above in age. Women participated well in answering the questionnaires. At least 73.3% were married people, and the remaining 26.7% were single and divorced. Permanent staff played an active role in answering the questionnaires, 80% of them responded. Finally, 73.3% preferred to speak or communicate in English rather than the local languages. In this situation, 46.7% of the respondents were Dangote cement workers while 26.7% came from Lafarge Cement factory, Ewekoro, Ogun State. Through the telephone conversation with a logistics manager in Dangote cement, it was revealed that using trucks alone as a means of logistics reduces their rate of delivery of large quantities to their customers at long distances, so they were seriously finding alternative ways of getting to their customers with larger consignments within the shortest possible time period. It was mentioned that trucks were limited in the loads they can carry.

Most of the members of staff of companies that responded said that their company produced cement was a percentage of 66.7% while 26.7% produced cement and aggregate. Most of these cement factories were situated in the Western part of Nigeria due to proximity to the source of raw material, so their logistics links were crucial to transport their product to other parts of the country. Some of

the companies (60%) were owned by individuals and 33.3% were multinationally owned. Dry process of cement production took the highest percentage lead with 93.3% because it is a fast method of production and more cost-effective.

Customers purchased their products from depots, factories and wholesalers. The percentage of customers who usually buy their products directly from the factory was 53.3%, followed by depot purchases at 40%, and wholesale plus those who had no idea where their products were purchased at 6.7%. Respondents who preferred using road to other means of logistics added up to 73.3%, and they confirmed that they had no intention of changing to another means of logistics for various reasons stated. Only 26.7% of the respondents were willing to change to another logistics system. Respondents emphasized that logistics and supply chain management were extremely important in their various organisations. Modularization quality was excellent and many agreed that poor use of modularization led to negative outcomes in the company.

78% of the respondents confirmed that collaborative working arrangements in logistics influenced customers and improved customer satisfaction, therefore being extremely influential. They found that the level of commitment by the workers in different departments was excellent. Finally, about three quarters of the customers came back for the product because of an excellent logistics system. The respondents strongly agreed that their company had enough partners with appropriate collaborative skills to effective logistics and supply chain systems. In terms of knowledge sharing and transfer within the working environment, 78% felt this was strongly achievable. There was strong agreement that collaboration procurement methods promote innovation and improvement on major projects. However, effective collaboration would bring better quality of service and collaboration not only within the working environment, but also to collaborate with logistics expertise for better improvement.

It was strongly agreed that good leadership in coordinating logistics and supply chain management and involvement of supply chain leadership served as a key to achieving target objectives on time. Finally, transparency between the logistics leadership and the partners was not often found in project execution, and 76.7% of the respondents strongly agreed with that. The performance and effectiveness of communication in a logistics environment was analysed, it was found that the respondents preferred to adopt roads logistics systems rather than any other logistics link, judging by the results collected from the questionnaires. This was caused by a lack of infrastructure in other logistics systems in Nigeria. Timeous delivery using trucks was regarded as *Excellent* by 90% of the respondents, while for the railway logistics system, it was 10% because it had not operated for some decades. Cost effectiveness in delivery by truck was regarded as *Excellent*, but this is due to the fact that the rail logistics had not been put into operation, it was therefore rated *Poor*. Customer satisfaction was rated *Excellent* for using road logistics because the product got to the end user at the appropriate time. Although, this is subjective as delays could occur as a result of heavy traffic, accidents and breakdowns on the way.

According to the questionnaire, profit-making for truck delivery was regarded as *Good* by 83% of the respondents, while for the rail, it was rated *Average*. On the information sharing aspect, frequent departmental meetings enhanced the improvement possibilities of logistics in the system. Furthermore, based on the results, every company had a website in which people or desired customers could view the company products and their logistics system. Finally, displaying of posters and pamphlets in the rural areas for product advertisement was regarded as *Excellent*, and to top it up through media advertisement was also confirmed as *Excellent*. At least 90% of the customers shared information from these areas.

V. COMPARATIVE ANALYSIS

The effective planning and management of a logistics and supply chain infrastructure is a challenge for most countries. However, a nation that is operating under only one kind of logistic system is an under-developed country. Most researchers have not deeply discussed a situation where it is suggested to the logistics and supply chain practitioners to implement another means of logistics different from the existing one. Ellram and Cooper [15] in their paper stated that the key roles of logistics are establishing and managing the supply chain.

In the investigation conducted by the authors, it was revealed that in Nigeria the logistics system are purely based on road (i.e using trucks), so in this research, the authors tried to find out why this is the case and to suggest other means of logistics (air and rail) to the cement industry. Rail transportation is one of the cheapest means of freight forwarding in terms of high volume cargoes shipped over long distances. Transportation expenses decrease by 20% compared to road transportation [15]. But according to the findings, the infrastructure for rail is obsolete and has been abandoned for decades. As such, in order to revive rail logistics system into operation, many things have to be implemented. First, by having a sound framework for rail transport infrastructure with ongoing vigilant monitoring arrangements. In addition, there must be good corporate governance arrangements that ensure openness and transparency in the manner in which these logistics infrastructure is planned, evaluated and delivered.

