ANALYSIS OF THE EFFECTS OF MARITIME CLUSTERS ON HINTERLAND OPERATIONS IN NIGERIA.

BY

NWOSU EMMANUEL NNADOZIE (B. Tech, M.Sc., FUTO)

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CERTIFICATION

This is to certify that this work "**ANALYSIS OF THE EFFECTS OF MARITIME CLUSTERS ON HINTERLAND OPERATIONS IN NIGERIA**"

was carried out by **Nwosu Emmanuel Nnadozie** with Reg. No: **20154989138** in partial fulfilment of the requirements for the award of Doctor of philosophy (Ph.D) Degree in Maritime Management Technology, Federal University of Technology Owerri.

Dr. Nze Ibeawuchi Chibueze
(Supervisor)

29/07/2024
Date

Prof. Godfrey .C Emeghara
(Co-Supervisor)

Date

Dr. Obed Ndikom
(Co-Supervisor)

18/07/24
Date

Dr. Obed Ndikom
(HOD, M.M.T)

18/07/24
Date

Prof. K.A. Okorocha
(Dean, SLIT)

23-07-24
Date

Prof. (Mrs) J .N Nwosu
(Dean, PGS)

Date

Prof. Ogbonnaya Ezenwa Alfred
External Examiner

24/03/24
Date

DEDICATION

This work is dedicated to God Almighty for the gift of life and safe journey throughout this period of study.

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ABSTRACT

The study was carried out to analyze the effects of the performance of selected port-based maritime clusters business components on hinterland operations in Nigeria. The specific objectives of the study were among other things, to determine the determinant maritime cluster business component that contributes significantly to maritime sector Development in Nigeria; to model the effects of maritime cluster development on the shipping export and import capacities in hinterland locations in the six geopolitical zones of Nigeria and the federal Capital Territory, Abuja; and the determine the significant factors influencing the decision of maritime and allied firms, to locate operational basis in port-based maritime clusters in Nigeria. The study used a mixed research design method in which both survey methods involving the use of primary data sourced through the use of questionnaire as survey instrument, and quantitative research methods which involved the use of time series quantitative data on the shipping export and import capacities of each of the hinterland zones in the six geopolitical zones of Nigeria were sourced from the Nigeria ports Authority Statistical reports, covering a time period of 19 years, were used. The statistical methods of principal component factor analysis (PCFA) and the log-linear multiple regression analysis were used to analyze the data obtained. The findings of the study indicate that the offshore oil and gas maritime-cluster business component has Eigen values greater than 1 (5.904>1) and constitute the determinant maritime-cluster business component that significantly contribute to the development of the maritime sector in Nigeria over the years. The findings of the study also indicate that there is significant relationship between maritime-cluster development and the shipping export and import capacities of hinterland regions in the six geopolitical zones of Nigeria. The result however indicate that, the North-East and Federal Capital territory hinterland regions each recorded zero shipping export operations over the period covered in the study. The findings of the study further reveal that the significant factors that contributes to the decision of firms to locate investments in maritime clusters in Nigeria include: Guaranteed security of investment, Favourable Government policy, The ease of administration and coordination of the business divisions of a firm from the cluster location, Reduced labour cost and access to professionals and Access to transport cum optimization of logistics and production cost, with each having Eigen values of 2.992, 2.244, 1p.241, 1.145, and 1.039. the policy implications of the findings were also discussed. It was recommended that, Government policies such as policies creating free trade zones in maritime regions and tax exemptions for new firms should be used to attract more maritime firms to locate in port-based maritime clusters in Nigeria. The significant relationship between maritime sector development, export and import capabilities of hinterlands in Nigeria, suggest that the hinterlands can guarantee the achievement of higher output in the maritime sector if necessary investment is made by Government to improve the shipping export and import trade potentials of the hinterlands.

Keywords: Maritime-clusters, performance, hinterlands-operations, trade operations.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

The achievement of equilibrium in shipping business and balancing the demands of business with environmental concerns is an onerous task. This is even more in the shipping and maritime industry that has very tight profit margins and risky operational environment. Maritime clusters remain one of the major strategies that companies in the maritime industry work together in close proximity to promote sustainability and also fulfilling the demands of consumers of shipping services in the market. The concept of maritime clusters denotes a group of allied maritime industries and operators located in close proximity to each other in with the intention of enabling each company to develop capacity to performance by leveraging on the advantages of proximity with similar or allied companies. Merk and Notteboom (2015) define maritime clusters as "naturally-occurring collections of different types of maritime activities" that arise to benefit all parties. Often, firms in a cluster are linked by buyer-supplier relationships, operating closely together as partners (Merk and Notteboom, 2015). It is therefore commonly recognized that clusters are a big part of the future in responding to economic and environmental challenges facing the maritime sector in several regions. Maritime clusters can be at the sub national, national and international level as a way to advance maritime businesses, especially in identifying opportunities, spurring innovations and addressing sustainable development challenges. Typical examples of international maritime cluster is Singapore which has over the years developed as a global hub for ship chartering and engagement of diversified maritime businesses and allied business that services the shipping needs of various countries of the World.

In Nigeria for example, the development of the Onne Oil and Gas Free Zone hosting the Federal Lighter Terminal (FLT), the Federal Ocean Terminal (FOT), and multiple allied maritime companies with the aim of agglomerating such companies into maritime cluster for the purposes acting as a "One Stop Shop" for servicing the logistics needs of the West African Offshore Oil and Gas Sector and the overall shipping market represent one of the deliberate attempt of the Federal Government at

developing maritime clusters in Nigeria; even though it was not directly mentioned as a maritime cluster. It was developed as a Free Trade Zone (FTZ) for the offshore oil and Gas, oil shipping and allied maritime services on 29th March, 1996 by Government Decree No. 8, issued in the Official Gazette No. 12 on the 29th March, 1996 declaring an area of some 16 square kilometres in Onne Rivers State as a dedicated "Oil & Gas Free Zone". Similarly, establishment of the Calabar Free Trade Zone in 1989, situated by willful planning in proximity to the Calabar seaport in Cross River State, with an area of 152 hectares of land represent an indirect attempt at enabling clustering of maritime businesses and allied companies around port. The Calabar cluster or Free Trade Zone allows the investors to produce goods and services for export and also permits them to conduct other business-related activities such as assembly, distribution and transportation, import processing, packaging, warehousing, etc. The latest of what we refer to as attempt at encouraging the development of maritime clusters in Nigeria in the establishment of the Lekki Export Processing Zone in 2006, in Lagos, Nigeria. The Lekki Free Zone, created in 2006, is a modern free zone managed in accordance with international best practices. The zone's 16,500 hectares are divided into four quadrants and managed by various operators, benefiting from Lagos State's position as the premier distribution hub in West Africa. The motivation for the development of maritime clusters derives from the benefits if offers for the economic development of the regions and the State.

For example, maritime clusters deliver a range of benefits to their constituent enterprises. Primarily, they create competitive advantage by facilitating mutually beneficial relationships between the companies in the cluster. This in turn leads to both business and environmental benefits, including higher incomes and employment levels, sustainable consumption and production patterns, and support for adjacent industries that also support overall sustainable development. As an example, Clasen (2022) notes that the Danish maritime cluster's success has led to a record high number of charters under the Danish flag. Today, Denmark has the world's fifth-largest commercial fleet. Merk and Notteboom (2022) argue that the Danish fleet's success today is directly attributable to plans laid for the Danish maritime cluster as far back as 2020. For the past 15 years, Denmark's maritime cluster

strategy has been developed by three maritime growth strategists who are responsible for developing maritime cluster policies. Crucially, maritime clusters provide access to know-how, according to (Merk and Notteboom, 2015). When companies are located in close proximity to each other, it's easier to share knowledge and best practices or recruit the right people. Given the industry-wide implications of many maritime problems, there's a clear role for maritime clusters to play in facilitating collaboration across the industry. Many problems – such as the search for a climate-neutral ship and solutions to other environmental challenges – need to be solved through collaboration and the different parts of a cluster working together, Merk and Notteboom (2015).

It is very important to note that the success of given maritime cluster in delivering the objectives for its development, does not imply that every other maritime clusters must be successful, without willful planning and strategic implementation of roles geared towards the achievement of predetermined maritime sector developmental goals. For example, the success of the Singapore maritime clusters as the most efficient vessel (all types of vessel) chartering market globally today, does not mean that all other maritime clusters existing in other regions of the World must succeed as vessel chartering cluster (Fraser and Notteboom, 2014). Philippines have developed a maritime education and seafaring maritime cluster that has made it the hub of global maritime labour currently, South Korea Germany, Europe and the U.S Americas have developed shipbuilding hubs and the shipbuilding and repair clusters in those countries have remained successful over the years (Notteboom 2020). The implication is that a a region/Country interested in development a maritime cluster must adopt planning to identify most areas of her competitive advantage and begin the process of maritime clustering through this, and grow or extend to other areas. Seaports have remained the best option and points that act as fulcrum for the development of maritime clusters in most developing countries with less advancement in technology. This brings the Calabar Free trade Zone, Onne oil and gas Free zone and the later Lekki Export processing were developed around the seaport such that other maritime, shipping and the allied companies develop around it as the base. Thus, for the success of such maritime clusters developed around the seaport, the port-hinterland relationship is critical in planning the success of the clusters

since the seaport must depend on the port-hinterland to have traffic while the allied industries will get life from the survival of the seaport. Thus, in Nigeria, empirical understanding of the port-hinterland relationship in the port-based maritime clusters established in Onne, Calabar, and Lekki is important in modeling the dependence of the seaports and by extension the allied maritime companies operating in the clusters, in the successful operation and optimal performance of these port-based maritime clusters in Nigeria.

Notteboom and Rodrigue (2007) argue that the hinterland plays an important role in shaping the supply chain of shippers and logistics service providers. For example, a large part of the volumes in dry and liquid bulk products is relatively captive to the discharging port region since customers are typically located in the port region or the vicinity of the port, if not directly co-located with a port terminal facility. The port hinterland is defined as a land area over which a port sells its services and interacts with its users (Notteboom 2007). It is an area over which a port draws most of its business and regroups all the customers directly bounded to the port and the land areas from which it draws and distributes traffic. Imports from a given seaport find market (consumers) in the port-hinterland while exports produced in the port-hinterland are transported to the seaport for delivery (export) to overseas countries by sea. The implication is that the survival of the seaport and the seaport-based maritime clusters dependent of the existence of a robust port-hinterland that consumer import traffic from the seaport and offers the seaport and the allied company's access to export cargo traffic.

1.2 Problem Statement

Nigeria is a maritime nation of worth endowed with vast potentials in the maritime sector awaiting development. Part of the many factors that has led to the continued non-realization of the potentials of the maritime sector in Nigeria is the lack of robust maritime policy that holistically identify and but specifically seek the grass root development of the multiple sub-sector of the maritime sector in Nigeria. One such areas of potential wealth in the maritime sector that has remained untapped over the years in the maritime clustering sector with the accruable benefits estimated in multiples of Billions of

Dollars. Though many maritime-based industrial or trade free zones such as the Calabar free trade zone, the Onne oil and gas free zone and Lekki free trade zone have been established to deepen the development of the maritime sector in Nigeria; no maritime clusters policy have been developed to deliberately harness the potential wealth accruable from such clusters in order to optimize the identified benefits of maritime clusters in Nigeria.

To be able to develop a robust policy to harness the potentials and the benefits of maritime clusters and sustain its development in Nigeria; there is need for empirical evidences of the port-hinterland relationships as basis for driving development in the maritime clusters. This is because, giving the technological advancement status of Nigeria, the existing maritime clusters are port-based maritime cluster built upon the seaports as the fulcrum. Thus, the direction of the relationship between the seaports and the hinterlands they serve influence and determine to an extent the levels of operations and performances of the existing companies in the maritime clusters. Therefore, empirical evidence of the port-hinterland relationship is critical towards influencing the growth and sustainable development of the maritime clusters. The problem however, is that there currently seems to exist empirical information evidencing the port-hinterland relationships and the influence of such relationships in the operations, performance, development and sustenance of most of the port-based maritime clusters in Nigeria. These are the key problems identified in the study for which it seeks solutions.

Maritime clusters over the years are known to affect port related activities such as Haulage and Hinter land operations among which the major impact is congestion. However the extent to which Maritime clusters affect the respective operations are yet to be asserted. Hence this study would attempt to provide empirical solutions to these problems by establishing measurable relationship and models capable of producing parametric estimates.

1.3 Aim and Objectives of the Study

The aim of the research is to analyses the effects of maritime cluster development on hinterland operations in Nigeria.

The specific research objectives include:

1. To determine the significant maritime cluster business components that contributes to maritime sector development in Nigeria.
2. To investigate the effect of maritime cluster operations on the development shipping export and import trade in the hinterland regions of south-east Nigeria
3. To determine the relationship between maritime cluster operations and the development shipping trade in the south-south hinterland region of Nigeria
4. To model the effects of maritime cluster operations on the hinterland operations in the south-west hinterland regions
5. To determine the effects of maritime clusters on the hinterland operations in north-west Nigeria
6. To establish the relationship between maritime cluster development and hinterland operations in north-central region of Nigeria.
7. To model the effect of maritime cluster development on hinterland operations in the FCT Abuja.
8. To investigate the determinant factors that influence the decision of firms to locate operational bases in maritime clusters in Nigeria

1.4 Research Questions.

1. What are the significant maritime cluster business components that contribute to maritime sector development in Nigeria?
2. Is there significant effect of maritime cluster operations on the development shipping export and import trade in the hinterland regions of south-east Nigeria?

3. To what extent is the relationship between maritime cluster operations and the development shipping trade in the south-south hinterland region of Nigeria significant?
4. To model the effects of maritime cluster operations on the hinterland operations in the south-west hinterland regions
5. Is there a significant effect of maritime clusters on the hinterland operations in north-west Nigeria?
6. Is there a significant relationship between maritime cluster development and trading operations in hinterland north-central region of Nigeria?
7. Is there a significant effect of maritime cluster development on hinterland operations in the FCT Abuja?
8. What are the determinant factors that influence the decision of firms to locate operational bases in maritime clusters in Nigeria?

1.5 Hypotheses

H_{01}: There is no determinant maritime cluster business component that contribute significantly to maritime sector Development in Nigeria

H_{02}: There is no significant Effect of Maritime Clusters development on export and Import shipping Trade Capacity of the South-East Hinterland Regions

H_{03}: There is no significant relationship between Maritime Cluster operations and the development of export and import shipping Trade Capacity in the South-South Hinterland Region.

H_{04}: There is no significant effect of Maritime Cluster development and hinterland operations in the South-west Hinterland Region

H_{05}: There is no significant relationship between Maritime Clusters development and hinterland operations in the North-West Hinterland Regions

H_{06}: There are no significant effects of Maritime Clusters development on trading operations in the hinterland of North-Central Hinterland Regions

H_{07}: There are no significant effects of Maritime Clusters on hinterland operations in FCT Abuja.

H_{08}: There is no significant factor that contributes into the decision of firms to locate investments in maritime clusters in Nigeria

The hypotheses include:

1. **H_{01}:** There is no significant factor that contributes into the decision of firms to locate investments in maritime clusters in Nigeria
2. **H_{02}**: There is no determinant maritime cluster business component that contribute significantly to maritime sector Development in Nigeria
3. **H_{03}**: There is no significant relationship between maritime sector development and the export and import capacities of port-hinterlands in the sustenance of maritime cluster in Nigeria
4. **H_{04}**: The coefficient of elasticity of port revenue to variations in shipping export trade originating from the hinterlands to the port-based shipping clusters in Nigeria is indeterminate.
5. **H_{05}**: There is no significant influence of port-hinterlands on the performance of the ship operations in the port-based maritime clusters in Nigeria seaports

1.6 Significance of Study

The contribution of this study would be of interest to researchers, maritime practitioners, providing them with fresh dimension of understanding on the major effects of maritime clusters on port hinterland and haulage operations, and as well helping the Nigerian Maritime Sector as a federal agency and pivoting measures and making decisions of curbing inefficiencies in Nigerian port hinterland and haulage operations.

This study is also very significant to the future researchers into the subject matter thereby filling an academic gap in the literature of marine clusters on port hinterland and haulage operations.

One reason for the sensitivity of this study is the scenario of revenue generation, profit maximization and the negative effects of gridlock during operation of the marine clusters in the hinterland and haulaging. A research work on such a sensitive matter as the relationship between marine cluster, port hinterland haulage operation corresponding to profit maximization and revenue generation, is therefore at this time a necessity. The need to provide a long lasting solution to the effect of marine clusters on port hinterland and haulage operations which affects human life, property and marine environment which as a result could yield a less breakdown and running cost, optimization of ship operations and resources among others as would be advocated in this research work is therefore a task that must be done and hence a justification for this research work.

