"The 9th International Conference on Engineering, Project, and Production Management"
EPPM 2018

Analysis of Outbound Logistics Channels for Construction Material in North- Central Nigeria.

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ABSTRACT

Outbound logistics channels are of crucial importance for an efficient construction materials logistics management and impacts on customer satisfaction. This study is aimed at understanding the out bound logistics channels of construction materials logistics management utilised in Nigeria manufacturing industries**.** A case study research approach and purposive sampling technique were adopted, sample comprising six construction materials manufactured and distributed within the North-central region of Nigeria. The study was descriptive using primary data collected through observations, direct measurement onsite and archival records of transactions. Data analysis revealed that all the manufacturing companies used multiple channels for the delivery of their products to customers, 79% of the distribution centers/warehouses and retailers store were located between 0 - 350 kilometers away from the manufacturers plants which is the recommended distance for road transport economies to be achieved. In addition, the findings established that the average transportation cost per average distances decreases as the distance increases, while the average transportation cost per average tons shipped increases with increases in average distance. The study findings would assist the practitioners and decision makers on how to achieve effective and efficient outbound logistics channels for construction materials.

Keyword: Logistics Channels, Distribution Center, Construction materials, Transportation and Warehousing

Introduction

Outbound logistics channels are important for an efficient construction materials logistics management and influence customer satisfaction (Robert & Skender, 2017)(Robert and Skender, 2017: 266). Individually, construction materials manufacturing industry operates its own outbound logistics network. The outbound logistics operations form the last step of the three main processes: order receiving from the Distribution centers(DC),Warehouses (WH) and retailers by the manufacturers of construction materials, and shipping finished products to the DC, WH, and retailers(Nazmul, 2012: 25) . Outbound logistics of construction materials from the company's plant to DC, WH, and retailers has influence on effectiveness of the overall logistics system by representing the lead time to customer which is interested when materials will be delivered. The proportion between manufacture lead-time and transport lead-time means little; customers just need to know when the materials will arrive."(Miemczyk, and Holweg, 2004:5). Thus, the research question, what is the performance of outbound logistics channel utilised by the Nigeria construction material manufacturing industry. While, the aim of this paper is to identify and examine the current outbound logistics channels of used by the Nigeria construction materials manufacturing industries.

Logistics Channels

Logistics channels are connections of middle parties or indirect marketing channel engaged with delivery, storage, handling, communication and supplementary roles that add to efficient flow of materials(Palvic, Host, and Nuhanovic, 2016:22). Contingent on whether the channel is modest or multifaceted the task of achieving effective logistical flow might be more challenging and the manufacturer might deal directly with the customer (Hannan, 2011: 27). Figure1, present the vital different logistics channels. While, channel 3 is common, in the food manufacturing. Channel 4 is as the same as channel 3, aside that a manufacturer contracts with an agent who advertise the materials to wholesalers (Rushton, Croucher and Baker, 2006: 46; Boone, Kurtz, MacKenzie and Snow, 2010: 390). However, the worldwide logistics revolution have modified traditional supply chains which leads to emergence of 'omni-channel' transaction where the customer knowledge of the products and ordering could be done through e-business or e-commerce (United States Postal Service, 2013).

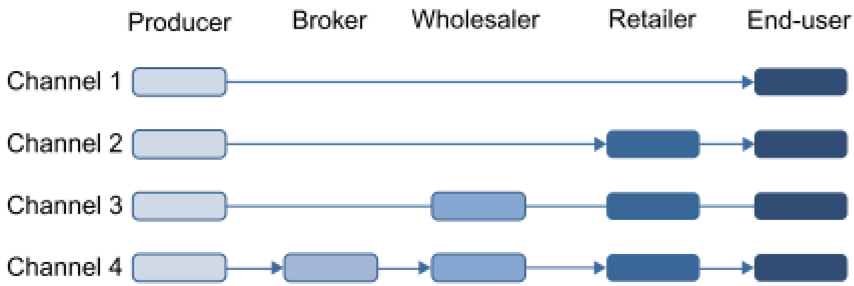

Figure 1. Outbound logistics channels

Source: Rushton, Croucher and Baker (2006:46); Boone *et al* (2010:390)

The significance of logistics channels has been widely debated in the literature (Andrejić and Kilibarda, 2016: 137). In spite of the fact that intermediaries add a markup to the products cost, they give some benefits to the two, manufacturer and customers, three of which are specialised outbound functions, better product variety, and increased transactional efficiency(McKinnon, 1989: 27).

