

## Correlation between the Firm's Location, Seaport Proximity, and the Cost of Port-Hinterland Transportation in Lagos and Ogun State, Nigeria

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### Abstract

*The literature on the influence of location on Nigerian container transportation efficiency is unclear, necessitating a thorough comprehension of port-hinterland relationships and transportation costs. The study investigates the correlation between a firm's location and port-to-site container transportation costs in Lagos and Ogun States, Nigeria, to enhance efficiency in the manufacturing supply chain. A survey was conducted on 23 publicly quoted manufacturing firms in Lagos and Ogun States, listed on the Nigerian Stock Exchange for over ten years. These firms are located in the major industrial estates in Lagos and Ogun States, which are Ilupeju, Agbara, Ewekoro, Ikeja, Ikorodu, Isolo, and Sagamu. The majority of firms, 88.9%, primarily use trucks for transporting containers from the port to their factory sites. The Pearson Correlation analysis reveals a significant correlation ( $r = 0.55$ ) between location and container transport costs, indicating a direct increase in costs for companies in the seaport hinterland. Business locations in the hinterland of a port should be strategically chosen in Lagos and Ogun States, where 88.9% of manufacturers use trucks and 11.1% use barges for container transport. Lagos and Ogun States manufacturing supply chains must reduce port-hinterland transport costs and locate factories near intermodal connections to boost profits amid container transport expansion.*

**Key words:** Hinterland, transport cost, firm competitiveness, manufacturing.

### Introduction

Hinterland transport involves in-land movement of goods to and from seaports using road, rail, and waterways, using vehicles like trucks, barges, and lighters (Rodrigue & Notteboom, 2010). Rodrigue & Notteboom (2010) argued that the seaport is part of a larger system comprising the foreland, seaport, and hinterland, indicating its involvement in both land and sea activities. Seaports facilitate goods and cargo transfer, transit, and contact between land and marine, while their hinterland

serves as the base for general economic activities. The seaport is a crucial infrastructure and logistics hub, attracting numerous industry clusters to support and expedite commodity movement and economic growth in the country. The geographical proximity between seaports and their surrounding areas can potentially offer benefits to the surrounding environments.

Studies indicate that improving transportation, including port-to-site

transportation, could significantly enhance the supply chain performance of Nigerian industrial companies, as transportation is crucial for their success (Ogwu & Agu, 2016; Uzonwanne *et al.*, 2020; and Ohida *et al.*, 2023). Effective transportation is a critical factor in a firm's success, providing social and economic benefits through efficient supply chain strategies. As a result, prospects for speedier market access, financial incentives for future investments, lower operating costs for businesses, and on-time product delivery are made possible by efficient transportation.

Nigeria's port-hinterland transportation system is plagued by out-dated infrastructure, overreliance on road, ineffective rail, and lack of inland water transport connecting seaports to their hinterlands (Financial Times, 2020; Stephen & Ukepere, 2011). The growth trend in container transport is anticipated to persist both locally and globally (Fan *et al.*, 2019). The implication is that the conditions under which cargoes are moved from the seaports to business locations within the hinterland are likely to be worsened. For instance, reports show that the cost of moving containers from the seaport in Lagos to various part of the country soared high by 400% for the first time since the 1970s due to various logistic challenges (Moov Logistics, 2018). Port-hinterland-related issues have led to 40% of Apapa enterprises in Lagos State relocating or scaling back operations, highlighting the importance of understanding location advantages in transportation for businesses to reduce manufacturing costs in a competitive context (Lagos Chambers of Commerce and Industry (LCCI, 2017).

Numerous studies have explored the correlation between port-hinterland transport, a firm's location, and its performance. The study of Chen *et al.* (2016), examined inland transportation

infrastructure, focusing on seaport connections, access to manufacturing and logistics centers, modal alternatives, main corridor carrying capacity, and shipment delivery reliability. Sefiani *et al.*, (2016) study on Tangier's SMEs found that location significantly impacts their success. The study involved semi-structured interviews with selected owners and managers, considering factors like sector, region, and gender. The findings highlight the importance of business location. Wang *et al.*, (2017) investigated how distance affected the decision between intermodal railroad and unimodal vehicle transport.