1.7 Scope and Limitation of Study

This study covers a greater view on the analysis of maritime clusters on port hinterland and haulage operations but due to the financial constraints, time constraints, and limited access to documents and organizations, lack of reliable data needed for this research, lack of prior research studies to this research, this research could not cover all the factors affected by marine cluster. It should be noted that these limitations do not really affect the content of the research.

CHAPTER TWO

LITERATURE REVIEW

2.1 CONCEPTUAL REVIEW

2.1.1THE CONCEPT OF HINTERLAND

Hinterland transport plays a very crucial role in any region's market; it enhances proficient movement of cargo, hence, improves the country's economy and the competitiveness of its ports, especially when the hinterland system is efficient. It becomes essential for national and international economic and trade growth, importantly, when it serves a wide geographical outreach. All modes of transport provide various ways of movement of cargo and freight to meet the needs of industry and transport users under a framework that engages all modes. Many researchers have researched on hinterland Transport. It has been posited that there is a shift of challenges from sea to the port and currently to the hinterland (Guthed, 2005;Notteboom, 2002; Alamoush, 2016).

Furthermore, the hinterland forms a crucial part of port composition. Most ports, despite high engagement in deep sea or feeder services such as transshipment, do have some percentage of transit traffic gateway, i.e. the containers are unloaded from the container ship to the yard then through the gate to the hinterland via modes of transport **(**Alamoush, 2016). In this sense, hinterland transport is a paramount component to ports. In their research, Horst and De Langen (2008) stressed the need to analyze hinterland transport systems because the hinterland transport costs are, by and large, more than the maritime costs (Davis, 2007).

Moreover, the problems of congestion, and bottlenecks, in door to door container service and handling of rails, barges, and trucks, take place in the hinterland networks. Also, the development of any container port and its expansion depends on good hinterland transport, for which sufficient provisions should be crafted for road and rail capacity to help in the functioning of the terminal with high value added services (Acciaro and Mckinnon, 2013; Alamoush, 2016). In general, the hinterland chain of ports is segmented into the gate process and hinterland transport process.

Hinterland Transport Modes and Development The intensity and intricacy of landside activities differ significantly depending on the terminal size, transport types, and infrastructure accessibility in the area, and the terminals operation technologies applied. The big terminals, noticeably, rely on a mixture of road and rail transport and also, if available, barge transport. Nevertheless, road transport continues to be one of the major hinterland transport modes given that its flexibility and possible outreach are high owing to the fact that trucks can go wherever there are roads, according to Zuidwijk and van Asperen (as cited in Acciaro & Mckinnon, 2013;(Alamoush, 2016)). According to UNCTAD (2008), hinterland transport can be divided into four modes; herewith hinterland transport is identified as:

a. Inland Waterway Transport

Inland waterway transport is the transport of cargo via ships or barges or any water craft in inland canals, rivers, and lakes between ports and harbors. While still under-utilized, it is considered the most environmentally friendly mode of transport. Inland waterway transport plays a critical role in linking cargo and passengers from remote areas to further or more developed places. It is considered a very valuable alternative in developed countries to relieve road transport congestion and reduce the environmental effects from trucks emissions; this fact helps to contribute more to the growth and development of inland waterways. Moreover, inland waterway transport has acquired a very considerable importance because it offers cheap and reliable transport, which has attracted many container shippers who have used barge transport since the eighties (Alamoush, 2016). According to UNCTAD (2008), the European inland waterway transported around 500 million tons of goods in 2007, an increase of 4% from 2006. Moreover, goods transported in the United States, in the same year, amounted to around 800 million tons, China as well along with Yangtze River increased the traffic of inland waterway up to 1.3 billion tons.

b. Railway Transport (Trains)

Railway transport is capable of carrying general cargo, containers, and dry/wet bulks, has developed significantly in recent years. The International Union of Railways (as cited in UNCTAD, 2008), reported that railway traffic witnessed improvements and advancements all around the world,

especially in BRIC countries, which resulted from the development of demographical aspects and the globalization of trade. In Europe as well, railways developed very quickly both within countries as in Germany, The Netherlands, Belgium and Sweden or across borders to serve wider hinterlands. The development continues in many countries, such as the United States, Russia, China, and Chile. By doing so, another mode of transport is given a share in the servicing of the hinterland, improving logistics and supply chain and decreasing congestion at ports. Rail and barge are highly advocated to be utilized because they offer substantial cost and environmental advantages (van der Horst & de Langen 2008; Alamoush, 2016).On the other hand, this kind 12 of development needs a proper infrastructure which requires capital intensive investment and many private and public investors and agencies to work together harmoniously. Hence, the coordination must rely on specific policy action to perform successfully (Van der Horst and de Langen 2008). Still, many countries may not move forward to invest in railways, nonetheless it is an efficient way to improve terminal integration with intermodal transport (Udoka and Anyingang, 2012).

c. **Road Transport (Trucks)**

Road transport is the haulage transport of goods mainly using trucks that operate on roads as its primary network. It is a more frequently used way to cover the hinterlands, carrying general cargo, containers, dry/wet bulks and dry break bulks. Many issues result from the use of road transport i.e. road congestion, pressure on infrastructure, and environmental and safety issues, especially when the whole system lacks the organized consolidation of its components and/or trans-country outreach. Despite that, European road transport makes up 90% of inter-urban transport traffic, which means that roads are still highly used among all other modes of hinterland transport (UNCTAD, 2008). Practically, trucks dominate most of the port hinterland traffic, causing most of the congestion in and around port areas, and commonly generating most external costs (Merk and Notteboom, 2015).

So, many ports included a modal shift in their strategic plans, from trucks to rail or inland waterway transport; unfortunately, not all ports are well connected with developed rail systems or have inland

waterways. Moreover, in some ports, if it is feasible to elect the use of railways, the cost may outweigh the return on such investment. Therefore, a modal shift in many ports is not applicable, but there is a wide variety of instruments that can be applied to mitigate and lessen the effect of truck usage in hinterland transport (Cullinane 2005).

2.1.1.1 The Roles of Hinterland in the Supply Chain

The hinterland plays an important role in shaping the supply chain of shippers and logistics service providers. Land scarcity concerns, combined with transport reliability issues, have led seaports and hinterland corridors to take up a more active role in supply chains. Port hinterlands are challenging to delimit as they vary according to the type of commodities, such as for bulk versus containers, seasonality, business cycles, technological changes, changes in transport policy, and the cost structure of inland transportation modes. For example, a large part of the volumes in dry and liquid bulk products is relatively captive to the discharging port region since customers are typically located in the port region or the vicinity of the port, if not directly co-located with a port terminal facility. These include steel plants, power generation plants, oil refineries, and chemical companies. Before containerization, several ports developed expertise in handling specific cargo types, securing the use of gateways according to the cargo base (Easterly and Levine, 2003; Parker and Saal, 2003).

The port hinterland is a land area over which a port sells its services and interacts with its users. It is an area over which a port draws most of its business and regroups all the customers directly bounded to the port and the land areas from which it draws and distributes traffic.

The gateway function for major dry and liquid bulks of ports mainly involves one direction for hinterland flows**,** either incoming or outgoing, a limited number of market players**,** and a limited number of destinations. However, for containerized cargo, the hinterland profile involves numerous origins and destinations dispersed over a vast hinterland with more competitors, a large number of economic players, and bi-directional hinterland flows. Therefore, the captive nature of container cargo for ports is typically much smaller than for bulk cargo. Moreover, market dynamics make it

counterintuitive to have a static concept of port hinterlands being taken for granted and stable in time (Cullinane, and Wang, 2005).

Before containerization, boxes were shipped from the inland production center to the nearest port, and shipping lines designed routes to cover all ports within a coastal range, resulting in captive hinterlands and limited inter-port competition**.** Containerization has expanded the hinterland reach of ports and has intensified inter-port competition**.** The expanding hinterland coverage and the associated shift from captive hinterlands to shared or contestable hinterlands has changed the perception of port markets from being monopolistic or oligopolistic to competitive. Thus, port competitiveness is increasingly derived from its hinterland access.

Most ports now act as gateways to often extensive inland networks**.** These gateways are nodal points where intercontinental transport flows are being transshipped onto continental areas and vice versa. Several factors have facilitated the rise of gateways that vie for contestable hinterlands. First, containerization and the deployment of ever-larger container vessels have gone hand in hand with a concentration of vessel calls in a limited number of load centers, especially on the main long-distance routes where economies of scale at sea are most apparent. Price fixing systems that ensured the reduction of port calls had no negative price impacts on the customer base. For example, shipping lines put in place port equalization systems to compensate inland customers for the longer inland transport distances they might incur when sending or receiving cargo via container load centers (Boubakri 2009).

The development of intermodal corridors by rail and barge and inland terminals allowed for a deep hinterland penetration via shuttle trains and barges. The rise of intermodalism and associated transport corridors had a significant structuring effect on the hinterland reach of seaports. Not only has intermodalizim given incentives for ports to expand their hinterland reach. Hinterlands also became more discontinuous, especially beyond the immediate hinterland of the port. Such a process can even lead to the formation of “islands” in the distant hinterland for which the load center achieves a

comparative cost and service advantage vis-à-vis rival seaports. Conventional market perspectives based on distance-decay are ill-fitted to address this new reality. High volume intermodal corridors typically offer a more favorable relation between transport price, lead time, and distance than the conventional/continuous inland transport coverage (Bernerth, 2004)

A port's service area by rail and barge consists of sets of overlapping service areas of individual inland terminals**.** The size of each of the inland service areas depends on the service frequency and the tariffs of intermodal shuttle services by rail and or barge, the extent to which the inland terminal acts as a gateway, as well as the efficiency and price of trucking. The more intermodality serves as a port competition tool, the more ports become dependent on the intermodal carriers offering services along the intermodal corridors. In terms of organizational and operational factors, a highly volatile intermodal market is thus not very conducive to creating a stable and sustainable competitive position for a port vis-à-vis the hinterland segments served through the corridors. The outcome has been a series of port hinterlands serviced by maritime ranges that are a function of economic density, structure, and orientation of transportation networks, which can be contestable(Thurber, Emelife, &Heller, 2010).

There is also a directional component to hinterlands. Inbound hinterland traffic in North America and Europe tends to be consumption-based, except when commodities and parts are involved in manufacturing. In contrast, outbound hinterland traffic is an outcome of extraction or export-oriented manufacturing. The relative importance of forelands and hinterlands varies from a distance and cost perspective. If the distance is considered for an international transport chain, the foreland is usually the most important, while the hinterland is usually where most of the transport costs are realized (Barro, 1991; Birdsall and Nellis, 2003).

The rise of corridors is a highly relevant development to any policies to generate a modal shift from road haulage to inland navigation, rail, and short sea shipping. Intermodal solutions based on barges or

rail prove competitive on several high-density traffic corridors or in specific niche markets. Still, they cannot serve as a continent-wide alternative for road haulage.

2.1.1.2The Hinterland as Part of the Maritime Land Interface

The maritime land interface concerns the relationships between maritime and inland freight distribution, which are two domains of freight circulation. Maritime shipping is entirely dependent on the performance of inland freight distribution as it ensures continuity in supply chains. While economic activities, such as production and retailing, are built on the concept of interdependency, distribution is a derived outcome of this interdependency. The maritime/ land interface is particularly important for the long-distance trade brought by globalization. Thus, the growing distances over which freight is being carried in addition to a surge in freight volumes has created multiplying effects on the ability of the maritime-land interface to deal with this new environment. There are four major functional elements that define the maritime-land interface:

- **Foreland**. Although conventionally, the foreland is a maritime space with which a port performs commercial relationships, it can be argued that maritime shipping networks are a more valid representation of the concept of the foreland. The network represents the level of service offered by maritime shipping companies in terms of port calls, capacity, and frequency.
- **Port system**. The set-up of intermodal infrastructures servicing port operations. The focus on gateways granting access to large domains on inland freight circulation.
- **Modes**. Each mode has technical constraints and is positioned to service specific inland markets effectively. They are structured as corridors accessing the hinterland and inland hubs acting as intermodal and transmodal centers. Inland modes represent one of the most difficult challenges in terms of reconciling the surge in containerized maritime volume and the capacity of inland transportation to accommodate these flows. There is a growing asymmetry between maritime transport and inland modes.

- **Hinterland**. Although the hinterland is the inland space, a port maintains commercial relations with; the emergence of supply chain management has placed the inland port at the core of hinterland transportation. Macro-economic factors linked with economic globalization have become particularly important for explaining the dynamics of hinterlands.

The maritime/ land interface can also take many transactional forms related to freight and information exchange. There is a trend involving the growing level of integration between maritime transport and inland freight transport systems. Until recently, these systems evolved separately, but the development of intermodal transportation and deregulation provided new opportunities, which significantly impacted maritime and inland logistics. One particular aspect concerns high inland transport costs since they account for between 40% and 80% of container shipping costs, depending on the transport chain. Under such circumstances, there is greater involvement of maritime actors (e.g. port holdings) in inland transport systems.

The maritime-land interface thus appears to be increasingly blurred depending on the level of port competition, ranging from a single port to multiple ranges. Corridors are becoming the main structure behind inland accessibility and through which port terminals gain access to inland distribution systems serviced by inland ports. Since transshipment is a fundamental component of intermodal transportation, the maritime / land interface relies on improving terminal activities along those corridors. Strategies are increasingly relying on the control of distribution channels to ensure an unimpeded circulation of containerized freight (Abdou and Moshiri, 2009)

2.1.1.3 The Hinterland Focus of Market Players

Hinterland connections are a key area for competition and coordination among market players involved in the maritime/land interface. Many market players understand that landside operations are key to a successful integration along the supply chain. As a result, competition between ports and across the logistics sector is intensifying. As ports and logistics firms battle to protect and gain market share, the race to find cost savings and efficiency gains becomes even more pronounced.

Shipping lines are keen on developing carrier haulage volumes, where the sea carrier arranges the hinterland transport of containerized cargo. In the case of merchant haulage**,** the shipper or forwarder manages the inland segment. The deployment of larger vessels, the formation of strategic alliances, and the waves of mergers and acquisitions have resulted in lower costs at sea, shifting the cost burden of shipping lines to the landside. Therefore, several shipping lines extend their scope beyond terminal operations to include inland transport and logistics**.** To streamline the inland distribution system, shipping lines and their alliances seek to increase the percentage of carrier haulage. However, in most parts of the world, the inland market is dominated by large shippers or their representatives, such as logistics service providers.

Still, several larger shipping lines are developing hub-concepts in the hinterland of the key ports in their networks. Inland terminals and rail and barge services are combined to push import containers from the ocean terminal to an inland location, from which the final delivery will be initiated at a later stage. This push strategy is initiated by the shipping line prioritized on the required delivery date. Export containers are pushed from an inland location to the ocean terminal, initiated by the shipping line, yet prioritized based on available inland transport capacity and the estimated time of arrival (ETA) of the mother vessel

Carriers are confronted with some important barriers to improve inland logistics further. Landside operations are management intensive and generally involve a high proportion of bought-in services. Moreover, inland movements generate some under-remunerated activities such as repositioning empty units, network control, and tracking. Other barriers relate to volume and equipment-types of imbalances, and unforeseen delays in ports and the inland transport leg, as well as the uncertainty of demand forecasts. Carriers have learned to lessen equipment surpluses and deficits through container cabotage, inter-line equipment interchanges, chassis pools, and master leases. Carriers have very little room to increase the income out of inland logistics. If the carrier haulage tariffs edge above the open market rates, the merchant haulage option might become more attractive. The risk of cost under-

recovery on second moves is another challenge in inland logistics. For example, where the line issues a bill of lading (B/L) to port A, but the vessel only calls at port B, it pays the full cost of moving the cargo to port A. Fewer ports of call implies more second moves and more substituted service and as such possibly large landside container interchanges between adjacent ports.

2.1.1.4 Terminalization and Inland Transport

Terminal operators are also increasing their influence throughout supply chains by engaging in inland transport. They do so mainly by incorporating inland terminals as extended gates to seaport terminals and introducing an integrated terminal operator haulage concept. The advantages of the extended gate system are substantial as customers can have their containers available in proximity to their customer base. Simultaneously, the deep-sea terminal operator faces less pressure on its terminals due to shorter dwell times and can guarantee better planning and utilization of the rail and barge shuttles. However, the success of both extended gates and terminal operator haulage largely depends on the transparency of the goods and information flows. Unfortunately, terminal operators often lack information on the onward inland transport segment for containers discharged at the terminal. Close coordination with shipping lines, forwarders, and shippers is needed to maximize the possibilities for developing integrated bundling concepts to the hinterland. Further, market players are contending with the terminalization of maritime supply chains where terminals can act as a constraint or a buffer.