Construction Material Logistics Cost

Poor cost execution of manufacturers and suppliers can increase the Total Acquisition Cost (TAC) of construction materials which, by rising material price, brings about higher construction costs. In any case, increased cost performance of material delivery bring about lower material costs and accordingly construction costs(Vidalakis and Sommerville, 2013:474). A study by (Wegelius-Lehtonen, 1995:209) established that materials delivery costs can vary between 2% and 18% of material price , certifying that construction costs can be fundamentally affected by the indirect costs associated with delivery logistics efficiency's. In addition, Scandinavian-based research by Soderman, (1985:78), up to 40% of materials cost can be ascribed to procurement costs connected to logistics operations. Thus, if the contractors don't watch out, their logistics too will be determined by the manufacturers and the dealers, who will minimize the cost of delivery to the construction site without considering the handling costs(Sven and Jorgen, 1997: 4)

Efficiency and Effectiveness of logistics channels

The objective of efficient and effective logistics network is to choose the optimum numbers, location and capacities of plants and warehouses to open so that all customers demand is fulfilled at minimal overall costs of the delivery network , (Turkensteen and Klose, 2012:499; Andrejić and Kilibarda, 2016:137). Minimisation of shipping distance-related costs can be accomplished by the optimal location of warehouses and 'distribution centers (Turkensteen and Klose, 2012:499) . But, in a construction industry setting this is especially complex, if not infeasible, since customers work in a geographically changing market(Vidalakis and Sommerville, 2013:471).

Additionally, important competitive benefits are 'reducing lead times, delays, and entire transportation costs, as well as improving efficiency, reliability and quality' in administration of the systems (Hoff, Andersson, Christiansen, Hasle, and Løkketangen, 2010: 181). However, it is worthy to note that, the cost of materials may rise due to presence of middle people (intermediaries) in the materials delivery process, but from a widespread perspective, comparing to manufacturers, intermediaries profit users by reducing the transportation unit cost.(Khooban, 2011: 111). From a micro scale viewpoint, logistics effectiveness depend on the time and distance between the nodes of the system, for example, DC/WH, Material Suppliers (MSs) and Builders Merchants (BMs') proximity to construction sites (Vidalakis, Tookey and Sommerville, 2011: 73).

Research Methodology

A case study research approach was adopted where six construction materials (cement, reinforcement bar, ceramic tiles, gravels, hollow sandcrete block and sand) manufactured and distributed within the North-central region of Nigeria were selected for this study. Purposive sampling techniques was adopted because it allows a researcher to choose sample or units for specific reasons. Consequently, the selected sites were logistically, rather than statistically significant in the population(Shakantu and Emuze, 2012; 662). Thus, the sample was composed of thirty-two (32) manufacturing companies, fourty-two (42) DC/WH's and seventy-two (72) transport providers. Multiple method of data collection techniques adopted were systematic observation of logistics process as it tends to record a phenomenon at the current state, measurement on site and use of records of order processing and delivery of materials. The data collected were, floor areas of DC/WH and retailers stores, road distances between plants and nodes, number of DC/WH in the various locations, quantities driven per vehicle, cost of transport per delivery, vehicle capacity, and unit price of materials.

The study adopts a descriptive analysis of the data obtained through data collection instruments. Observations were presented with the aid of bar charts as figures and interpreted directly. This kind of descriptive study can be informative when there is little knowledge and understanding of a phenomenon (Loeb, Dynarski, McFarland, Morris, Reardon, and Reber, 2017: 2).

Data Analysis, Result, and Discussion.

This presents the result of summary analysis of outbound logistics channels utilised by construction material manufacturing companies. The analysis thematically starting with identifying current logistics channels, network structures used in DC/WHs and retailer store, size of DC/WHs and retailers store, and the economies of distance of the logistics channels.

Outbound logistics channels.
Figure:2 presents results of analysis of percentage of all the companies using each of the identified outbound logistics channels in the delivery of materials. It was established 100% of companies used direct- end user channel which tend to bypass all other intermediaries in the supply chain. It was also established that 60% of the companies used Agent/Marketer/Distributor/Wholesaler-retailer-end user channel. Furthermore, 40% of the companies used BM/MS channel, 30% used DC/WH's retailer end -user channel. While 20% of the companies observed used retailer-end user channels.