Wang *et al.*, (2017) additionally looked at the effects of distance on import goods patterns from a seaport to its hinterland. The findings demonstrated that cargo shipped via seaports with a comparatively small volume mostly serves local communities. The amount of cargo transported from bigger seaports to associated places is significantly less. A gravity model, the Gompertz function, and other methods were used to show that freight flows from a major seaport to its hinterland increase with distance until a specific point and begin to stabilize once they pass it. Guerrero (2017) study found that distance is a key factor in shippers' decision-making, but less so when intermodal connections are available. Port selection is also affected by the distance to the hinterland. The study suggests expanding the study to consider the intertwined relationship between the hinterland and ports. Zgonc *et al.*, (2019) found that distance significantly influences mode selection in freight transport, with break-even distances varying based on travel itineraries and transportation infrastructure. The study suggests a connection between distance and freight transportation form, and further research on harbor distance and hinterland firm performance is needed. In a related study, Ticiana (2019) used the

Spanish scenario to propose and empirically evaluate a framework for defining the seaport's hinterland. Throughput (attractiveness) and port location (distance/repulsiveness) were found to be related.

Mueller *et al.*, (2020) developed a model to assess the adaptability of containerized shipments to port developments in hinterland approaches, focusing on five key port decision criteria: land transportation price, marine transportation duration, and port visit frequency. The cost of transportation into the hinterland was determined to be crucial. Similarly, Sdoukopoulos & Boile (2020) highlight that port competitiveness is significantly influenced by various factors, with hinterland connection ranking second. Behdani *et al.*, (2020); and Beresford *et al.*, (2012) noted that port-hinterland connectivity is significantly impacting the supply chain solutions of shippers and manufacturers, accounting for 40-80% of the overall costs of international container transport. Chopra & Meindl (2007); Behdani (2020) and Oni, et al. (2023) highlight the significance of supply chain management, including port-hinterland transport, in enhancing a company's global competitiveness. The literature reviewed lacks clarity on the impact of location on container transportation efficiency in Nigeria, necessitating a comprehensive understanding of port-hinterland relationships and transportation costs. Understanding port's hinterland relationships and transportation costs is crucial due to logistical obstacles and intense competition, with container transport growth expected to persist locally and globally. This paper investigates the correlation between a firm's location and the cost of port-to-site container transportation in Lagos and Ogun States, Nigeria, highlighting its potential for improving supply chain performance. The

paper covers five sections: review of studies on firms' locations' impact on efficient port-to-site goods transportation, methodology description, findings and discussions, and results and suggestions.

### **Theoretical Framework**

#### **The logistics value chain model.**

The paper is based on the Logistics Value Chain Model, which explains how firms generate value in their supply chains by organizing activities with suppliers in different counties (Zhou, 2013; Chopra & Meindl, 2007). The company's value chain includes internal logistics operations like production and selling, as well as external operations like inventory and final product transportation. The logistics value chain refers to the relationship between the logistics process, from upstream to downstream (Zhou, 2013). Port-to-site or port-hinterland transport is a crucial part of the intrinsic logistics value-added activities in the international transport logistics value chain. The Logistics Value Chain Model highlights port-hinterland transport as a crucial component of firms' logistics value-added activities in the international transportation logistics process. The argument suggests a significant correlation between the location of firms in the port's hinterland and the cost of transporting containers from seaports to various firms' sites.

This study used the SPSS to conduct a Pearson Correlation to measure the relationship or association between firms' location (measured by distance between firms' sites and the seaports) and port-hinterland transport (measured by mode of transport and transportation cost).

### **Methodology**

#### **Data Sources and Variable description**

The study focused on manufacturing firms with locations in Nigeria's most industrialized states- Lagos and Ogun. 23 publicly quoted manufacturing firms that

frequently import cargo in containers through the seaports in Lagos and have been consistently listed on the Nigerian Stock Exchange (NSE) list for more than ten years (2010-2019) make up the study's population. These firms are located in the major

industrial estates in Lagos and Ogun States, which are Ilupeju, Agbara, Ewekoro, Ikeja, Ikorodu, Isolo, and Shagamu (see Figure 1). The study administered questionnaires to the 23 firms which were actually completed and returned.