Terminals taking up a more active role in supply chains with operational considerations such as berthing windows, dwell time charges, truck slots, to increase throughput, optimize terminal capacity and make the best use of available land. Also involves logistics players making best use of the free time available in seaports terminals and inland terminals, thereby optimizing the terminal buffer function. Terminalization incites the setting of a hierarchy of flows along a transport chain where terminals act as important regulators, either as bottlenecks or as buffers.

2.1.3. Measurement of Hinterland Related Performance

According to the UNECE report (Woodburn, 2010),no uniform method measures hinterland connection performance due to the data unavailability and consistency matters 13 that make the comparison very hard. Hinterland can be regarded from a macro level, a country level, and a micro level, the county's ports and corridors. However, the World Bank and the World Economic Forum provide an international comparison between countries on the basis of logistic activities, which aims to quantify countries' logistical performance; certainly, this incorporates the hinterland links within the index(Bennett, Estrin, and Urga, 2007).

Three significant indices can incorporate the hinterland connection performance, those indices, as stated by Woodburn (2010), are, the Logistics Performance Index (LPI), produced by the World Bank, which measures the country's logistics performance friendliness. Based on the World Bank (2007a), the LPI is composed of six core component. Importantly, they measure the perceptions of the logistics environment of trading partner countries. This incorporates customs, border procedures, transport quality, shipment arrangement, the industry of local logistics, the cost of domestic logistics, shipment tracking ability, timeliness in shipment arrival to end destination, and IT infrastructure. Moreover, the index provides information on the logistics environment in the home country of operation, and the real time-cost performance data for country of operation. Trading across borders indices, produced by the World Bank and focus on the specific procedures taken to export and import goods in countries (Megginson and Netter, 2001).

The Enabling Trading Index, produced by the World Economic Forum covers market access, border administration, communication and transport infrastructure and the business environment (World Economic Forum, 2008).

For the hinterland connection at the individual port or corridor level, there is no regular analysis. However, ports, individually, can quantify the hinterland performance concerning the connectivity to inland location through measures related to the number of inland terminals served, the frequency of

service, the journey time, turnaround time, and goods that terminals or geographical areas receive. Moreover, measures regarding environmental performance are progressively more important (Woodburn, 2010).

2.1.2 CONCEPT OF MARITIME CLUSTERS

Maritime clusters are simply a group of companies in the maritime industries located in close proximity. Maritime clusters are "naturally occurring collections of different types of maritime activities" that arise to benefit all parties. Often, firms in a cluster are linked by buyer-supplier relationships, operating closely together as partners. While maritime clusters are found around the world, their structure and goals vary by geography. At the international level, the World Ocean Council the Global Blue Economy Business and Investment Organisation has been bringing together all ocean-related industries in a leadership alliance for Corporate Ocean Responsibility since 2009 and produced a white paper on this topic in February 2018.According to Paul Holthus, WOC's Founding President and CEO, many European clusters "are often well structured in looking at global competitiveness, really providing a platform that links national maritime-level strategic interests to their governments' interest in economic development." "For the smaller, dynamic Asian economies such as Singapore," Holthus says, "it was also a very natural evolution of the triple helix between the industry, government, and research communities that was able to quickly develop collaboration, which has been facilitated by national policies." Holthus notes there are some distinctions in how clusters are developing in larger Asian countries. "For the larger Asian countries, it's perhaps more challenging to create the commonalities and dynamics at a national level, and so clusters are emerging more at the level of key maritime centers," Holthus says. Clusters in the Middle East face other challenges, according to Holthus. "The importance of the oil sector has perhaps meant there has been less need to have a multi-sectorial cluster in an area that's historically been reliant on a single maritime-related industry. This may have reduced the incentives for competitiveness and innovation, however that is changing rapidly as maritime clusters look to be developing in the region." Holthus says that,

regardless of region, there is an understanding that the clusters are important for growth and, increasingly, for sustainable development.

The common recognition is that clusters are a big part of the future in responding to economic and environmental challenges. People are looking at clusters at the subnational, national and international level as a way to advance business, identify opportunities, spur innovations and address sustainable development challenges, and the WOC is assisting with this around the world," says Holthus.

2.1.2.1 Benefits of Clustering

Maritime clusters have been defined as networks of connected businesses, suppliers, and associates in the maritime field that are located in the same geographical area, operating and influenced by related relationships and institutions. A feature that distinguishes clusters from other types of networks is their mutual relatedness and interdependence. There are both economic and social ties that relate cluster members around their economic specialization interests. Clusters are seen as means of providing improved efficiency and productivity so that businesses can be competitive on a national, regional and global scale. Further socio-economic factors, such as employment and sustainability are also seen as positively influenced by cluster dynamics (Scabrosetti 2008)

Cluster theory has been identified and adopted over the past two decades as a tool for better understanding the economic activities in service and knowledge based regional economies. Clustering is primarily viewed to enhance the advantage of competitiveness, generate productivity, foster innovation abilities and embody the transfer of new knowledge and business information, with different development functions (Starr, 1988).

Maritime clusters have emphasized, so far, shipping, port, also shipbuilding and associated services, namely financial or technology research and development maritime services as the principal services of the cluster. In other words, "traditional" maritime services have been the strategic pillars within successful international clusters, with varying emphasis and distinguishing configuration features. As maritime clusters evolve over time in terms of the composition of maritime services provided and

actors represented, also overall strategic re-orientation and positioning of established and emerging stakeholders of the maritime sector, we witness an evolution of new or changing cluster services and functions, reflecting quite different stages of economic and social developments, such as the growth of blue economy sectors (i.e. aquaculture, maritime tourism), environmental sustainability strategies, the growing recognition of embedding and formally including related technical research and innovation mechanisms and actors in a cluster's governance and functions, and further modernization in the maritime clusters governance along with a revival in its overall attractiveness(Cavaliere & Scabrosetti, 2008).

In more detail, the theoretical definition and the actual operation of a maritime cluster, based on available literature and professional reality reviewed, is not uniform. The scope or focus and driving forces of a maritime cluster can be very wide and diverse. As regards the structure of maritime clusters, three main groups of actors have be identified, namely shipping, shipping and maritime services and ship industry, supported and cooperating with facilitating associations, educational and research institutions and political bodies. As to the linkages and relationship within a maritime cluster, these also vary significantly with a profound impact on the clusters functions and institutional form and enabling governance mechanisms.

According to literature reviewed and also largely validated in practice, businesses cluster because of the access to a large employment infrastructure inside the cluster, which reduces search costs and allows for the existence of training and education programme, which in turn enhance the quality of the human capital. Also, businesses cluster together because of the existence of suppliers and customers in a cluster, in the proximity of both offering low transport costs. Proximity also enables closer and more efficient interactions and monitoring. Lastly, businesses cluster together because of the occurrence of "knowledge spillovers", because of frequent and creative interaction and because of more proficient identification opportunities and challenges, locally (agglomeration economies). Cluster complementarities account to the benefits (scale economies) arising from the use of common

resources. Infrastructure, such as maritime education and ports are examples of such scale-dependent resources. Attaining and maintaining the aforementioned benefits of clustering requires that there are sufficiently strong linkages between the various constituent parts of a cluster (Wright, 1993).

The performance of the cluster is measured in value added: a good performance is shown by a rise in the value added generated in the cluster; namely more start-ups and entrants than bankruptcies and exits, also the growth of established firms, along with pertinent, topical indicators of interest i.e. employment growth. Strong industrial clusters are characterized by inherent, self-reinforcing upgrading mechanisms, specifically (a) pressure for innovation, (b) complementary resources, and (c) knowledge dissemination. Innovation is dependent on demanding customers, on rich and open communication between the actors in the sector, and on some level of competition between present firms as well as among suppliers (Stiglitz and Godoy, 2006).

According to the literature reviewed, an established framework to analyze cluster performance considers factors related to the cluster structure and factors related to the cluster governance. As regards the structural factors, cluster performance should be cited as regards a positive influence of heterogeneity; the cluster population is rather heterogeneous with regard to the economic activities included in the cluster and includes a substantial number of large firms, internationally active firms and innovative firms. Internal competition adds to the cluster performance as it fosters specialization and, therefore, enhances, from a cluster perspective, the service to specific market segments. In many cases a balanced form of competition and co-operation is apparent. As regards cluster governance, defined as "the mix of and relations between different modes of governance, i.e. mechanisms to co-ordinate interaction in a cluster", the following pertinent factors are examined: the presence of trust which is viewed to reduce transaction costs in the cluster; the presence of intermediaries such as associations, the value of which is predominantly their role as intermediary between firms and governments. An opportunity could be to expand the economic functions of associations (such as diffusion of innovations, financing, consulting, marketing etc); the presence of "leader firm behavior", which is viewed to increase the performance of a cluster, since such firms actively further the interests

of the cluster as a whole, with “multiplier effects” and “knowledge spillovers”; also quality solutions to collective action problems.

Maritime clusters deliver a range of benefits to their constituent enterprises. Primarily, they create competitive advantage by facilitating mutually beneficial relationships between the companies in the cluster. This in turn leads to both business and environmental benefits, including higher incomes and employment levels, sustainable consumption and production patterns, and support for adjacent industries that also support overall sustainable development. As an example, Clarkson notes that the Nigerian maritime cluster’s success has led to a record high number of charters under the Nigerian flag. Today, Nigeria has one of the world’s largest commercial fleet. Clarkson argues that the Nigeria fleet’s success today is directly attributable to plans laid for the Nigerian maritime cluster as far back as 2010. For the past 15 years, Nigeria’s maritime cluster strategy has been developed by three maritime growth strategists who are responsible for developing maritime cluster policies. “So, you don’t have one individual institute setting a maritime cluster policy. It’s a continuous effort to look at the various parts of the cluster and see what we can do to develop the cluster,” he says. “This broad government focus is necessary to develop a maritime cluster.” Crucially, maritime clusters provide access to know-how, according to Clarkson. When companies are located in close proximity to each other, it’s easier to share knowledge and best practices or recruit the right people.

2.1.2.2 Increasing Importance of Maritime Cluster

Consequently, Cluster Organizations and Sector Associations complement each other. In that respect, Sector Associations often join a Cluster Organization to team up with other Sector Associations and companies in order to cooperate on the realization of common interests.(Viederytea, 2013)

More than 20 years ago, Martin and Irvine (1989) pointed out that five premises should be taken into account when successful partnerships are looked as follows, Communication (bring together disparate groups in an arena to discuss and interact, Concentration on the long term, Coordination through networks and partnerships, Consensus attainment of a common vision and Commitment (desire to

implement the common vision in the light of a common output. (Martin & Irvine, 1989; Viederytea, 2013)

The one cornerstone of the cluster is the significance of B-to-B cooperation. Companies operating in different fields benefit from mutual interaction and the network of expertise are a central factor of the Cluster Organizations.

2.1.2.3Top-Down Maritime Cluster Organizations

The main strength of top-down Maritime Cluster Organizations is that they are initiated by the Government and consequently aim to increase the growth of all maritime sectors within the Cluster. This growth is supported by a long term strategy and policy, focusing on the improvement of research, development and innovation and the creation of a level playing field through legislation within the Maritime Cluster. Through RDI and legislation and relatively high budgets, top-down clusters can positively influence common interests (e.g. environment). One of the identified weaknesses of top-down cluster organizations are the difficulties they experience in defining to which cluster a sector belongs. This occurs, for example, in categorizing ports. Ports belong both to the logistics cluster and to the Maritime cluster. Moreover, it is not always clear which interests are at stake or how they can be aligned with other maritime sector interests. Another challenge is caused by the continuous balancing process between the interests of Cluster Organizations and those of Sector Associations, requiring continuous interaction. As a result of the widespread variety of interests, this often leads to a focus on more universal, softer themes. In this respect, the surplus value of the Maritime Cluster Organizations needs to be proved constantly. Opportunities for top-down Cluster Organizations are the increasing cooperation on European level to discuss best practices and lessons learned (Filipovic, 2005).

A second opportunity is that Cluster Organizations could take the initiatives to establish a single-point-of-entry to increase structural interactions between the Maritime cluster and the Government. Another opportunity for top-down clusters is to increasingly involve sectors opinion in the structural evaluation of Cluster Organizations activities.(Viederytea, 2013)

A possible threat for top-down clusters is the limited in-depth cooperation between the ministries involved in the Maritime sectors. This limited cooperation could lead to suboptimal integrated Maritime cluster policy. Another potential threat is that top-down Maritime clusters have limited structural sector involvement. This may lead to focusing too much on long-term benefits for the maritime sectors that may hamper or conflict with the cluster companies short term interests.

2.1.3 The concept of Road Haulage

This is the business of transporting goods by road or rail between suppliers and large consumer outlets, factories, warehouses, or depots. This includes everything humans might wish to move in bulk, from vegetables and other foodstuffs, to clothes, ore, coal, and other supplies. Haulage also involves the transportation of chemicals in large sealed containers, and the removal of waste. As the word implies, goods are loaded into large trailers or carriages and hauled between different locations. Traditionally, this was by large animals such as horses or oxen - where the practice may also be called cartage or drayage. However, in the modern age, this act is mostly performed by trains or trucks - with large shipping vessels acting as intermediaries for crossing oceans. Truck drivers on haulage shifts are typically male, and often work long and difficult hours with few breaks regularly sleeping in their vehicles overnight and eating/showering at rest stops. It is expected that Vehicular automation will largely render human drivers obsolete within a few decades (Ezema & Ogujiuba, 2011).

Haulage fees, sometimes also simply called "haulage", include the charges made for hauling freight on carts, drays, lorries, or trucks, and is incorporated for example in the cost of loading raw ore at a mine site and transporting it to a processing plant. A railway, supplying cars, may negotiate rates with customers located on another railway's line, the road granting haulage rights. This differs from trackage rights in that the host railway operates the trains for the other railway, where with track age rights, the secondary railway operates trains over the host's tracking (Al-Obaidan, 2002).

2.1.4 The concept of Port regionalization

The focus on hinterland development has transformed the relationships between the port and its surrounding regions and its port system. A port system is defined as a group of ports sharing similar geographic characteristics such as a coastline, or a bay, and to some extent serving overlapping hinterland regions. Since the mid-19th century and up to the diffusion of containerization as a dominant form of freight distribution in the 1980s, the development of a port system evolved from an initial pattern of scattered, poorly connected ports along a coastline to a network consisting of corridors between gateway ports and major hinterland centers.

Containerization revolutionized maritime shipping and port terminal operations and has supported the substantial growth in international transoceanic trade over recent decades. While traditionally, most ports had a fairly clear and distinctive hinterland, containerization initiated a trend towards large overlapping or contestable hinterland regions. The competitive landscape became even more complex with large container transshipment facilities set up, in many cases, in locations with a limited or non-existing hinterland. From the late 1980s, the integration of such transshipment hubs led to a new paradigm in port evolution. Transshipment hubs tend to have greater depth in view of accommodating modern containership drafts, placing them at a technical advantage and inciting hub-feeder services and interlining/relay configurations between mainline vessels. As intermediary locations, they offered a compromise between economies of scale in vessels and terminals and the need to maximize connectivity in maritime networks.

The hierarchization and complexification of maritime shipping networks have a correspondence with port hinterlands. The current development phase underlines that ports are going beyond their own facilities to accommodate additional traffic and the complexity of freight distribution, namely by improving hinterland transportation. This has come to be known as port regionalization**.** Port regionalization is the logistical integration between maritime and inland transport systems, particularly

through the development of rail and barge corridors between a port and a network of inland load centers.

Port regionalization addresses two fundamental issues in port development:

- **Local constraints**. Ports, especially large gateways, face a wide array of local constraints that impair their growth and efficiency. The lack of available land for expansion is among the most acute problems, an issue exacerbated by the deepwater requirements for handling larger ships. Increased port traffic may also lead to diseconomies as local road and rail systems are heavily burdened. Environmental constraints and local opposition to port development are also of significance. Port regionalization thus enables to avoid local constraints by partially externalizing them.
- **Supply chain integration**. Global production and consumption have substantially changed distribution, with the emergence of logistics and manufacturing clusters as well as large consumer markets. No single port can efficiently service the distribution requirements of such a complex web of activities. For instance, globally integrated logistics zones have emerged near many load centers, but seeing logistics zones as functionally integrated entities may be misleading as each activity has its own supply chain. Port regionalization allows for developing a distribution network that corresponds more closely to fragmented production and consumption systems.