The ratio of multiples channels used was established, it revealed that 70 % of companies used at least two channels while the remaining 30% used multiple of three channels in delivery of their products to customer. The significance findings are that all the companies used the direct–end user channels, while majority used agent /marketer/distributor/wholesaler and retailer-end-user channels for delivery.

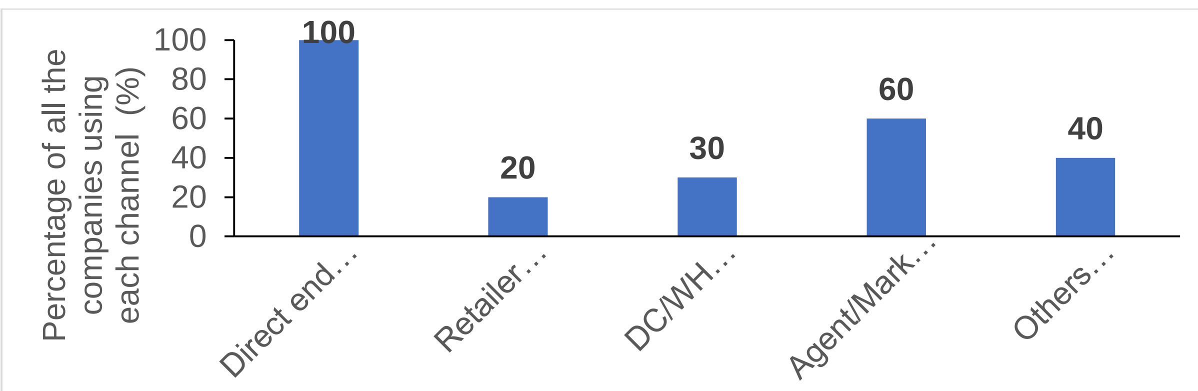

Figure 2. logistics channels utilised by construction materials manufacturing companies

Network structures used in DC/WHs and Retailer Store
From figure3 it revealed that 93% of DC/WHs and Retailer Store were mixed warehouse structures, while 7% were consolidated warehouse. In a mixed warehouse, deliveries from several manufacturing plants arrive in Full Truck Load (FTL) to the DC/WH's and retailers shop. Thereafter, deliveries are broken up and consolidated once more to create several multi-product FTL shipments. Each of these multi-product FTL or Less Truck Load (LTL) as direct shipment to one of the several retailers/customers.

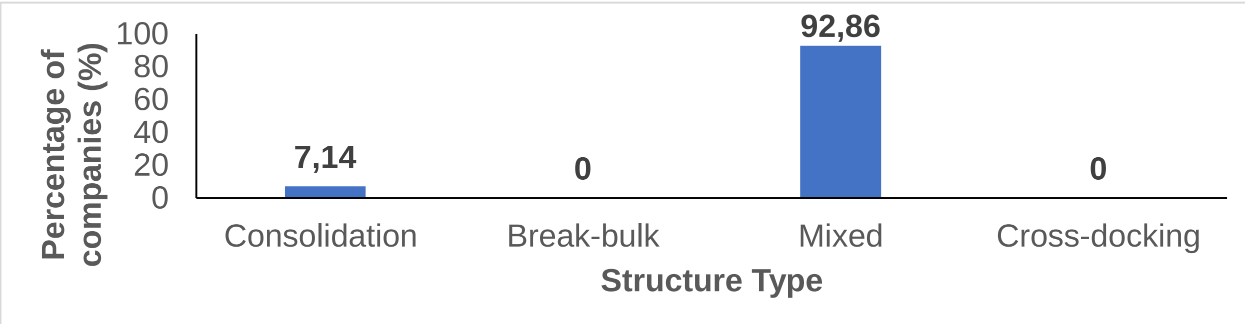

Figure 3. Network Structures Used in DC/WHs and Retailer Stores

Size and space utilisation in DC/WHs and retailers store

Figure 4 shows 80% of the DC/WHs and retailers stores sizes were less than 500m2 and 17% were between 5001-3000m2. The significance of the findings is that majority of the DC/WHs were small sizes (less than 500m2) therefore have limited capacity for large stockholding of materials. However, an interesting finding is that granite is being stored in three towns, Minna, Lafia and Makurdi.