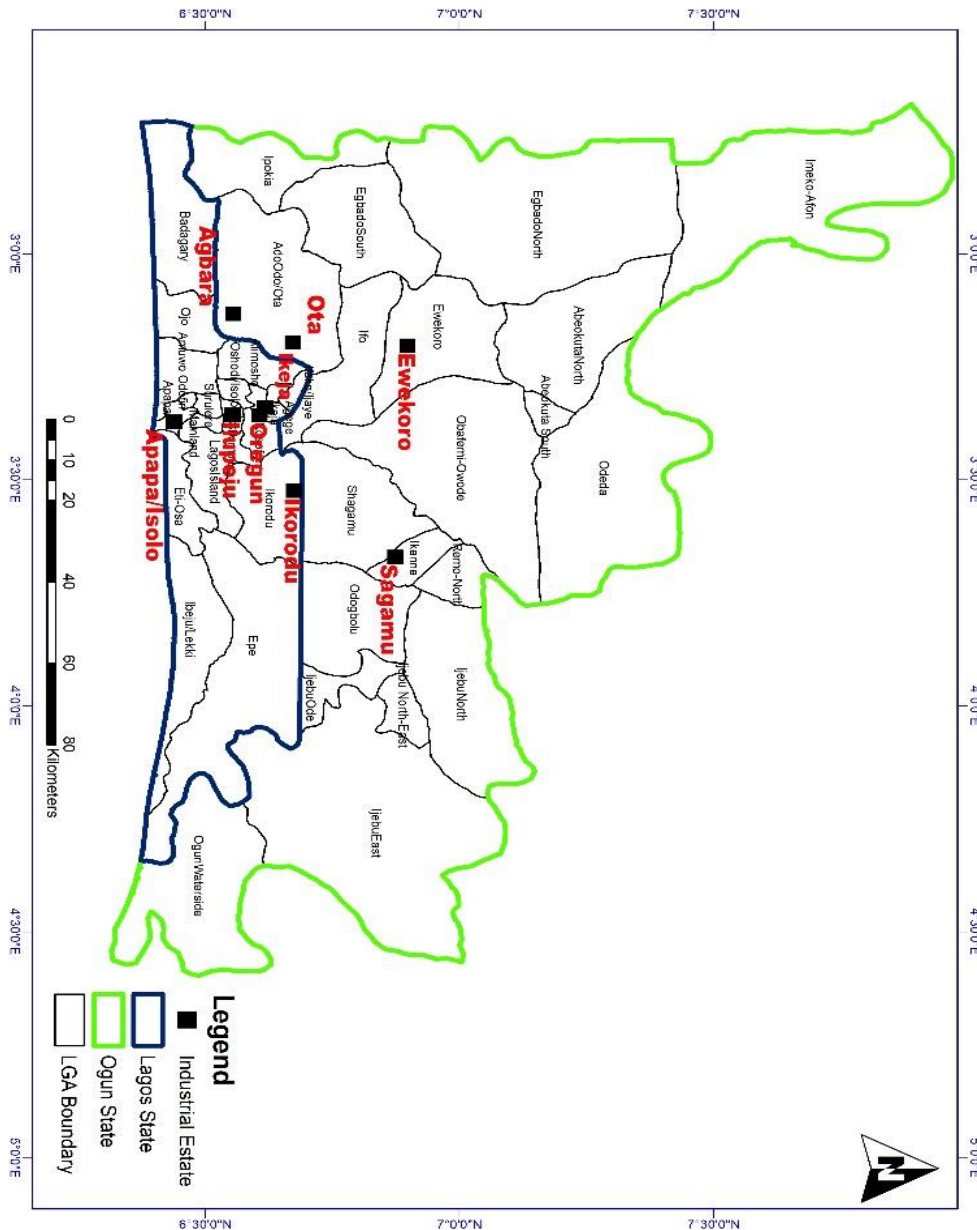


Figure 1: Map of Lagos and Ogun States showing industrial estates.

Source: Authors, (2023).

**Results and Discussion**

**Percentage Frequency Distribution**

This subsection presents the descriptive analysis of the variables under investigation. The completed information of the 23 firms were presented in Table 1. Table 1 reveals that 43.5% of the sampled firms have their factories in Lagos State, while 56.5% are in Ogun State. The majority of the firms sampled are situated in Ogun state. The table shows that trucks were used by 88.9% of manufacturers in Lagos and Ogun States to transport containers from the port to their factory sites, while barges were used by 11.1%. The primary mode of transportation for containers from the port to factory locations in Lagos and Ogun States is road transport, indicating a significant reliance on trucks. The absence of rail transportation in

the mentioned locations suggests its absence or ineffectiveness. The study indicates that inland water transportation in Lagos and Ogun States, Nigeria, is underutilized, with only a small percentage of firms using barges.

Regarding the precise locations of the companies in the two states, Table 1 shows that 30.3%, 21.47%, 4.35%, 17.35%, 4.35%, 4.35%, 4.35%, and 8.70%, of the sampled firms are located in Ilupeju, Agbara, Ewekoro, Ikeja, Ikorodu, Oregun, Ota, and Shagamu, respectively. This implies that every significant industrial estate in Lagos and Ogun was included in the data collection process. The analysis further reveals that the majority of the firms sampled are primarily located in the Ilupeju industrial areas.