Regionalization is a process that can take place both on the foreland and the hinterland with the goal of providing continuity between the maritime and inland freight transport systems.

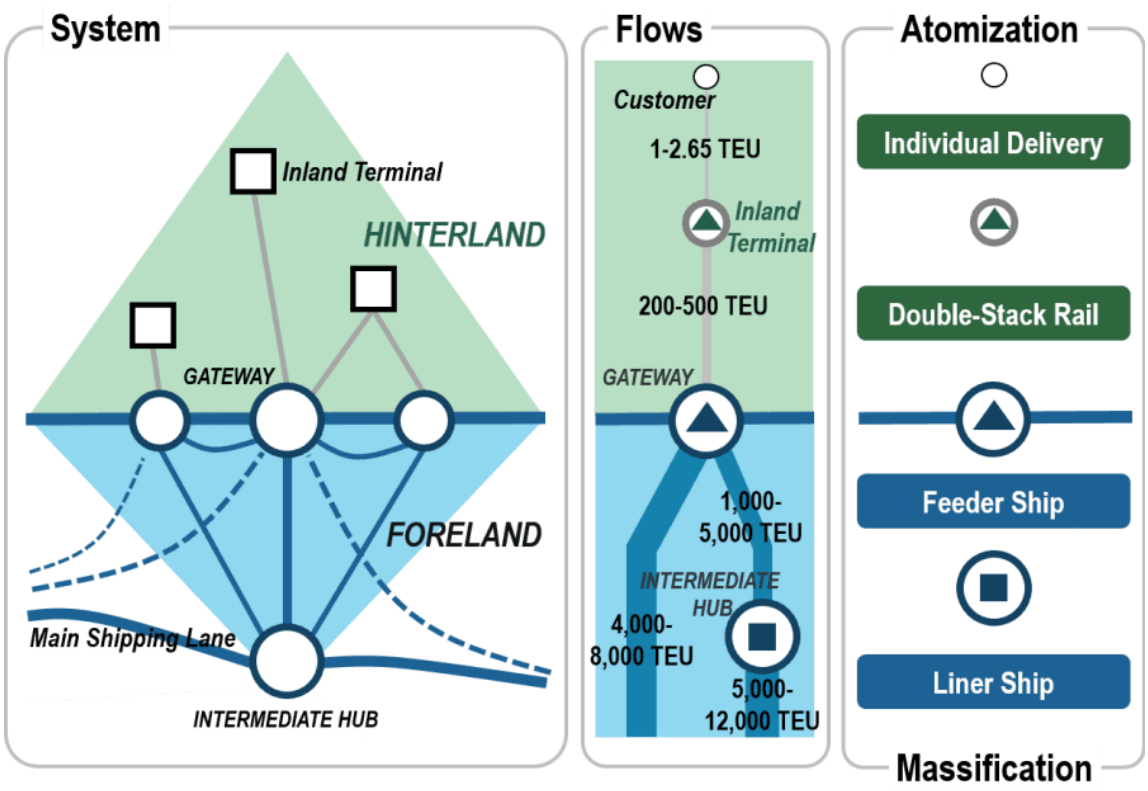


Fig 2.1: Foreland and Hinterland-Based Regionalization

Source: ICRC (compliance monitoring reports)

2.1.5 The concept of Hinterland accessibility

Accessibility can be defined as the ease with which activities may be reached from a given location using a particular transportation system. It is a measure of the quality of access from a specific location to several other locations.

A fundamental distinction can be made between relative accessibility and integral accessibility. Relative accessibility describes the relation or degree of connection between any two nodes in a transport system, such as a seaport and a central place). In contrast, integral accessibility describes the relation or degree of interconnection between a given node (a seaport) and all other nodes within a spatial network. The former measure is relevant in assessing land access on a specific origin-destination relation via a transport link or corridor. The latter is more appropriate in determining the

overall accessibility and connectivity of a seaport (Hockney & Whiteneck, 1986, as cited in World Bank, 2004).

Another approach to the issue of land accessibility consists of discriminating between the supply characteristics of the transport system and the actual use and levels of satisfaction. On the one hand, hinterland accessibility may be interpreted as the potential to connect to selected markets in the hinterland. This intrinsic accessibility is a function of the supply/capacity of the infrastructure and transport services. It must be borne in mind that the intrinsic land accessibility to seaports is no longer only considered in terms of proximity but more and more in terms of lead time and reliability. Alternatively, it may be held that the proof of access lies in the use of services, not simply in the presence of opportunities. This behavioral dimension could be described as revealed accessibility and reflects the demand side, such as the actual traffic flows on specific hinterland corridors. The concept of revealed accessibility is a particularly appropriate criterion for assessing the market's valuation and satisfaction regarding the quality of the land access to a seaport.

2.1.5.1 A multilevel approach to hinterland accessibility

In general, four interrelated layers shape land access to seaports:

- The **locational layer** (first level) relates to the geographical location of a gateway in relation to central places in the economic space. It forms a basic element for the intrinsic accessibility of a seaport. Therefore, the locational layer is mainly a relative concept to market demand.
- The **infrastructural layer** (second level) involves providing basic infrastructure for both links and nodes in the transport system. It is a key factor in valorizing a location since it changes its locational characteristics, particularly its accessibility.
- The **transport layer** (third level) involves the physical aspects linked to transport chains, such as transport services operating on links and corridors between the port and other nodes within the transport system and the transshipment function in the nodes of the system.

- The **logistical layer** (fourth level) involves organizing transport chains and their integration in the logistic chain.

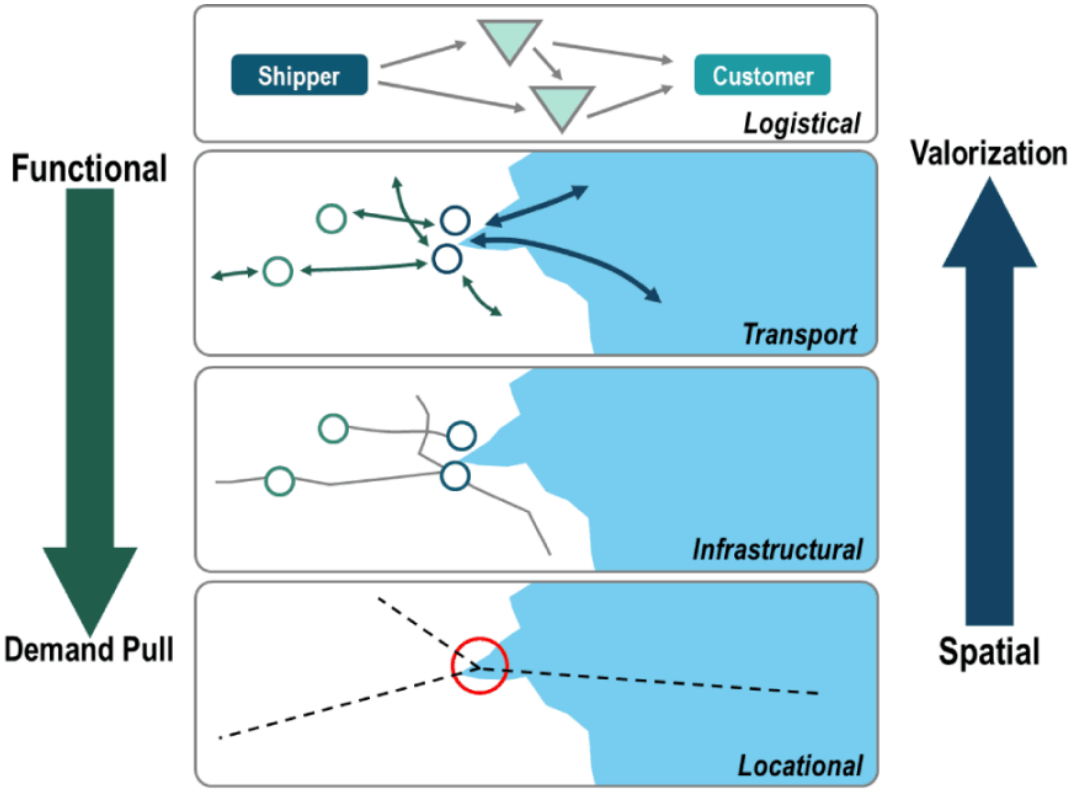


Fig 2.2: A Multi-Layer Approach to Port Dynamics

Source: ICRC (compliance monitoring reports)

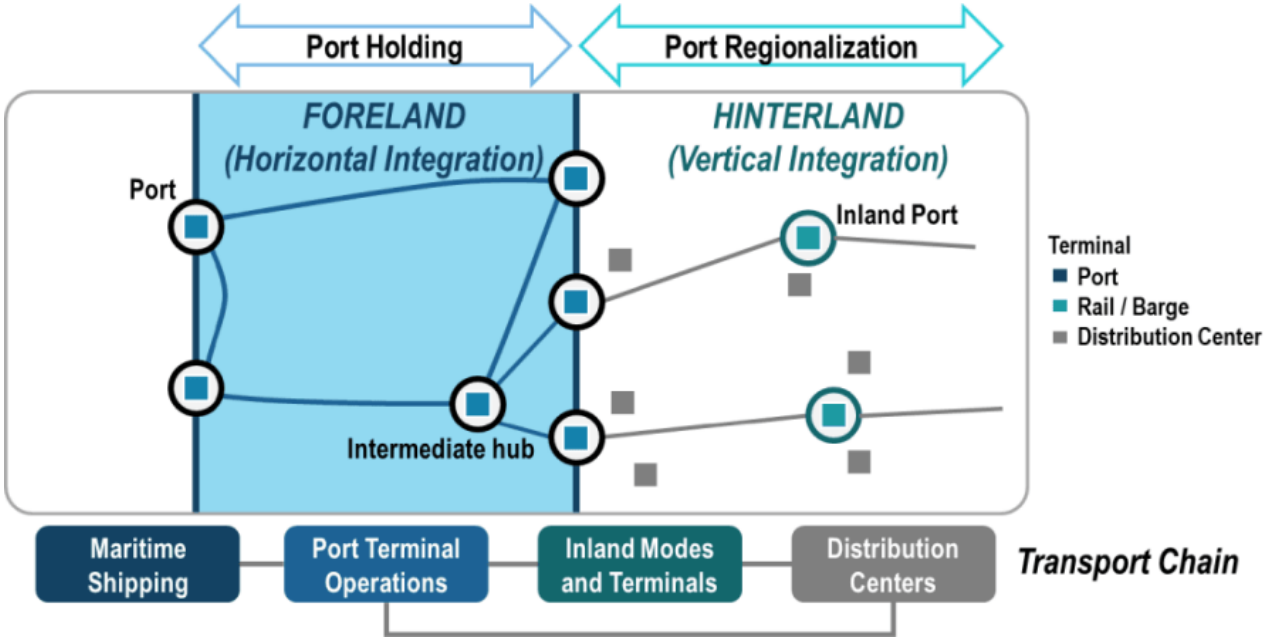


Fig 2.2.1: Vertical and Horizontal Integration in Port Development

Source: ICRC (compliance monitoring reports)

Each layer valorizes the lower layers**,** and there is a demand pull exerted from the higher levels towards more basic layers**.** In a demand-driven market environment, the infrastructural layer serves the transport layer and logistical layer. The first and second levels demand a more spatial approach, whereas the functional approach prevails for the upper levels. The more basic the layer, the lower the responsiveness or adaptability (expressed in time) to market demand changes. For instance, the planning and construction of major rail infrastructures (infrastructural level) normally take many years, not including possible delays resulting from the resistance from pressure groups or due to legal complications with financial institutions or building contractors (Ifionu & Ogbuagu, 2013)..

The political aspect related to the provision of most basic land infrastructures further complicates and lengthens the decision-making process. The duration of the planning and implementation of shuttle trains on specific railway corridors (transport-level) usually varies between a few months up to one year. At the logistical level, freight forwarders and multimodal transport operators (MTOs) can respond almost instantly to variations in the market by modifying the transport chain design, such as routing goods through the transport system (Eniola et al., 2014).

The differences in responsiveness on the proposed levels lead to considerable time lags between proposed structural changes on the logistical and transport levels and the necessary infrastructural adaptations needed to meet these changes adequately. This observation partly explains both the existing under-capacity (congestion) or overcapacity situations in the European hinterland network and port system.

2.1.5.2 Stakeholders in hinterland accessibility

Several stakeholders are involved in land access to seaports:

- Through the infrastructure and transport policy, supranational, national, and regional authorities significantly impact intrinsic accessibility to seaports. The infrastructural investments in links and partly also in the nodes of a transport system shape the basic access profile of a seaport. Moreover, the transport service operators have to comply with the regulatory specifications issued by governments, such as technical specifications for transport modes and their operational conditions.
- Shipping companies, road haulers, inland waterway companies, and rail companies have a large impact on the second layer (transport-level) as they determine the frequency, reliability, and quality of services on specific origin-destination relations. These services try to match the logistical requirements of their customers.
- By providing physical transshipment and related activities, stevedoring companies and terminal operators in seaports and inland terminals contribute to the transition and integration of transport modes and networks.
- The higher the efficiency of freight forwarders, multimodal transport operators (MTOs), and other logistic organizers in designing transport chains between origins and destinations, the higher the revealed accessibility for a given intrinsic accessibility. An optimal transport chain design combines quality, reliability, and lead time at the lowest possible costs.

- ❖ The role of port authorities in enhancing access in the foreland-hinterland continuum can vary from that of a reactive facilitator to a proactive accessibility manager.
- ❖ The trade relations of shippers and their network formations with other firms (particularly outsourcing) shape their demand for accessibility on the logistical and transport level.

Major freight forwarders, shipping lines, transport operators; terminal operators, integrators, and other logistic service providers are competing for a level of control over door-to-door transport chains. By a vertical and horizontal integration of activities, a large number of these players increasingly affect both the transport level and logistical level of the accessibility profile of an individual seaport or port system in a direct manner (Barro, 2000; Calderón & Servén, 2010).

On the infrastructural level, national and supranational public authorities may be facing severe budget constraints. Any lack of public funds for transport infrastructures puts more pressure on alternative financing via public-private partnerships (PPPs), especially in relation to safeguarding or improving the hinterland access to seaports.

2.1.5.3 Centrality and hinterland accessibility

The geographical location of a seaport constitutes the foundation for its competitiveness in terms of hinterland accessibility. The centrality index**,** as developed by the Bremer Ausschuss für Wirts chafts for schung in 1980, is an early example of how to assess the hinterland centrality of a port as a function of port-hinterland distance and population of the main economic regions in the hinterland. The assumption is that the further the nodes are apart, the less interaction there will be because time and cost are presumed to increase with distance (distance-decay hypothesis). Moreover, it is assumed that the larger the size of a place, measured in terms of population or economic output for central places and cargo volumes for gateways, the larger the attraction exerted towards other places (scale hypothesis).

Any definition of the concept of centrality is relative, in that a central location cannot exist other than by reference to other central areas, or a **core area**, which is a cluster of central areas. For Western Europe, this core corresponds to the "blue banana" (southern England, the Netherlands, Belgium, Luxembourg, the northeast of France, the Rhine axis, southern Germany, and northern Italy). For North America, the most prevalent core is the Eastern Seaboard, a conurbation extending from Boston to Washington. In East Asia, the Pearl River Delta, the Yangtze River Delta, and Tokaido (Tokyo-Osaka) are prevalent core areas. The clusters of container port activity reflect this centrality well (Easterly & Rebelo, 1993; Fischer, 1993).

The distance and scale hypotheses are applied in an imperfect geographical space**:**

- Customer valuation and satisfaction of port hinterland may differ from the basic intrinsic accessibility obtained by scale and location. This is a consequence of the value the customer attaches to the attractiveness of the port in terms of other more qualitative factors.
- The relation between distance and transport price is sometimes far from being straightforward and linear. In an optimal system, port hinterlands for a specific commodity are separated by lines of equal costs of carrying cargo to and from the port. However, transport pricing and tariffs can lead to large discrepancies among transport modes for hinterland access to major ports. For example, the container tariff policy of railway companies might include high cross-border interconnection fees; giving rival ports situated in these countries an artificial competitive edge over foreign ports.
- The transshipment cost (including the intermediate terminal costs) and its share in the total direct costs related to the inland segment of an intermodal transport chain partly determine the competitiveness of an inland transport mode or intermodal transport solution.
- The relation between distance and lead times sometimes far from straightforward. The lead time on a given origin-destination relation is a function of two factors. First, the travel time on the transport links is affected by vehicle speed and delays/congestion on infrastructural

networks and border-crossings. Second, the transit time at the terminals, is affected by the terminal productivity and the dwell time of the cargo at the terminal. The dwell time is typically lower for carrier haulage than for merchant haulage.