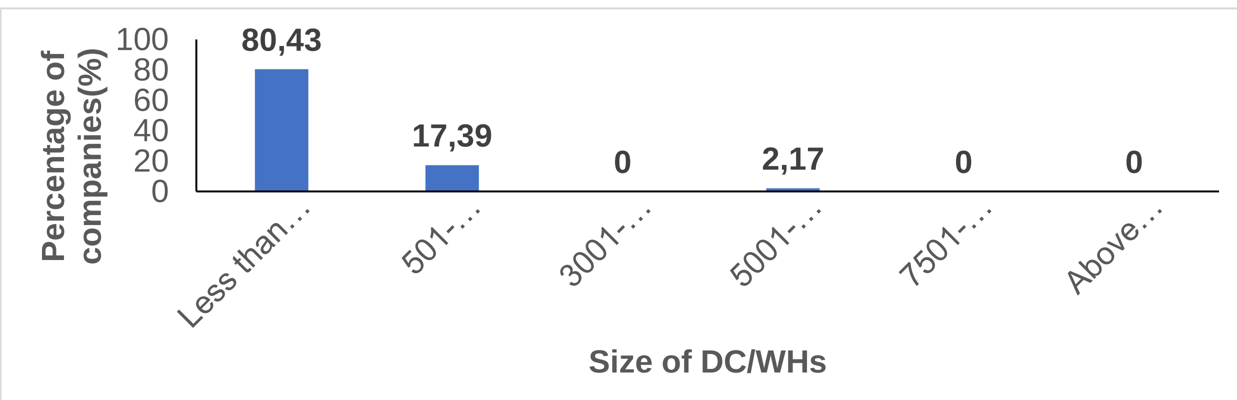

Figure 4. Size of DC/WHs and Retailers stores

Distance for individual materials manufacturers plant to DCS/WH's, retailer shop and sites

Distance and cost plays an important role in the outbound logistics process of any product**.** Figure.5 present analysis of distances from individual materials manufacturers plants to the DC/WH's, retailers shop and construction site. It shows that the 42%, 50% and 83% of manufacturer plants distances to DC/WH's, retailer shop and sites were between 151-350km for reinforcement bar, tiles and granite respectively. In addition, 50% of cement manufacturing plant distances to DC/WH's and retailers shop were between 351-500km, while 100% and 92% of the block and sand industries distances to sites were between 0-50km. The major findings are that majority of DC/WH's and retailers shop for reinforcement bar, tiles and granites were between 151-350km away from their manufacturers plant, while half of cement DC/WH's and retailers shop were between 351-500km away from cement plants. But majority of block and sand industries distances to construction sites were between 0-50km.

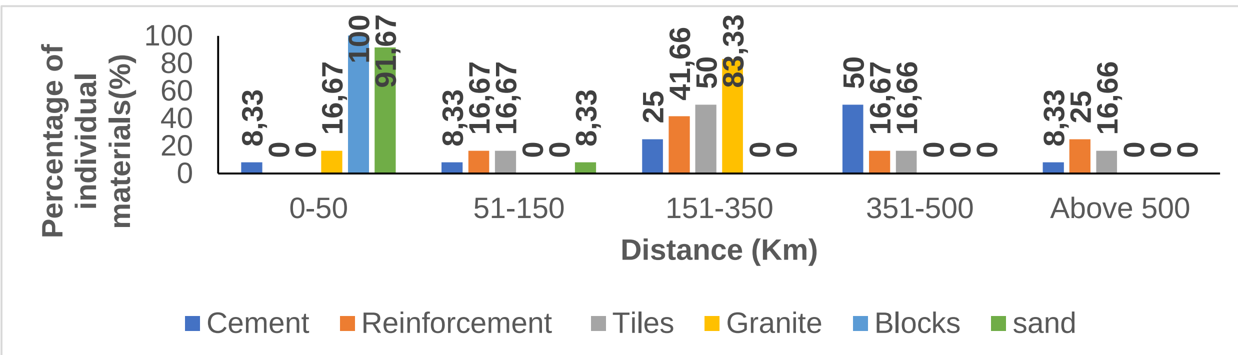

Figure 5. The average transportation cost of material per average distance travelled

Summary of distance from manufacturers plant to DCS/WH's, retailer shop and sites
Figure 6 indicates the summary of distances from manufacturers plants to DC/WH's, retailers stores and construction sites. It established 36% of DC/WH's were between 0-50 kilometers away from the manufacturers plant. While 35% of DC/WH's were located between 151 – 300 kilometers away from the manufacturer's plants.