The practitioners of logistics infrastructure should always be ready to listen to external advice in order to enhance the quality of logistics operation and to ensure that the logistics system does generate benefits and contribute immensely to the economic growth of the nation. From the comparative discussion that was presented in this section, it is highly advisable to encourage most of the cement companies to use other means of logistics transportation system which are cheaper and more efficient. Maintaining such a system like the railway transportation system will enhance effective delivery, on time delivery and increase the overall turnover.

VI. CONCLUSIONS

Cement is a binder, a substance that sets and hardens independently, and it can also bind other materials together. It is a combination of different materials such as red alluvium, shale, limestone and gypsum in some cases, to

produce cement. It is used in the construction of roads, bridges and also in building houses and towers. The effectiveness of the logistics system in the cement industry is of importance to the sustainability and execution of many building projects. The main target of this research was to find out why only trucks were used as the major means of transportation in the cement industry in Nigeria and also to use the findings of this research to minimize or eliminate the likely hazards that may occur when using trucks alone as a logistics system. Hazards such as, high accident rate on the road, product wastages, and traffic congestion on the highways are common in Nigeria. According to the survey questionnaire sent to different cement companies in Nigeria; it was found that 73.3% of the respondents still preferred to use the road link logistics system. The reason was that, though there is a railway infrastructure from one point to another, even from the factory to some towns far and near, the rail system logistics could not be used due to the obsolete infrastructure of the railway. To bring this back into operation, new infrastructures would have to be put in place. Furthermore, there are some works to be done concerning the logistics system which included collaboration with the government and to have the knowledge of how the modern rail logistics system is very significant in the world today. The use of only trucks for logistics in Nigeria is not only applicable to the cement factory alone but to other factories and companies like the sugar companies, breweries and petroleum companies. Proper orientation and information about the logistics and supply chain should be given to people in order to improve the logistics and the supply chain activities.

This research has exposed the need for modern railway logistics and supply chain management systems in Nigeria, and this can be done through the combined efforts of the government, the department of transport and the companies, in order to have a better, effective and efficient logistics system. Focusing on only one logistics system implies that the nation is still under-developed and not willing to advance into the modern day of transportation systems. The recommendation concerning this issue for Nigeria is to establish a modern institute of logistics and supply chain management under the administration of the department of transport tasked with providing road maps to the effective implementation of other means of transportation in Nigeria and to actively involve companies for them to contribute their quota in order to benefit everybody and at the same time have a better relief transportation system. The authors strongly believe that by putting this advice into practice, a better transportation system will emerge in a positive way. Further study can be conducted to focus on monitoring the implementation of other types of logistics systems.

REFERENCES

- [1] B. S. Blanchard, "Logistics engineering and management (4 ed.)". Englewood Cliffs, N. J. : Prentice-Hall, (2009).
- [2] G. N. Okeudo, *The impact of human resources management in logistic service providers and supply chain capabilities: A case study*. British Journal of Science, 4 (1), 2012, pp. 57-71.
- [3] X. Cai, J. Chen, Y. Xiao, X. Xu, and Yu, G. Fresh-product supply chain management with logistics outsourcing. *Omega (United Kingdom)*, 41 (4), 2012. pp. 752-765.

- [4] S. M. Adams, J. Sarkis and D. Liles, The development of strategic performance metrics. *Engineering Management Journal*, 17 (1), 1995. pp. 24-32.
- [5] M. Christopher, "Logistics and supply chain management: Strategies for reducing costs and improving services". London: Pitman. 1998.
- [6] R. H. Ballou, Business logistics/Supply chain management: planning, organizing, and controlling the Supply chain (5 Ed.). Upper Saddle River, N.J.: Pearson Prentice Hall, 2004.
- [7] L. M. Ellram, *Supply-chain management: the industrial organisation perspective*. International Journal of Physical Distribution and Logistics Management, 21(1), 1991. pp. 13-22.
- [8] D. Simchi-Levi, P. Kaminsky and E. Simchi-Levi, "Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies". Irwin McGraw-Hill, New York. 2000.
- [9] Council Supply Chain Management professional (CSCMP), "CSCMP supply chain management definitions" (2012). Available online at <http://cscmp.org/about-us/supply-chain-management-definitions>. accessed 20/05/2013.
- [10] Byrne, P. J., and Heavey, C. The impact of information sharing and forecasting in capacitated industrial supply chains: A case study. *International Journal of Production Economics* , 103 (1), 2006. pp. 420-437.
- [11] J. Mangan, "Global logistics and supply chain management (2nd Ed.). New York: Wiley Publisher". 2012
- [12] A. O. Aniki, *Identifying ways to improve logistics and supply-chain management in the cement industry in Nigeria*. Masters disertation in Engineering Management, University of Johannesburg, South Africa. 2014.
- [13] P. Meindl, and S. Chopra, Supply chain management: strategy, planning, and operation (4 ed.). Prentice Hall. 2009.
- [14] G. K. Leong, J. D. Wisner, and K. Tan, Principles of supply chain management: A balanced approach. Mason, OH: South-Western Publisher, (2005).
- [15] L. M. Ellram and M. C. Cooper, Supply chain management, partnerships, and the shipper-third party relationship. International Journal of Logistics Management, 1 (2), 1-2, 1990.