**Table 1: Percentage Frequency Distribution**

Variable	Percentage
Factory Location	
Lagos	43.5
Ogun	56.5
Transport mode frequently used (Seaport to Site)	
By Truck	88.9
By Berge	11.1
<b>Specific Area of States</b>	
Ilupeju	30.43
Agbara	21.47
Ewekoro	4.35
Ikeja	17.35
Ikorodu	4.35
Oregun	4.35
Ota	4.35
Sagamu	8.70

**Source:** Authors' compilation based on Field work (2023)

**Relationship between firm's location (Distance) from seaport and cost of port-hinterland transportation**

To determine the relationship between firms' location and port-hinterland transportation of containers, a Pearson Correlation analysis was carried out. The

results of SPSS analyses are presented in Table 2, 3 and 4. The distance from seaport to site has minimum and maximum values of 50 and 120 Kilometres. It has an average of 89.5652 Kilometres and a standard deviation of 35.4809.

**Table 2: Descriptive Statistics of distance from seaport to site**

	Descriptive Statistics				
	N	Minimum	Maximum	Mean	Std. Deviation
Distance from seaport to site	23	50.00	120.00	89.5652	35.48089
Valid N (listwise)	23				

Source: SPSS Analysis

**Table 3: Descriptive Statistics of Cost of transporting 20ft and 40ft Containers from Port to Site ('000)**

	Descriptive Statistics					
	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Cost of transporting 20ft from port to site ('000)	23	400.00	950.00	13060.00	567.8261	179.69561
Cost of transporting 40ft from port to site ('000)	23	450.00	1000.00	15110.00	656.9565	174.78389
Valid N (listwise)	23					

Source: SPSS Analysis

**Table 4: Relationship between firm's location (Distance) from seaport and cost of port-hinterland transportation**

		Mean Cost of Transportation from Port to Site	Distance from sea port to site
Mean Cost of Transportation from Port to Site	Pearson Correlation	1	.550**
	Sig. (2-tailed)		.007
	N	23	23
Distance from sea port to site	Pearson Correlation	.550**	1
	Sig. (2-tailed)	.007	
	N	23	23

\*\* . Correlation is significant at the 0.05 level (2-tailed).

Source: SPSS Analysis

The Cost of transporting 20ft from port to site ('000) has minimum and maximum values of 400,000 and 950,000 naira respectively. It has an average of 567.8261 and a standard deviation of 179.69561. The Cost of transporting 40ft from port to site ('000) has minimum and maximum values of

450,000 and 1000,000 naira respectively. It has an average of 656.9565 and a standard deviation of 174.78389.

The finding in Table 4 demonstrates a positive correlation between container transportation costs (from the seaport to manufacturing locations) and the location of

firms within the hinterland ( $r = 0.55$ ). In other words, there is a statistically significant correlation ( $r = 0.007$ ) between location, as determined by the distance from the ports, and the cost of transporting containers.

### Conclusion and recommendation

The study indicates a direct increase in container transportation costs for companies located in the hinterland of a seaport. The study supports the research of Uzonwanne *et al.*, (2020), indicating that reducing transportation costs can significantly improve business performance. Guerrero (2017) suggests that barges and rail, capable of transporting multiple containers simultaneously, are likely to be more cost-effective than trucks due to their limited capacity. Guerrero's claim was not confirmed, as truck transport accounts for 88.9% of container transportation in Lagos and Ogun States. Lagos and Ogun States manufacturing supply chains must reduce port-hinterland transport costs and locate factories near intermodal connections to boost profits amid container transport expansion (Guerrero's (2017).

The investigation conducted by Zgonc *et al.* (2019) also emphasized the importance of location in determining the cost and mode of freight transport. Thus, business locations in the hinterland of a port should be strategically chosen in Lagos and Ogun States, where 88.9% of manufacturers use trucks and 11.1% use barges for container transport. Based on the findings, the study makes several recommendations for ensuring efficient container transportation from ports to locations in Lagos and Ogun States.

- i. In order to encourage the use of barges or rail services frequently, governments must invest in rail and inland water transport infrastructure.
- ii. The expansion of inland waterways' capacity for shipping containers from

ports to their destinations should be given a priority

- iii. Firms must understand how to focus their plans to avoid having the rising costs of port-hinterland transit have an influence on their revenue and profit.