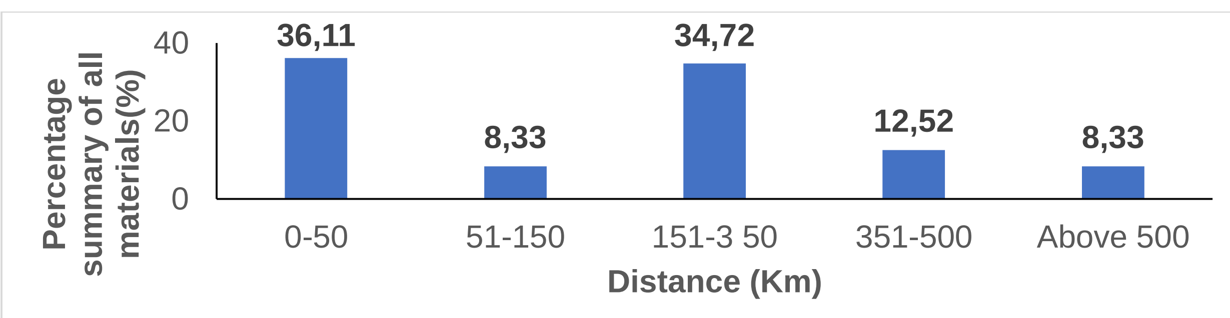

Figure 6. Distances between manufacturers plants and DC/WH's, retailers store and sites

Summary of average transportation cost of material per average distance travelled
The summary of correlation between average transportation cost and average distance for all materials is presented in figure7. The highest transportation cost per distance of N996.95/km was recorded between 51-150km, while a trend was noted, as the transportation cost/ distance decreases

as the distance increases, N610.05/km and N328.18/km for 151-350km and above 500km respectively. But in the case of 0-50km where the transportation cost per distance was lower (N662.27/km) may be explained by the fact that some blocks moulding industries normally give discount on transportation for certain range of distances. While some only charge for fueling the vehicle.

Additionally, information generated was that average transportation cost/ average tons shipped were increasing as the distance increases, N823.99/tons, N4447.67/tons and N5200.00/tons for 0-50, 151-350 and above 500km respectively.

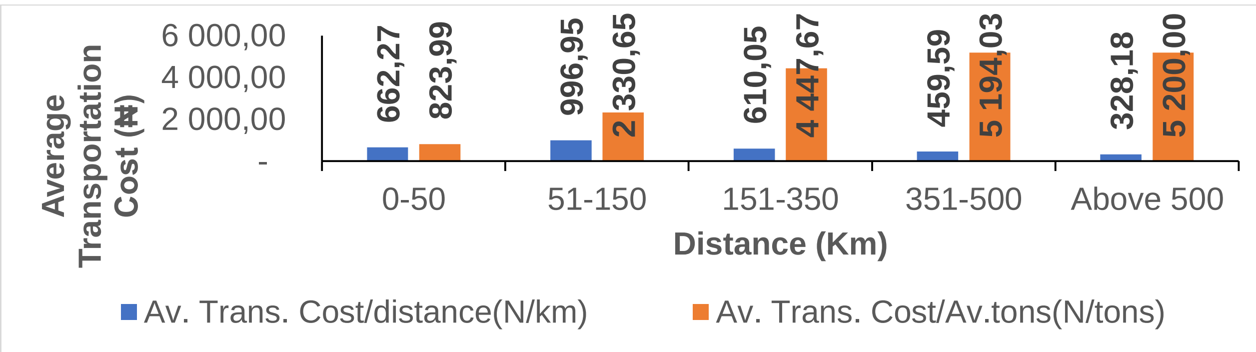

Figure 7. Average transportation cost of material per average distance travelled

Discussion of Result

The study of outbound logistics channels for construction material in North Central Nigeria and in most developing countries is relatively new, more so in the construction sector which is dismally under researched in this part of the world. The aim of this research is to identify and examine the current logistics channels utilised in the Nigerian construction materials manufacturing industries. Based on literature there exist six alternative outbound logistics channels that can be used separately or in combination with each other to deliver materials to end users. The result of analysis revealed all the manufacturing companies used direct to end -user channel. However, most of the companies have minimum quantities an individual or company can order at a time. This create a constrain on customers using the direct to end-user channel. The research established that all companies studied used multiple channels for delivering their products to customers. This is supported by Gwynne, (2014: 41) companies are increasingly delivering via multiple channels to reach customers more effectively. Though, the cost of materials may rise due to the presence of intermediaries in the materials delivery process, but from a widespread perspective, compared to manufacturers, intermediaries profit users by reducing the transportation unit cost(Khooban, 2011:111). Additionally, customers benefit through, reducing lead times, delays, and entire transportation costs, as well as improving efficiency, reliability and quality in delivery of materials *(*Hoff, *et al*, 2010: 181).