2.1.6 The concept of Transport corridors

Port regionalization and hinterland transportation tend to be coordinated along corridors**,** which have become the object of intense modal competition with the growth of movements of freight. Freight corridors are a particularly dominant convergence paradigm of urbanization integrating global, regional, and local transportation and economic processes in the geography of distribution.

A corridor is a linear orientation of transport routes and flows, connecting important locations that act as origins, destinations, or points of transshipment.

2.1.6.1Afreight corridor

This is a linear orientation of freight flows supported by an accumulation of transport infrastructures and activities servicing these flows.

A freight corridor is the main paradigm of hinterland accessibility as it is through a major transportation axis that port terminals gain access to the inland distribution systems. Inland corridor formation has allowed seaports to access formerly captive hinterlands of other ports. Hinterland corridors complement maritime corridors to form the main arteries of world trade. Corridors are created by economies of scale. When compound demand in clusters reaches a critical mass, cargo can be consolidated, allowing other modes of transport and creating (multimodal) corridors. Corridors allow gateways to face less resistance in reaching the natural hinterland of other ports. The outcome has been a wide variety of modal split characteristics of each port hinterland with regional differences, such as between Europe and North America, attributable to hinterland size and market proximity as well as available modal options and massification potential Fischer (1993).

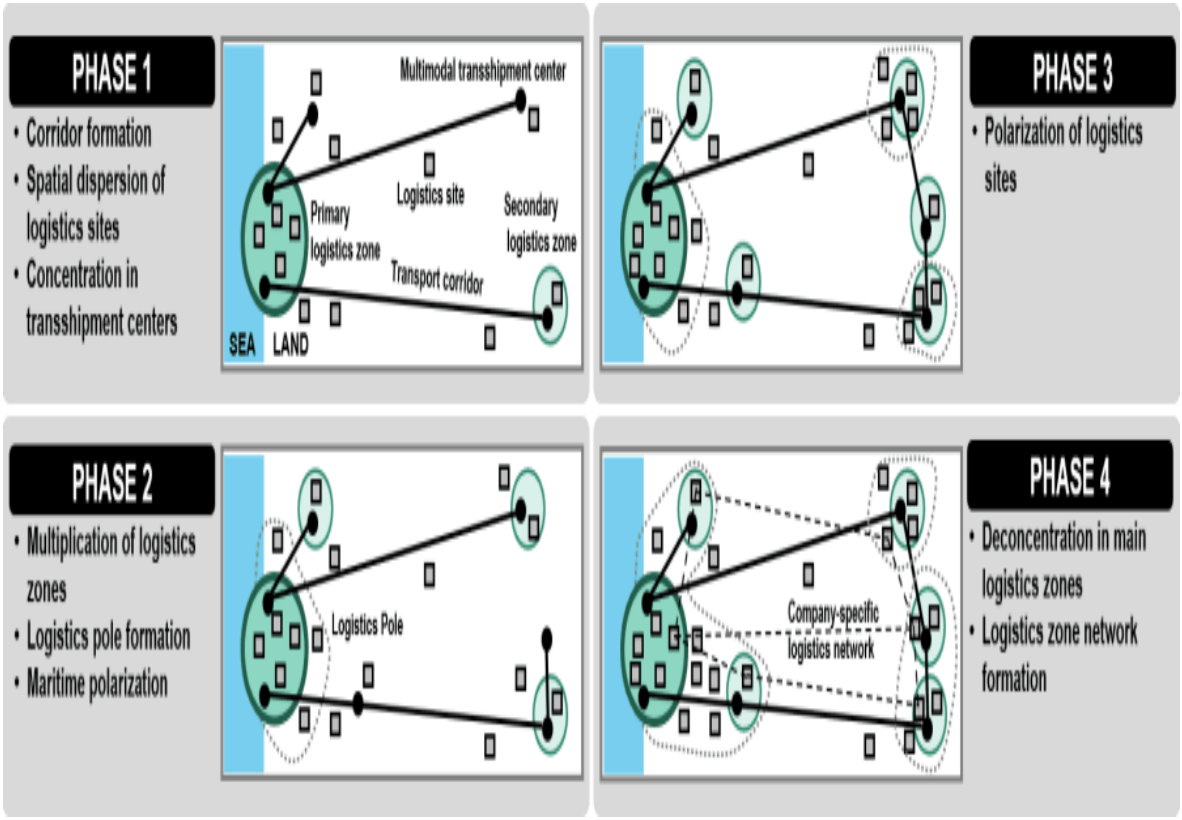


Fig 2.3: A Spatial Model on Logistics Sites in the Port Hinterland

Source: ICRC (compliance monitoring reports) 2006

The multiplication of hinterland corridors brings about a change in the relationship between gateways and their hinterland. On the one hand, the inland penetration strategy is part of maritime gateways' objective of increasing their cargo base. On the other hand, interior regions recognize that it is in their interest to establish efficient links to as many gateways as possible. This strategy not only prevents these regions from becoming captive to one specific gateway. It also improves the locational attributes of inland economic centers. Hence, linking up to more gateways implies more routing options and flexibility for shippers and logistics service providers. The performance profile of each of the corridors in terms of infrastructure provision (capacity), transport operations (price and quality of the shuttle services), and the associated logistical control is a key competitiveness attribute among various multi-port gateway regions (Frees, 2004).

2.1.6.2 Corridor attractiveness

Depending on the corridor's inherent value proposition to stakeholders. Several factors impact corridor competitiveness, including distance from the gateway to market, transit time, logistics performance, political stability, security issues, environmental conditions, and gateway to market costs. A corridor's performance can be analyzed from three perspectives:

- The corridor's physical infrastructure**,** such as the physical capacity of the links and nodes including the level of utilization of the corridor.
- The quality of services provided for the goods moving along the corridor, including time and cost dimensions linked to specific links and nodes.
- The movements of goods in the corridor are disaggregated for transport services on the links and the processing services at the nodes of the corridor.

2.1.6.3 Rail corridors

Corridors can offer cost and time-competitive options to the continuity of maritime distribution. In particular, long-distance rail corridors or land bridges can compete with maritime trade routes. This competition and complementarily take shape differently depending on the regional setting. Eurasian land bridges, a set of railway lines connecting East Asia, Central Asia, Russia, and Europe, are becoming more commercially viable. While several segments of the Eurasian land bridge were set up in the late nineteenth century, it was only in the early 2000s that significant land bridge traffic emerged. It was further reinforced by China's Belt and Road Initiative (BRI), seeking to develop long-distance commercial corridors between China, Central Asia, and Europe. The Eurasian land bridge is developing a niche for time-sensitive cargo, offering a complimentary option to maritime shipping (Barro, 2000; Calderón and Servén, 2010).

In North America**,** longitudinal long-distance rail corridors, often taking the form of land bridges between coastal gateway ports, are servicing a continental hinterland articulated by major transportation and industrial hubs such as Chicago and Kansas City. Double-stack trains have unit

capacities of up to 400 TEU and a total length of well above 2 km, enabling a large-scale inland rail freight distribution that is unique in the world, not only because of its size but also because of the direct link between two different coastlines. The major hinterlands in North America have changed, with the decline of the industrial belt and the industrialization of the "sunbelt", both of which have long-term impact on inland freight flows. The setting up of NAFTA in the 1990s incited the setting up of new gateways and corridors servicing the American market, namely through Canada (particularly Vancouver and Montreal) and Mexico, and a reorientation of traffic flows. One of the key advantages of North American rail is the almost exclusive freight orientation of the network, allowing the planning and operation of rail freight services without impediments from passenger services (Frankfort-Nachmias and Nachmias 2008).

In Western Europe**,** the hinterland is not only intense along the coastline but also in the interior, notably along the Rhine river system and its tributary rivers (Main and Neckar), in Bavaria in the South of Germany, in the economics centers around Milan in Northern Italy and Madrid in central Spain and in major markets in Paris, the Liverpool-Manchester-Leeds belt in the UK and the belt reaching from Austria to the growing production clusters in Hungary, the Czech Republic, and southern Poland. Moreover, many European economic centers are somewhat remote from the main shipping lanes, as is the case for the Baltic countries. Therefore, European gateways are not the only major markets but are often intermediary locations, even if many are important industrial centers. The hinterland is accessed from coastal gateways such as Rotterdam, Antwerp, Hamburg, Bremerhaven, Le Havre, Barcelona, Marseille, and Felixstowe by medium-distance corridors involving a variety of combinations of road, barge (where available), and rail services.

The development of the rail corridors in Europe is enhanced by EU policy on creating a Trans-European Transport Network (TEN-T)and initiatives of rail operators, megacarriers, and other market players to extend their European transport networks. Major contestable hinterlands are increasingly being serviced not only by the ports of one region but by several gateway regions. The performance

profile of each of the corridors in terms of infrastructure provision (capacity), transport operations (price and quality of the shuttle services), and the associated logistical control (management in a supply chain context) is a key attribute for port competition in Europe. With a few exceptions (such as the Betuwe route in the Netherlands), most long-distance and short-distance rail corridors in Europe have a mixed-use by freight and passenger trains**.** Rail Net Europe (RNE)**,** which groups the rail infrastructure managers in Europe, has developed corridor management along a set of European rail freight corridors (RFCS) to plan international train paths and shape corridor infrastructure capacity to market requirements. Therefore, the focus has been on stretching existing capacity on the corridors through advanced traffic management systems and implementing effective cargo bundling and cargo coordination systems. While measures to optimize the use of existing capacity are effective, there are limits to capacity management, implying that new rail infrastructure might need to be developed to service the hinterland (Hamaker, Kuiper, &Grasman, 2015).

2.1.6.4 Inland waterways as hinterland corridors

Corridors are also found in the inland waterway infrastructure network. This network is still deeply influenced by geographical considerations concerning the orientation of the waterways in relation to the orientation of commercial flows. Modifying and improving waterways is capital intensive and is undertaken when clear scale advantages are realized. In Europe, the main axes include:

A) The Rhine and its tributary rivers (Main, Neckar, Mosel).
B) The river system in the Benelux countries and northern France, including main canals such as the Albert Canal between Antwerp and Liège.
C) The Rhône-Saône basin.
D) The Northern network around the Elbe and Weser and associated canals, (e) the Rhine-Main-Danube linking the Alpine Region to the Black Sea.

The Seine-Nord project is among the most significant infrastructure projects with potential structural effects on port competition and cargo routing in the Benelux countries and Northern France. In Eastern Europe, ships can reach the Danube from the Rhine, opening up the larger industrial areas in Austria, the Czech Republic, Hungary, Croatia, Serbia, Romania, and Bulgaria. Via the Elbe and the Oder, the industrial areas in Austria, Germany, Poland, and the Czech Republic are within reach. Other countries in Europe that boast inland shipping are Italy, Finland, Sweden, Russia, and Ukraine. However, these pertain to isolated national waterways networks, which (if they are not maritime) have no connection with the European network (Lord, 1973).

2.1.6.5 Cargo bundling in hinterland transport

Bundling is one of the key driving forces of inland container service network dynamics. The bundling of cargo typically involves several layers starting with the consolidation of parcels onto a pallet up to the bundling of a large number of containers onto a corridor connecting the port to the hinterland. This section focuses on the upper level of bundling activities involving a large number of boxes grouped as one batch on a train or inland barge. Three types of bundling networks can be used as an alternative to direct point-to-point inland services. These bundling networks all rely on en route bundling in transfer/intermediate terminals. In rail transport and inland shipping, these types are often combined to form multi-layered networks.

The advantages of cargo bundling are higher load factors, the use of larger transport units in terms of TEU capacity, higher frequencies, and more destinations served. The main disadvantages of complex bundling networks are the need for extra container handling at intermediate terminals resulting in higher transit times and an increased risk of damage, longer transport distances, and a higher dependency on service quality. These elements incur additional costs that could counterbalance the cost advantages linked to higher load factors or larger unit capacities. Longer transport distances combined with time lost at intermediate terminals usually result in a longer transport time than direct services. The attractiveness of direct services with a low frequency largely depends on the ability of

the operator to coordinate departure and arrival times with deep-sea operations and the normal working hours of firms. There are also some time constraints related to the infrastructure, such as train slots availability for freight trains or lock operating schedules on canals.

Complex bundling networks strongly rely on the speed and cost-effectiveness of the transfers at intermediate terminals. Appropriate handling equipment needs to be in place, which is financially justified where there is sufficient traffic. In rail, container transfers between trains offer possibilities as an alternative to shunting container wagons. Lo-lo (load on load off) rail hub terminals (also known as thruports) can even outperform marshaling yards in terms of efficiency and speed (De Soto, 1993).

One way to guarantee higher cargo volumes is by providing a broader range of services and modes and mixing local traffic with transit traffic. Another way is by directing cargo of different ports to the same inland hub for consolidation. The duplication of hub terminals, each operated by other market players, is only feasible in places with sufficient cargo volumes (Tongzon & Heng, 2005).

If an operator opts for a line bundling network, a decision must be taken concerning the number of intermediate stops. Limiting the number of stops at intermediate terminals shortens round trip times. It increases the number of round trips per year, thereby maximizing revenue and minimizing the equipment required for that specific service. This is a combined result of several effects which includes

a) Lower total (inland) port time and inland port charges on the round voyage.
b) A smaller number of units needed to run a service.
c) A smaller total round trip length as possible diversion distances to intermediate terminals are avoided.

More intermediate stops can lead to lower pre- and end-haul costs by truck. These costs typically are very high in intermodal transport. Moreover, it might be possible to realize a higher utilization rate for the transport equipment by having more calls per roundtrip. Hence, the vicinity of an inland terminal

could incite shippers to opt for intermodal transport. For container transport by barge, the addition of an extra intermediate terminal in a roundtrip might generate additional costs for more complex vessel stowage. In rail transport, the inclusion of an additional intermediate terminal leads to more complex shunting of wagon groups or container lo-lo operations (Boris and Whited (2009).