### References

- Behdani B., Wiegman B., Roso V., and Haralambides H., (2020). Port-hinterland transport and logistics: emerging trends and frontier research, *Maritime Economics & Logistics* 22, (1), 1–25.
- Beresford, A., S. Pettit, Q. Xu, and S. Williams, (2012). A study of dry port development in China. *Maritime Economics & Logistics* 14 (1), 73-98
- Chen, S., Jeevan J. and Cahoon S. (2016). Malaysian container seaport-hinterland connectivity: status, challenges and strategies. *The Asian Journal of Shipping and Logistics* 32 (3), 127-137.
- Chopra, S., and Meindl P., (2007). Supply chain management, strategy, planning & operations. Pearson Education Inc., New Jersey.
- Fan Y., Behdani B., Bloemhof-Ruwaard j., and Zuidwijk R., (2019). Flow consolidation in hinterland container transport: an analysis for perishable and dry cargo. *Transportation Research Part E: Logistics and Transportation Review* 130, (C), 128-160.
- Financial Times, (2020). Nigeria's port crisis: the \$4000 charge to carry goods across Lagos, December, 28, Retrieved from <https://www.ft.com>>.....Nigeria.
- Guerrero David, (2017). Impacts of transport connections on port hinterlands. *Regional Studies*, retrieved from [ff10.1080/00343404.2018.1474192](https://doi.org/10.1080/00343404.2018.1474192). [ffhal-01822851](https://doi.org/10.1080/00343404.2018.1474192) on 9/27/2019.
- Lagos Chambers of Commerce and Industry (LCCI, (2017). Costs of maritime port challenges in Nigeria

- Moov Logistics News, (2018). Nigeria: importers, agents groan under 400 % hike in cost of container haulage. Retrieved from <https://moovafrica.com>newz> on 6/24/2020.
- Mueller M.A., Wiegmans B., & Duin J.H.R van, (2020). The geography of container port choice: modeling the impact of hinterland changes on port choice, *Maritime Economics & Logistics*, 22, 26–52.
- Ogwu, E. O. and Agu, G. A. (2016). Transport infrastructure, manufacturing sector performance and the growth of gross domestic product in Nigeria, *Journal of Business and African Economy*, 3 (3), 63-77.
- Ohida, M. E., Ajiboye, A. O., Abubakar, I. D., Garba, H. A., and Yusuf, N. B., (2023). Effectiveness of humanitarian logistics of relief material at internal displaced persons camp in Abuja, Nigeria. *Journal of Economics and Allied Research*, 8 (1), 13-27.
- Oni, B. G., Ojekunle A. J., Irinyemi, A., & Adekunle O. A., (2023). The firm's location in relation to the seaport as a key factor in enhancing firm performance in the manufacturing supply chain, *Journal of Economics and Allied Research*, 8, (3), 74-84.
- Rodrigue, J. & Notteboom, T. (2010). Foreland-based regionalization: Integrating intermediate hubs with port hinterlands. *Research in Transportation Economics*, 27 (1), 19-29.
- Sefiani, Y., Davies, B., and Bown, R. (2016). The perpetual effects of location on the performance of small business. Munich Personal RePEc Archive. Retrieved from [mpra.ub.uni-muench.de/74768/](https://mpra.ub.uni-muench.de/74768/) on 7/4/2022.
- Stephens, M. and Ukepere W. (2011). Port performance: The importance of land transport in a developing economy, *African Journal of Business Management*, 5 (21), 8545-8551.
- Ticiana G.Z.M (2019). Analysis of the relevance of location for port activity, programa de Doctorado, department de Economia, Universidad de Oviedo.
- Sdoukopoulos, E., and Boile, M. (2020). Port-hinterland concept evolution: A critical review. *Journal of Transport Geography*, Elsevier, 8 (C)
- Uzonwanne, M. C., Ezenekwe, U., Nzeribe G., Mathew, N., & Adonike, K. C., (2020) Impact of transportation cost on prices of consumable commodity in Anambra State, *Journal of Economic Studies*, 17, (2), 2020.
- Wang L., Goodchild A., and Yong W., (2017). The effect of distance on cargo flow: a case study of Chinese imports and their hinterland destinations. *Maritime Economics & Logistics*, 20 (3), 456-475.
- Zgonc, B., Tekavčič, M., and Marko Jakšič, M. (2019). The impact of distance on mode choice in freight transport. *European Transport Research Review*, 11 (10), 2-18
- Zhou X., (2013). Research on logistics value chain analysis and competitiveness construction for express enterprises. *American Journal of Industrial and Business Management*, 3 (2), 131-135