Furthermore, the study established that majority (80%) of DC/WHs, retailers stores sizes were less than 500m2. However, there is an ongoing debate as to whether companies are going to increase or decrease the number of warehouses operated within locations (Gwynne, 2014:20). A study by Motorola, (2013:14) showed some planned to increase the number of warehouses operated whilst others to increase the size of their existing facilities. In the other hand Milan (2013: 98) suggest that it does not matter the size of a warehouse or distribution center but the importance is to cut costs and to improve operating efficiencies. However, the size of the storage facilities will also affect, the stockholding capacity, transport arrangements and frequency of delivery. (Gwynne, 2014: 219). In addition, the study revealed that majority of the DC/WHs and retailers stores adopted mixed structure. This agrees with Apte and Viswanathan (2000: 93) and Bowersox, Closs, Cooper and Bowersox (2013:226) that a mixed structure DC/WH combines the approaches of both consolidation and break-bulk warehouses in which transportation economies can be obtained. This leads to better product variety, and increased transactional efficiency(McKinnon, 1989: 27).

The result of summary analysis for individual company (cement, reinforcement bar, ceramic tiles and granite) established majority (79%) of distances from manufacturer plant to DC/WH's, retailer shop and sites were between 0–350 kilometers. This agrees with Khooban (2011:118) recommendation of road transport range of 350km as ideal for achieving economies of transport for long distance haulage. However, if road distance is beyond the 350km, rail road intermodal transport becomes more economical than road transport, progressively more expensive if distance increase above 500km (Pienaar, 2016:390). Moreover, the distance between manufacturer and the end customer determine the amount of stock to be held in the warehouse and distribution centers. The trade-off here is between more expensive local suppliers and producers and increased costs in transport and inventory holding costs (Gwynne, 2014:13). In addition, the result revealed majority of block and sand industries distances to the construction sites were between 0-50km. This finding is similar to study by Saka and Mudi, (2007: 784) that most suppliers of selected materials are located at between 5 and 10 km from construction site. Vidalakis,Tookey and Sommerville(2011:73) asserted that logistics effectiveness depends on the time and distance between the nodes of the system, for example, DC/WH, MSs and BMs proximity to construction sites

The study established 67% (4) of the materials average transport cost per average distance were above ₦500/km and 50% (3) of the materials average transportation cost per average tons were above N5000/ average tons. This supported the claim by Andrejić and Kilibarda, (2016: 138) that though distance driven, and quantity of goods delivered in tons are important information for transport management. But these major drivers are not sufficiently examined in the literature. In additions, the analysis revealed the average transportation cost per average distances decreases as the distance increases. This supports Pienaar,(2016:381) assertion, that the economics of distance is attained when total transport cost per kilometer decreases as the trip distance increases. This will invariably reduce the price of material thereby reducing construction project cost.

Conclusion

The study concludes, there exist six alternative outbound logistics channels that can be used separately or in combination with each other to deliver materials to end users. Majority of the Nigeria construction material manufacturing companies used multiple channels for quick response and more effective delivery of materials to customers. The DC/WHs and retailers store were mostly sited within the distances of 0- 350km form the manufacturing plants and the average transportation cost per average distances decreases as the distance increases which signify that economies of distance were achieved. Generally, the DC/WHs, and retailers stores floor area sizes are small, this limit their capacity for large stock holding, but it is more important to cut costs and to improve operating efficiencies. Besides, the DC/WH's and retailer store were mixed network structure which allowed them to gain both consolidation and breakbulk transportation economies and improved product variety.

The findings of this study would provide guidelines for decision making and planning towards effective and efficient construction materials logistics management. This study was conducted using observations which is one of the limitations of this study. Another limitation of this study is geographical in nature; since this study covered only one out of the six geopolitical zones of the country, other zones should be study and compare the results.

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