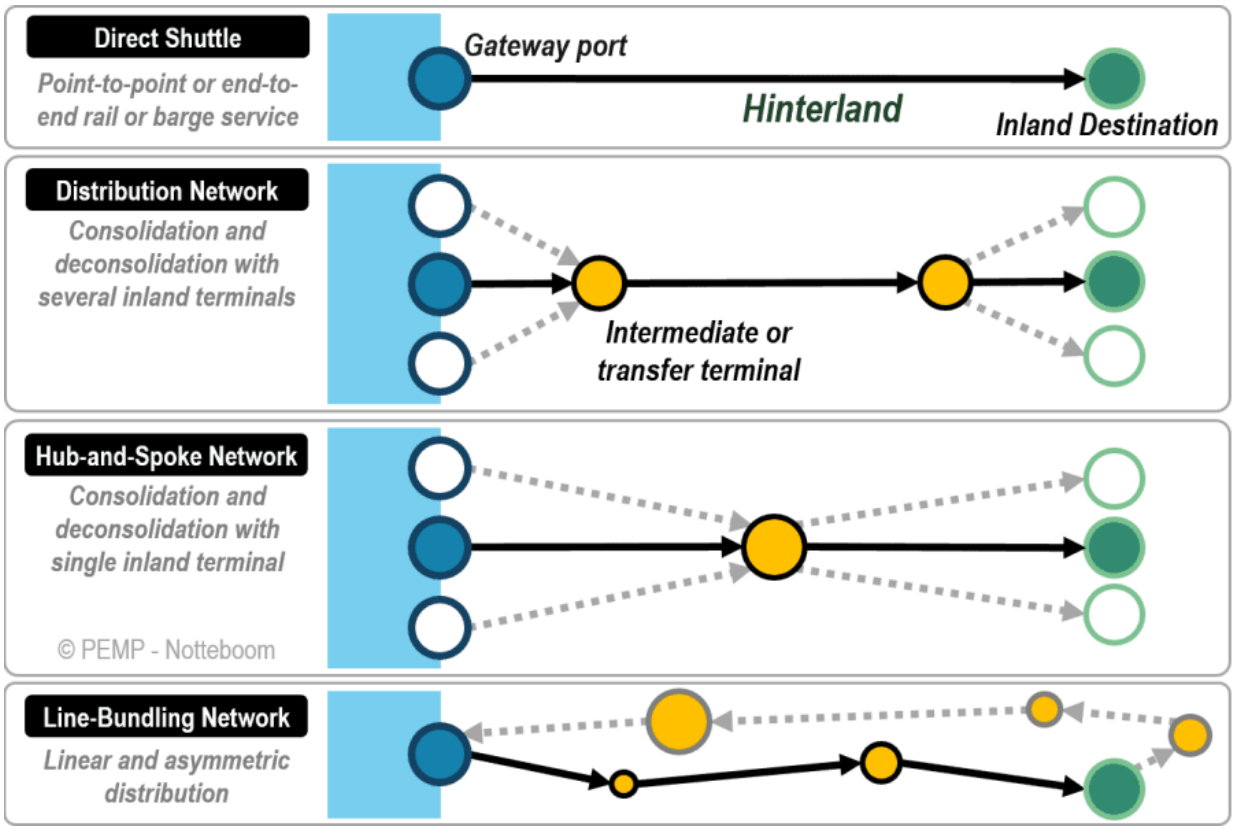


Fig 2.4.1: Cargo Bundling Options in Hinterland Transportation

Source: ICRC (compliance monitoring reports) 2008

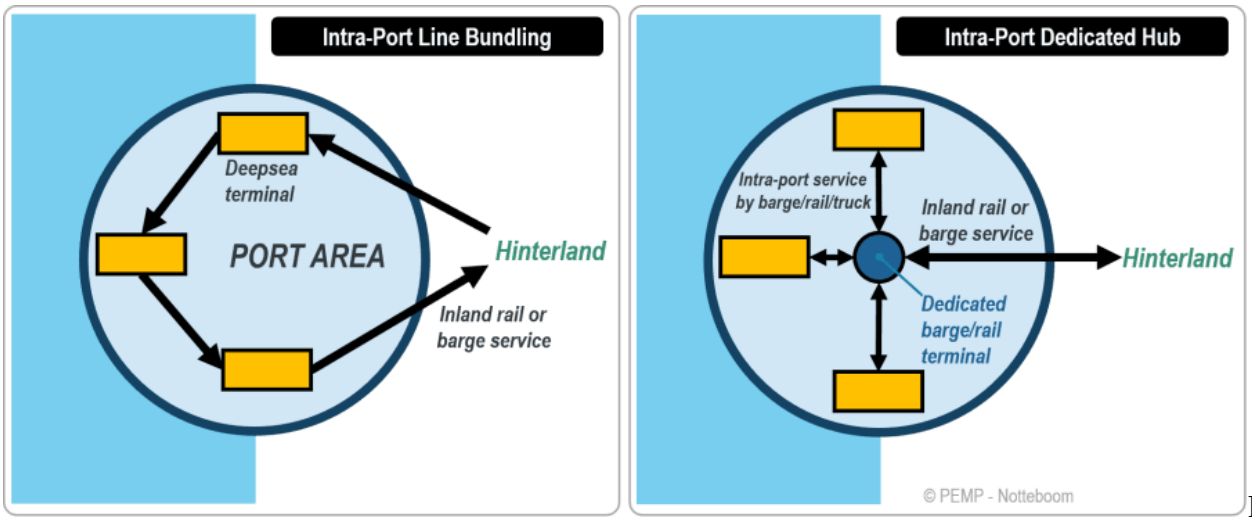


Fig 2.4.2: Cargo Bundling in Ports with Multiple Deep-sea Container Terminals

Source: ICRC (compliance monitoring reports) 2008

2.1.6.6 Cargo bundling in seaport areas

Large seaports with several container terminals often face the challenge of bundling cargo from different terminals on the same train or barge. Two alternative systems exist. The vehicle (i.e. barge or combination train) sequentially calls at various deep-sea container terminals in order to fill the available capacity. All containers bound for a specific inland service are brought to one (or more) dedicated rail or barge terminal in the port area through a network of intra-port services by truck, barge, or rail. In the first option, barges and trains consume additional time while collecting hinterland cargo. For example, in the ports of Rotterdam and Antwerp, some inland barges might spend more than 48 hours in the port area collecting containers from different deep-sea terminals. The use of a central loading/discharging point in the port area dramatically reduces the port time for barges and train combinations. Still, it incurs extra costs related to the operation of inter-terminal container transfers and extra container handlings. The desired configuration depends on the spatial layout of the port area, particularly inter-terminal distances, operational characteristics of terminals, berths, transport equipment, and the decision on who will have to bear the costs of the inter-terminal transfers, mostly the shipping line or the terminal operator.

2.1.6.7 Specific considerations related to cargo bundling

Cargo bundling typically requires coordination among different supply chain actors supported by digital solutions to increase visibility and transparency of cargo bundling opportunities and overall performance metrics. There might also be tensions between the expectations and objectives of different market actors**:**

A) **Operators** typically aim for cost minimization of their intermodal network operations. As such, transport operators are tempted to design only the bundling networks, they find convenient to offer. Still, at the same time, they have to provide the services their customers want in terms of frequency, direct accessibility, and connectivity. Moreover, operators have to offer regular schedules with service characteristics, as any change may conflict with existing terminal operations.

B) **Customer preferences** are driven by the minimization of generalized costs. These costs include all the costs of freight movements, loading and unloading and transfer, handling operations at group-age points, capital costs of the goods and depreciation during transport, costs related to damages, and inventory costs to the consignee. Shippers also show a keen interest in the qualitative performance of the whole transport chain in terms of reliability, availability, and compatibility. Hence, inefficiencies at this level will generate indirect logistics costs, such as production delays caused by late deliveries. Transport operators have to take account of the wider logistics perspective of the shippers(De Soto, 1994; Heitger, 2003).

The tension between routing and demand is another important aspect of cargo bundling. Network planners may direct flows along paths that are optimal for the system, with the lowest cost for the entire network being achieved by indirect routing via intermediate terminals and the consolidation of flows. However, the more efficient the network from the operator's point of view, the less convenient it could be for shippers' needs. Time, cost, or reliability concerns of the shipper could make an operator with indirect routes less competitive, thereby opening the possibilities for other operators to

fill market gaps. The optimal service schedule is not only a function of operator-specific operational factors but also of shippers' needs for transit time and other service elements and shippers' willingness to pay for a better service. Thus, the spatial development of bundling networks largely depends on the balance of power between shippers and operators (De Soto, 1993; Filipovic, 2005).

Cargo availability has a significant impact on choices made in inland transport services. A port that only serves a dense local economic cluster will have fewer difficulties developing a regular inland service than a port handling containers for a large number of final destinations dispersed over a vast hinterland. A port with a large local cargo base will sooner or later be tempted to increase the inland penetration of its intermodal hinterland network to increase its capture area. From that moment on, the existing dense network of direct shuttles to nearby destinations might complement indirect inland services to more distant destinations built around one or more inland hubs. Extensive cargo concentration on a few trunk lines opens possibilities for economies of scale in inland shuttles through the deployment of longer trains or larger inland barges with higher frequencies (Barro, 1989; Calderón and Servén 2010)

Finally, the choice of an optimal service configuration also depends on network characteristics**.** River systems typically have a treelike structure with limited or no lateral connections between the different branches. Vessel capacity that can be deployed is restricted and not homogeneous due to varying draft limitations and other physical conditions in various parts of the river system. Rail networks usually have some lateral connections and offer a more homogenous profile in terms of train configurations. These differences between river systems and rail networks imply that the collection-distribution and hub-and-spoke network solutions are mainly found in rail container transport. In contrast, inland container barge services such as on the Yangtze River and the Rhine River heavily rely on line-bundling solutions, calling at several inland terminals per navigation area, such as the upper, middle, or lower sections of the river system (Kessy, 2008).

2.1.6.8 The concept of Port cluster formation

Ports are clusters of companies and economic activities. Port clusters exhibit strong scale and scope advantages linked to physical cargo flows. The concentration of activities opens more opportunities to the bundling of cargo flows via intermodal transport (short-sea, barge, or rail) and to achieve higher connectivity to the rest of the world via frequent transport services. The process of cluster formation takes place at two scales. The first concerns the clustering of ports around a maritime range, and the second concerns the clustering of activities around a port (Tian and Zhou, 2008).

There are important geographical attributes behind port cluster formation, which varies substantially by maritime range, mainly owning to the following constraints:

A) **Availability of port sites**. Coastal geography varies across ranges, impacting the number of suitable port sites because of factors such as protected bays, river deltas, and tidal ranges. Such characteristics are related to the distribution of cities where a coastal cluster of cities is more prone to forming port clusters reflecting the urban system. Also, container terminals require a substantial amount of real estate for piers and yards, that is challenging to find. Coastal geography attributes along a maritime range are generally prone to cluster formation.

B) **Administrative divisions**. Nations states commonly have their own cabotage rules and restrictions, which can impact how hinterlands are serviced. In a context of limited economic integration, adjacent national states, or even administrative divisions, a dedicated container port can be serviced with the level of activity constrained by the size of the administrative unit. This can also incite the over-supply and duplication of port infrastructure, giving the illusion of a port cluster. Simultaneously, the absence of administrative divisions would have generated to fewer ports, or even a single large port, to service this hinterland.

C) **Hinterland accessibility and density**. Economic development, urbanization, and the distribution of resources imply an uneven hinterland density. As major economic regions are structured along corridors, this concentration favors specific container ports and port groups

servicing these areas. The higher the density, the greater the propensity for clustering. Therefore, the nature of the hinterland influences cluster formation.

D) **Economies of scale and infrastructure**. The growing average size of containerships tends to restrict port choice because of draft limitations and underline the capital intensiveness of containerization. In turn, this incites a concentration of investments and infrastructure in a specific number of efficient container ports in order to generate enough traffic and economic return. Technical and technological developments and lean towards cluster formation.

2.1.7 Activities in Port Clusters

2.1.7.1Transport and Cargo Handling

Ports use infrastructures to channel ships and vehicles and to accommodate cargo and information flows. While other typologies might be found, a distinction can be made between basic nautical infrastructure (such as access channels and locks), commercial port infrastructure (such as quay walls), and port superstructure (such as cranes, warehouses). The construction, operation, and maintenance of these infrastructures constitute a key activity in ports. For example, dredging companies execute most of the capital and maintenance dredging works in seaports and are involved in land reclamation projects. The development of new terminals, port zones, and intra-port and inland access infrastructure offers project work to consultancy firms, contractors and construction firms, to engineering firms, and to all sorts of suppliers of technical equipment and services (Campbell and Stanley, 1963).

The call of a vessel in a port generally requires the involvement of towage companies, pilotage services, mooring/unmooring services, the harbor master's office (part of the port authority or government department), lock operators (if any), ship agents, companies involved in signaling and shipping services, waste reception facilities, ship suppliers and chandlers, marine surveyors, bunkering firms, classification societies, safety contractors, and security firms. Quite a number of ports also offer ship repair facilities or are home to shipyards.

2.1.7.2 Cargo Handling Operations

Ports can relate to different types of goods: liquid bulk cargo (crude oil, oil products, LNG), dry bulk cargo (coal, iron ore, grain), roll-on/ roll-off cargo (new cars, used cars, rolling material, trailers), containerized cargo and conventional general cargo. Conventional general cargo encompasses a myriad of different non-containerized commodities such as project cargo (power generation plants, steel mills, wood-pulp factories, gas power plants, road construction equipment), power plant equipment (gas turbines, power generators, transformers, turbines, heavy machinery, industrial equipment), iron and steel products (bars, coils, plates, wires), forest products (wood and paper products), parcels (malt, fertilizer, sugar, rice), reefer vessel trades (fruit, meat) and break-bulk shipments of smaller lots (Anyingang &Udoka, 2012; Seabrooke, Hui, Lam, & Wong, 2003).

The efficiency and effectiveness with which loading and discharging activities occur in a port are important cornerstones for the port's competitiveness and its ability to generate broader economic effects in employment and value-added creation. Cargo handling in the first place involves terminal and stevedoring companies that employ or use dock workers. The dock labor needs are very dependent on the cargo flows handled in the port. Other cargo-related service jobs include cargo survey, land transport and storage, port-related storage, conveyor/pipeline, and transfer between berths and storage facilities. Generally speaking, conventional general cargo handling is confronted with ever-tighter handling space in many seaports (containers consume more and more square meters). Given the strong labor intensity, it is also sensitive to labor-related issues (Cullinane et al., 2005),

2.1.7.3 Government Agencies and Organizations

Develop activities linked to cargo and vessel operations in ports. Semi-public or public managing bodies of ports are important players in the port arena, depending on the tasks the port authority adopts. Government agencies typically include customs, sanitary and food inspection, environmental offices, harbor police, the pilotage service, state-owned tugboat companies, navigation aids, and vessel traffic systems (VTS), firefighters, and maritime courts (Boubakri, Smaoui, & Zammiti, 2009)

2.1.7.4 Military Activities

Naval bases can also be found in seaport areas. The permanent stationing of naval fleets in a seaport or visits by foreign naval vessels may affect a regional economy in the form of purchasing fuel and provisions and the expenditure by crews in the local economy (Kessy, 2008).

Many seaports also act as important nodes for passenger traffic. These passenger flows might be linked to cruise vessels, ferries, and Regional River or coastal passenger services. Passenger terminals create direct value-added and employment, but also have an impact on other activities that might be located elsewhere. Examples include tourism agencies, hotels, restaurants, museums, taxi and bus companies, and airports (Cullinane, Ji & Wang, 2005).

2.1.7.5 Logistics

Goods can undergo logistics transformations in the port area, which is defined as port-centric logistics. Examples include storage, distribution, and other logistics activities in the framework of industrial subcontracting or postponed manufacturing in the port area. The gateway position of major seaports offers opportunities for the development of value-added logistics services(VALS). Many seaports have evolved from pure transshipment centers to complexes of key functions within a logistics system. A mix of pure stevedoring activities and logistics activities occurs. Ports are not only nodes handling goods flows. They also deal with large quantities of information flows**.** Many service companies involved in the booking, consolidation, and tracking of vessels and cargo (freight forwarders and ship agents) are located in the seaport or immediate vicinity (Quansah, 2014; Talley, 2006). The consolidation of cargo is an important port activity, which generates added value and employment and contributes to efficiency improvements in loading rates and the balance between incoming and outgoing goods flows. Ports often act as consolidation points for partial loads, such as LCL (less than container load) cargo and group age activities. However, disintermediation in the supply chains and the increasing globalization of the maritime and port industry can imply that some ports face a relocation of some of the decision-making power over cargo flows to inland centers or major

(maritime) cities. When cargo control centers are set up outside the port area, the role of the local service providers is narrowed down to specific operational tasks or back-office functions. Therefore, the role of the port in supply chains is increasingly dependent on factors and actors outside the port area (Bernerth, 2004).

The branch associations of economic sectors in the port (i.e. freight forwarders, ship agents, industrial firms) and umbrella associations (for example, Delta linqs in Rotterdam and Alfa port Voka in Antwerp) are involved in the promotion of their respective port sectors. Numerous jobs are created in training and education, not only at the public level (universities, schools of higher education, technical schools) but also in private training centers. A wide range of advanced trade service firms (such as banks, other financial institutions, investment firms, insurance firms, law firms) realize a part of their turnover in ports (Nellis, 2003).

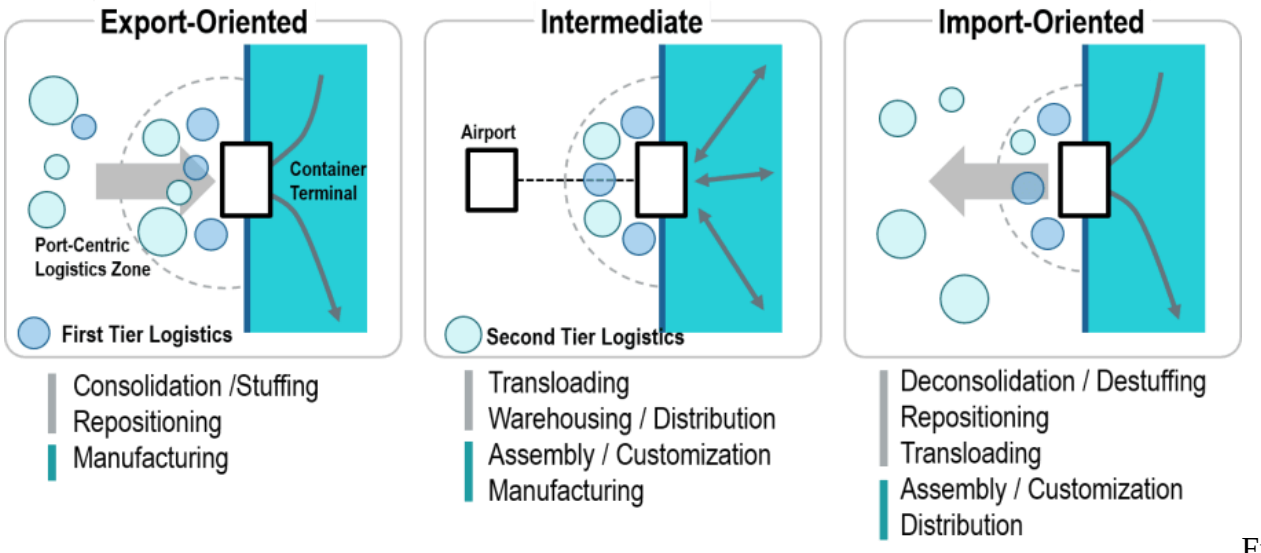


Fig 2.5: Functional Types of Port Centric Logistics

Source: ICRC (compliance monitoring reports) 2017

2.1.7.6 Industrial Activities

There exists a wide range of industrial activities that typically locate in port areas. Industries that are part of maritime clusters include shipyards (ship repair and shipbuilding), marine equipment

companies, crane and terminal equipment producers, salvage companies, offshore companies (offshore survey, exploration, production, installation, supply, pipe laying), marine construction firms, dredging firms, naval bases, and the fish processing industry. Non-maritime cluster industries that are often found in ports include chemical plants, power plants, steel plants, car assembly plants, paper mills, food production companies, and firms producing Building Materials (Cement, Bricks, and Tiles).

2.1.7.7 Petrochemical and Chemical Companies

Large integrated centers of industrial activities in seaports constitute an essential part of the economic activity in ports, exemplified by the large petrochemical and chemical clusters in Singapore, Houston, Rotterdam, and Antwerp. These clusters are integrated upstream into primary raw materials, feedstock, commodities, or intermediates and downstream into other chemical industry sectors or key customer industries (automotive, packaging, construction). The petrochemical industry is strongly based on oil refinery activities, many of which are located in ports:

A) First, there are the basic chemicals which include polymers (e.g. polyethylene (PE), polyvinyl chloride (PVC), polypropylene (PP), polystyrene (PS) and fibers such as polyester, nylon, polypropylene, and acrylics), bulk petrochemicals and intermediates (i.e. primarily made from liquefied petroleum gas (LPG), natural gas and crude oil and used for the production of ethylene, propylene, benzene, toluene, methanol, styrene), other derivatives and basic industrials (e.g. synthetic rubber, surfactants, dyes and pigments, resins, carbon black, explosives), inorganic chemicals (e.g. salt, chlorine, caustic soda, soda ash, acids) and fertilizers (phosphates, ammonia and potash chemicals).
B) Second, the life sciences include differentiated chemical and biological substances, pharmaceuticals, diagnostics, animal health products, vitamins, and crop protection (herbicides, insecticides, and fungicides). These products tend to have very high prices and require substantial investment in research and development.

C) The third group concerns specialty chemicals such as electronic chemicals, industrial gases, adhesives, sealants, coatings, cleaning products, and catalysts.

D) The fourth group consists of consumer products that are directly sold to the consumer, such as soaps, detergents, and cosmetics.

The successful development of the chemical clusters in seaports depends on various factors such as, the availability of skilled labor at competitive prices, Good training and educational facilities, the role and support of port authorities and government agencies in providing incentives and support in the development of infrastructure, the availability of land, the availability of raw material supplies at competitive prices, Competitive prices for energy and utilities, A low-risk and stable business climate and stable regulatory environment, Co-siting and partnering opportunities (industrial cascades) and the availability of efficient services (logistics, finance, IT, packaging, security, marketing, promotion).

Industrial clusters in ports often rely on sustainable industrial symbiosis or sustainable industrial ecosystems**.** Raw materials are extracted locally, and finished products and secondary flows are used locally. By-products of the production process (for example, oxygen, heat, or water) are recycled and reused locally. This ensures far-reaching industrial and circular integration and the creation of so-called ecologies of scale. Such symbiosis requires supporting infrastructures, such as pipelines and storage tanks, to transport raw materials and finished products to the correct location. Thus, a competitive cluster requires good inter-company infrastructure (e.g. pipelines), product diversity, the sharing of utility services and infrastructure, and strong cluster governance. Chemical clusters are increasingly overcoming regional boundaries by developing pipeline systems and other mass transport infrastructure that link chemical clusters in several ports (e.g. pipeline linkages between Rotterdam, Antwerp, and Terneuzen) and also link the ports to major chemical clusters in the hinterland (e.g. links between the Rhine-Scheldt Delta ports in Belgium and the Netherlands, the chemical axis along the Albert Canal to Liège in Belgium and the German Ruhr area.

Many of the world's steel plants are located in seaport areas. The steel industry operates in a highly competitive environment globally, where rigorous cost management is imperative for maintaining and strengthening its competitiveness. Therefore, steelmaking processes have been developed and refined over the years. Steelmaking is capital intensive, and the average plant life is very long, which makes changes to new technologies possible only in a timeframe of several decades. Many steel plants are located in seaport areas. A good example is Arcelor Mittal. Arcelor Mittal operates several maritime flat carbon steel mills (e.g. in Europe: Dunkirk, Ghent, FOS Marseille, Gijon, and Bremen). Most other mills are located less than 100km from major import ports. On the import side, steel plants generate large iron ore flows, pellets, coking coal, metal scrap, and steel slabs. The outgoing cargo flows typically include steel coils, steel booms, steel wires, and related products (Al-Obaidan, 2002).

The same applies to the automotive industry**.** While assembly plants mostly do not locate in seaport areas (for example, only about 10 of the 150 European assembly plants are located in seaport areas), they often locate quite close to seaports for reasons of ingoing and outgoing flows of parts and finished cars (Eniola 2014).

2.1.7.8 Energy

Many seaports are home to large energy plants**.** Electricity is produced in conventional steam-electric plants (coal and lignite), conventional steam-electric plants (other fuels), combined-cycle and gas turbine plants, conventional hydroelectric plants, pumped-storage hydroelectric plants, nuclear power plants, waste-to-energy plants, biomass power plants, diesel and gas-engine power plants, wind energy plants, geothermal power plants and solar power plants. The availability of land and cooling water and the presence of large industrial customers are some of the reasons for energy-producing firms to set up business in seaport areas (Ducruet and Merk, 2013).

Depending on the set-up, conventional steam-electric plants are massive consumers of coal. Growing trends in electricity production include plants that produce electricity based on gas, pellets, waste, or biomass. Stations powered by these fuels present economic advantages, are often faster to build and

are more environmentally friendly when compared to electricity production from other (fossil) fuels. There is also an increased interest in wind energy**.** While most wind farms are installed offshore (mostly on sandbanks) or in open plots in the hinterland, a number of seaports are also home to wind farms. These wind farms are typically installed on breakwaters or narrow stretches of land close to the sea, thereby benefiting from favorable winds in coastal areas (Filipovic, 2005; Oghojafor 2012).

Many seaports also play an essential role in the distribution of natural gas. The gas comes in either via vessels (LNG carrier) using specialized deep-sea terminals or via pipelines that land in the seaport area. The presence of power plants and power distribution infrastructure not only generates direct jobs and value-added in power plants, energy distribution platforms, and the terminal operating business (i.e. handling of coal, gas, and other fuels), but is also a major creator of jobs and value-added in other industries and services such as engineering firms, construction companies, maintenance and repair companies, survey and inspection firms, and security services (Jaja, 2009).

2.1.8. Port-Centric Logistics

The clustering of ports is associated with the clustering of logistics. Port-centric logistics refers to the range of freight transportation and distribution activities that are directly related to port terminals. Port terminals handle three types of flows, which are inbound (imports), outbound (exports), and transshipment (mostly for containers), each of which is associated with different forms of port-centric logistics. These come into two tiers:

A) **Port cargo logistics (first tier)**. The set of activities that directly affect the load unit of the cargo handled at the port. The first is the function of storing where the cargo is waiting to be picked up or transshipped. This usually occurs within the terminal facility (for transshipment, a container rarely leaves the terminal facility), with the dwell time an important consideration for supply chain managers to organize pickup. The de-stuffing (and often palletization) of container loads is an important activity that takes place at nearby specialized facilities. Trans

loading is also commonly associated with de-stuffing activities as it transfers loads of maritime (ISO) containers into domestic containers. Empty containers are then repositioned either back to the container terminal or to an empty depot. Containers are then available to be picked up for stuffing and then exported (Nwanosike, 2014).

B) **Port-related production and distribution(second tier).** Activities that perform a level of transformation (in whole or in part) to the cargo that is either imported or exported through a port. Inbound cargo, particularly finished goods, must be consolidated and sorted in distribution centers for hinterland customers. Outbound cargo is usually warehoused waiting to be loaded (break-bulk cargo) or stuffed (containerized cargo). Manufacturing activities that are closely dependent on global markets, either for inputs (suppliers) or outputs (customers), will tend to be located in the vicinity of port areas. The commodity sector has traditionally shown a high association with port terminals (e.g. petrochemicals), which has usually endured. However, the growing use of containers to transport commodities such as agricultural goods, including refrigerated goods, conveys a new dynamic to port-centric logistics.

Moreover, instead of using the stacking area as a facilitator for a smooth synchronization between transport modes, shippers and logistics service providers started to use terminals as places for the temporary storage of consignments. Terminals thus serve as buffers in logistics chains**.** This has allowed them to develop value-added logistics activities such as:

i. Paper-cutting operations at forest products terminals.
ii. Steel-cutting operations and packaging of project cargo at general cargo terminals.
iii. Quality control and packaging at fruit terminals.
iv. Sorting and blending operations at major bulk terminals.
v. PDI activities (pre-delivery and inspection) at car terminals.
vi. Bagging at minor bulk terminals (e.g. plastics).

Containerization had enduring impacts on the relationships between ports and their hinterlands. These relationships shifted in time with dissociation in the earlier phases of containerization and the recent reinsertion phase with port-centric logistics. Port-centric logistics is not a uniform strategy because it is a function of the position of a port within the global maritime transport system and the dominant direction of the flows they handle. In this regard, three main types of port-centric logistics can be retained, export-oriented, intermediate, and import-oriented. (Gidado, 2015).

2.1.8.1 Port Cluster Governance

The governance of hinterland access regimes is linked with cluster formation. It refers to the agglomeration effects and the degree of internal cohesion and competition within a hinterland. This governance concept not only applies to ports, but can also be inferred for airports, inland ports and logistical zones, or any freight distribution construct where a closer integration of the involved actors could lead to performance improvements. An emerging paradigm concerns the city as a terminal and a hub**,** which means it acts as a functional freight region. This paradigm is fundamental because:

I) A metropolitan area is the origin, destination, and point of transit of large volumes of passengers and freight. They are embedded within their respective supply chains with a wide array of flows.

II) All regional transportation assets are interrelated and contribute to the regional, national, and global economy. They are embedded within their respective transport chains with an array of modes and terminals.

III) Existing governance and regulatory structures are ill-placed to reflect this jurisdictional, functional, and operational reality**.**

Cluster governance is a business strategy that relates to the mix of, and relations between, organizations and institutions that foster coordination and pursue projects that improve the cluster as a whole through regional strategies and the coordination of their hinterland. The main advantages of cluster governance are better access to competencies and innovative ideas, better access to suppliers

and customers, better access to capital, and an overall reduction of transactional costs. Although there is no single cluster governance model, as each port (or terminal) region has a different set of geographical, economic, regulatory, and operational characteristics, the following four issues tend to be common to all clusters:

A) **Service efficiency**. Concerns a series of initiatives to improve the quality and reliability of terminal assets. This goes beyond infrastructural issues, as it involves some operational commitments to standard levels of service, often through certification by external agencies. An emerging strategy in this direction consists of developing port community systems that are making available information to manage terminal-related supply chains, commonly through a web portal. Service efficiency can also involve technical and managerial training to improve labor quality. A standard is thus set among the terminal users regarding what level of quality and efficiency is expected. In turn, this promotes the marketability of all the terminal users

B) **Logistical integration**. Concern strategies that aim at better embedding terminals within their regional supply chains. For a port, this can involve the setting up of satellite terminals or inland ports that are accessed through dedicated corridors. The setting up of co-located logistics zones is also common in proximity to the port, rail, or airport terminal facilities.

C) **Infrastructure and growth management**. Although port authorities conventionally undertake both infrastructure and growth management, the emerging paradigm concerns a higher level of intermodal integration with, for instance, on-dock rail facilities. Infrastructure development also takes place more in a public-private partnership form with terminal operators and other private stakeholders such as rail operators and logistical firms (Adi, Iheanachor, Ndukwe, & Dim, 2013; Eniola, Njoku, Oluwatosin, & Okoko, 2014; Jaja, 2011; Oghojafor, Kuye, & Alaneme, 2012)

D) **Terminal-city integration**. Concern various strategies that help mitigate the frequently significant environmental and social externalities that terminals have on their surrounding communities. As terminal facilities, notably ports, tend to be in proximity to high-density

urban areas, environmental management, and corporate responsibility are perceived as tools helping to promote better coordination and avoid possible conflicts. On the other end, airport terminals are typically located away from central areas implying that their integration can lean on the setting up of transit corridors and adjacent retailing, office, and housing activities (Chigbue 2007)

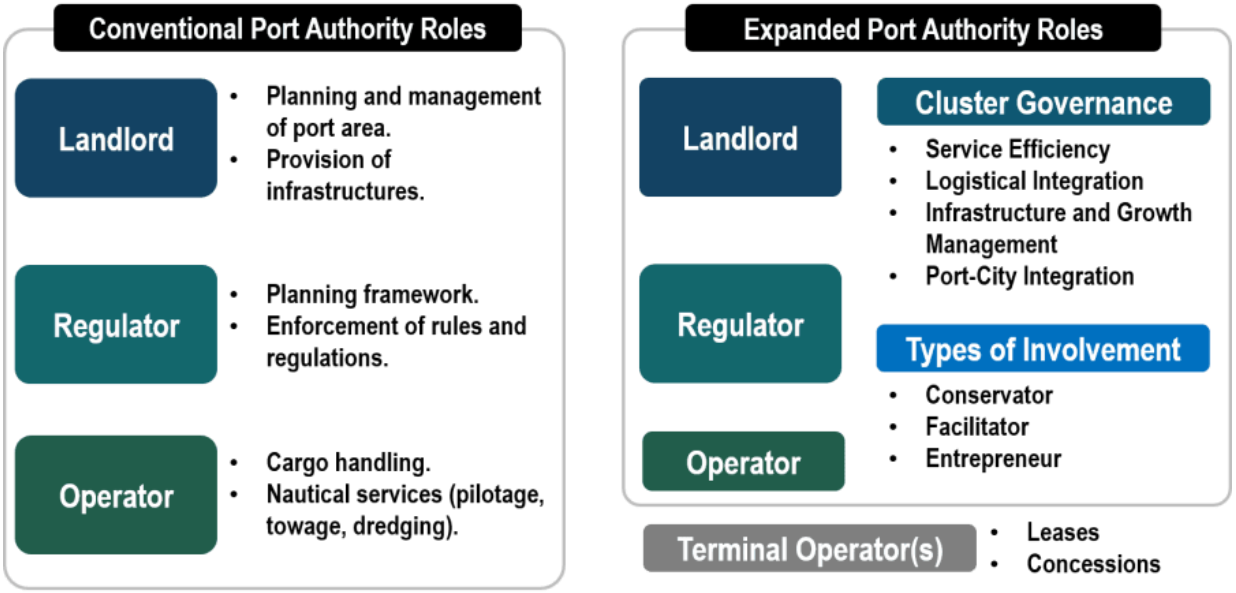


Fig 2.6: Emerging Paradigm in the Roles of Port Authorities

Source:ICRC (compliance monitoring reports) 2017

Fig 2.6.1: Port Community System

Source: ICRC (compliance monitoring reports)

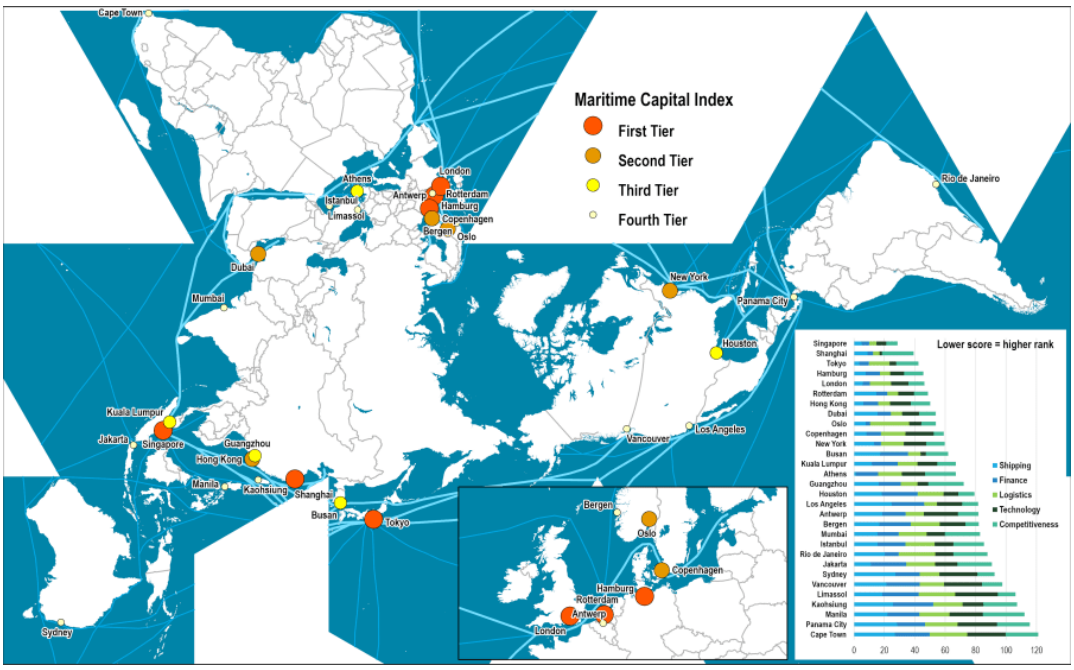


Fig2.6.2: World Maritime Capitals, 2017
Source: ICRC (compliance monitoring reports)

The full implications of cluster governance remain to be assessed, particularly the extent to which they generate added value to the terminal region and if such strategies are linked with the attraction, or at least the retention of customers and the traffic they generate. There are also impacts on competition within the cluster as firms undertake collaborative strategies to improve their respective efficiency (Tongzon and Heng, 2005). It is to be expected that better access to international markets will be achieved, which would indirectly promote the globalization of the companies within the cluster. This also has an impact on competition between clusters over discretionary traffic, namely transshipment (Al-Obaidan, 2002)

2.2 Theoretical Review

2.2.1 Theory of Agglomeration

The term agglomeration describes the phenomenon where businesses tend to cluster close to each other and high population areas. One of the major subfields of urban economics, economies of agglomeration (or agglomeration effects) describes, in broad terms, how urban agglomeration occurs in locations where cost savings can naturally arise. Most often discussed in terms of economic firm productivity, agglomeration effects can also explain the phenomenon where large proportions of the population are clustered in cities and major urban centers. Similar to economies of scale, the costs and benefits of agglomerating increase the larger the agglomerated urban cluster becomes. A prominent example of where agglomeration has brought together firms of a specific industry is Silicon Valley in California, USA. As more firms in related fields of business cluster together, their costs of production may decline significantly (firms have competing multiple suppliers; greater specialization and division of labor result). Even when competing firms in the same sector cluster, there may be advantages because the cluster attracts more suppliers and customers than a single firm could achieve alone. Cities form and grow to exploit economies of agglomeration.(Bolter, Kathleen and jim 2020)

Diseconomies of agglomeration are the opposite. For example, spatially concentrated growth in automobile-oriented fields may create problems of crowding and traffic congestion. It is the tension

between economies and diseconomies that allows cities to grow but keeps them from becoming too large.

At the foundational level, proximity – especially to other facilities and suppliers – is a driving force behind economic growth, and is one explanation for why agglomeration effects are so evident in major urban centres. While the concentration of economic activity in cities has a positive effect on their development and growth, cities in turn help foster economic activity by accommodating for population growth, driving wage increases, and facilitating technological change.

Proponents of agglomeration posit that one of the advantages is that when firms form clusters of economic activity, there are particular development strategies that flow in and throughout this area of economic activity. This helps to accumulate information and the flow of new and innovative ideas among firms for the achievement of what economists call increasing returns to scale. Increasing returns to scale, and economies of scale, are internal to a firm and may allow for the establishment of more of the same firm outside the area or region. Economies of scale external to a firm are the result of spatial proximity and are referred to as agglomeration economies of scale. Agglomeration economies may be external to a firm but internal to a region.

Increasing returns to scale, according to Beckmann, are integral to understanding why urban centres form. These increasing returns to scale "give rise to [urban systems]", capturing "the trade-off between transportation costs and economies of scale". Agglomeration economies exist when production is cheaper because of this clustering of economic activity. As a result of this clustering it becomes possible to establish other businesses that may take advantage of these economies without joining any big organization. This process may help to urbanize areas as well.

Benefits arise from the spatial agglomeration of physical capital, companies, consumers and workers includes

i) Low transport costs: physical proximity to other firms and centres of production can minimise costs associated with transportation. While this may have been the case for many manufacturing firms in the United States, Glaeser and Gottlieb argue that reducing transportation costs is more

important for firms producing services. Moreover, other studies have shown that when negative externalities like pollution are taken into account, agglomerated city centres are more likely to be dispersed over a larger geographical area rather than be confined to a single, metropolis-like urban region.

ii) Geographic advantages: a longstanding theory in urban economic literature is that firms (and cities) are likely to agglomerate where there are natural geographic advantages, which would give these firms both comparative and cost advantages over their competitors.

iii) Ellison and Glaeser argue that while this may be true for firms whose location decisions are highly sensitive to cost differences or geographic locations, such as the wine industry, they find that only 20% of geographic agglomeration effects in the United States can be explained by "natural" cost advantages.

iv) Labour pooling and matching: agglomerating effects, such as an increase in population and therefore human capital, arguably help improve matching within the economy, e.g. employees with employers, suppliers with buyers, and so on. Moreover, massive urban areas like cities which contain a multitude of industries in a localized area, can help firms offset their reaction to shocks more efficiently by 'pooling' labour resources together.

Knowledge spillovers: the accumulation of knowledge and human capital in concentrated areas like major urban centres can contribute to the sharing of production technologies (i.e. know-how) between firms. Econometric analysis by Liang and Goetz showed that agglomeration effects account for technology-intensive industries benefitting from Jacobs-type knowledge spillovers. Furthermore, agglomerated centers of production, like cities, also facilitate learning – that is, knowledge generation, diffusion, and accumulation – on a larger scale than smaller economic regions.

Disadvantages of agglomeration include the fact that while the existence of cities can only persist if the advantages outweigh the disadvantages, agglomeration may also lead to traffic congestion, pollution and other negative externalities caused by the clustering of a population of firms and people and that this may lead to diseconomies of scale. Another source of agglomeration diseconomies—

higher crowding and increased waiting time—can be observed in disciplines or industries that are characterized by constrained access to relevant production facilities or resources. As stated above, these factors are what decrease the pricing power of firms because of the many competitors in the area as well as a shortage of labor and lack of flexibility among firms to the laborers abound. Large cities experience these problems, and it is this tension between agglomeration economies and agglomeration dis-economies that may contribute to the growth of the area, control the growth of the area, or cause the area to experience a lack of growth.

The economies of agglomeration has also been shown to increase inequality both within urban areas, and between urban and rural areas. The Oxford development economist Paul Collier has proposed that the gains of agglomeration should be taxed as rents which lead to behaviour-distorting rent-seeking (Henry George theorem). This would be both ethical and efficient, in that gains would be better aligned with deserts and rent-seeking would be curbed. Collier recommends a tax calculated by combining high income and metropolitan location, which can then be redistributed to other cities that have been hard hit by agglomeration.

The disadvantages of agglomerations are as follows: Strong environmental pressures, High land prices, Bottlenecks in public goods (e.g. poor/overburdened infrastructure), Corruption, High competitive pressure, Lack of reserve areas, Economic inequality.(Kathleen 2020)

2.2.2 Theory of Industrial District

Alfred Marshall and industrial districts the Marshallian industrial district is now recognised as an important part of modern industrial economics (Amin, Brusco, Piore, Pyke, Sabel, Sengenberger) and as a chief element of Marshall's thought (Becattini, Loasby, Martin, Raffaelli), we think it useful to recall its main characteristics in order to better understand its further developments made by the Old Cambridge School. ‘Industrial district’ means an area where a concentration of firms has settled down; but, it is not simply a localized industry, as Marshall clarifies well, especially in his Principles of Economics.

The reasons for a geographical concentration of firms may be various: first, the needs of the manufacturers to be close to the resources on which they depend. Localization is particularly related to physical conditions (such as climate, soil, mines, quarries, access to land or water) and characterizes the origin of many English districts like Staffordshire, Bedfordshire and Buckinghamshire. Second, 'the patronage of a court' that produces a 'demand for goods of specially high quality

According to Marshall, small and medium firms collected in a district can compete with large vertically integrated firms. The strength of small and medium firms in a district is provided by external economies that 'depend on the general organisation of the trade, on the growth of the knowledge and appliances common to the trade, on the development of subsidiary industries, and so on' (Marshall, 1898). External economies are opposed to internal economies that characterize large firms. The division of labour that increases productivity and efficiency is not considered by Marshall as a feature of only large firms but also of small and medium size firms.

As we have seen, among the main features of the Marshallian industrial district there is the precious combination 'competition–cooperation'. The importance of this mix is underlined mainly by MacGregor (1929). Association (or cooperation) is, according to him, 'a new way of organizing competition' (1929) rather than a challenger of competition. MacGregor recalls Mill's position who 'in spite of his strong sympathies toward every kind of industrial cooperation, refused to regard progress towards association as meaning the suppression of competition' (1929, p. 189). MacGregor distinguishes between personal and industrial competition. Personal competition is advantageous since 'it is a means whereby society as a whole shall have the power to choose its best men from any grade' (1929): on the contrary, industrial competition can be rather detrimental since 'the very meaning of industrial competition' is 'the attempt to obtain a monopoly' (1929). Cooperation—or association as he calls it—has brought industrial competition 'under constantly greater control' (1929, p. 193). MacGregor does not distinguish between conscious and unconscious cooperation.

With industrial competition, firms fight against each other in order to gain more than the others. Indeed in modern industrial systems, this attitude is not advantageous. Industrial competition has

many defects due to the 'separateness of organization and of policy' (MacGregor, 1929). For instance, as MacGregor notes, 'nothing is more infectious in an industry where many separate firms are competing than the influence upon any one producer of a local glut or over-supply' (1929). Association among firms might be a way to overcome these defects. Being organised, firms may face problems more easily than in isolation.

2.2.3 Theory of Spatial Economics

Producers and buyers are dispersed in space, and overcoming the distances between them can be costly. Much commercial activity is concerned with "space bridging," and much entrepreneurship is aimed at making good use of locational opportunities and cutting the costs of transport and communication. Spatial economics is the study of how space (distance) affects economic behavior.

Throughout history, transport costs have hampered specialization, and improvements in transport and communications have been among the main driving forces of economic progress. In medieval Europe and China, most ordinary people never moved farther than twenty miles from their birthplaces, and before the advent of book printing, most people knew very little about what happened beyond those narrow horizons. Firms that depended on heavy inputs, such as steel makers, used to locate near the source of major inputs—coal mines, in particular. By contrast, firms that interacted intensively and frequently with customers tended to locate near the demand. Thus, gasoline stations are still found near busy intersections.

In recent decades, technical and organizational progress has caused the costs of transport to fall steadily and communication costs to plummet. Between 1950 and 2000, the price of bulk sea freight and port handling dropped, on average, by 0.9 percent annually, of long-distance passenger air transport by 2.6 percent annually and of trans-Atlantic phone calls by an astounding 8 percent annually. The inflation-adjusted price of a long-distance phone call from New York to London is now less than 1 percent of what it was in 1950. Fax machines, portable video cameras, satellite TV, computers, and cell phones have all cut communication costs greatly. More recently, the Internet has made global communication so cheap and user friendly that words and images can be distributed by

almost anyone globally, without delay and at near-zero cost. These technologies have opened new, easily accessible channels of communicating, so that entirely new forms of the division of labor between different locations have become feasible.

This reduction in transport costs has revolutionized decisions about where goods and services are produced. The relative costs of employing immobile production factors, such as land and labor, have become relatively more important in influencing the spatial arrangement of industries, irrespective of national borders. Yet, most businesses still take account of transport and communication costs (and the risks of disruptions) between the locations from which their inputs are supplied and the locations where they find their market demand.

Another aspect of spatial economics, one that has become increasingly contentious in recent years, is the legal and illegal migration of workers across borders. This aspect of globalization is now putting social strain on some societies. A potentially less disruptive measure would be to reduce government barriers to mobility of capital and goods. As International Trade economists have known for a long time, to the extent that governments restrict Free Trade and the free movement of capital, they create incentives for people to move. For example, the stronger are the U.S. government's restrictions on imports from Brazil and the Brazilian government's restrictions on investment from the United States, the stronger is the inducement for Brazilians to migrate to the United States.(de leeuw 2001)

The rising global mobility of products, people, capital, and enterprise poses new competitive challenges to producers and workers in the established economic centers, who are losing some of their relative advantage. They can react to the emergence of competitive new economies in one of two ways. They can "Japan/Korea/China bash" to extract subsidies and political patronage, or, instead, they can be competitive and innovative, raising productivity in the traditional central production places and specializing in goods and services that still incur high transport costs, so that they still enjoy a degree of locational advantage. They can also draw on cheap imported inputs to produce end-products competitively for domestic and world markets. The mature, high-income economies at the center of the global system enjoy an important asset in the dynamic game of global competition: their

innovative capacity. On that score, they are more likely to succeed if they reject political and social regulations that hamper innovative enterprise and cause high costs of transacting business, such as a legal system that raises the risks of innovation.. Competitive producers in the old centers are also discovering that the new industrial countries buy many goods and services that the advanced economies are still best able to produce.

Economic theory suggests—and history amply confirms—that defensive political responses are rarely sustainable over the long term, whereas the competitive, open response of enterprises generates opportunity for most. Globalization is a positive-sum game, one reason being that economic openness to trade and factor mobility has been the most powerful antidote to political "rent-seeking" (the use of political restrictions to secure artificial market niches). In open economies, political and bureaucratic energies are channeled to support mobile producers and to create an investment climate in which all production factors can thrive by cooperating. Openness was the reason modern industrial development took off in Western Europe. There, small, open states had to attract footloose merchants and industrialists by providing the rule of law, secure private property rights, and other economic freedoms, protected by expedient, impartial courts of law

In conclusion, the basic problem with doing theory in economic geography has always been the observation that any sensible story about regional and urban development must hinge crucially on the role of increasing returns. Suppose that we really lived in the constant-returns world that is still assumed in much economic theory. Then it would be hard to understand why the economy is not characterized by "backyard capitalism", in which each household or small group produces most items for itself. There would, admittedly, be some unevenness in population density and some trade between locations because of the variation in the natural environment: land differs in fertility, while differences in soil, climate, and resources mean that no one locality would produce all goods even under constant returns. Nonetheless, the dramatic spatial unevenness of the real economy -- the disparities between densely populated manufacturing belts and thinly populated farm belts, between congested cities and desolate rural areas; the spectacular concentration of particular industries in Silicon Valleys and

Hollywoods -- is surely the result not of inherent differences between locations but of some set of cumulative processes, necessarily involving some form of increasing returns, whereby geographic concentration can be self-reinforcing. (wolfgang 2018)

2.2.4 Theoretical Economic Geography

Theoretical economic geography is a branch of economic geography concerned with understanding the spatial distribution of economic activity.

Theoretical techniques in this branch of economics explain a number of phenomena such as,

the clustering of people and businesses into cities, the location of major population centers, which is often based on proximity to trade routes. For example, most major cities are located on harbours, the distribution of people and businesses within cities with higher density in the centres, reducing to lower density on the fringes, the distribution of populations across land masses, with major cities, interspersed with regional centers which are in turn interspersed with smaller towns, the clustering of similar businesses together. Economic geography is a very broad discipline, with economic geographers using many different methodologies in the study of economic phenomena in the world some distinct approaches to study have evolved over time, theoretical economic geography focuses on building theories about spatial arrangement and distribution of economic activities ,Regional economic geography examines the economic conditions of particular regions or countries of the world. It deals with economic regionalization as well as local economic development; historical economic geography examines the history and development of spatial economic structure. Using historical data, it examines how centers of population and economic activity shift, what patterns of regional specialization and localization evolve over time and what factors explain these changes, evolutionary economic geography adopts an evolutionary approach to economic geography. More specifically, Evolutionary Economic Geography uses concepts and ideas from evolutionary economics to understand the evolution of cities, regions, and other economic systems.

Economic geography is sometimes approached as a branch of anthropogeography that focuses on regional systems of human economic activity. An alternative description of different approaches to the

study of human economic activity can be organized around spatiotemporal analysis, analysis of production/consumption of economic items, and analysis of economic flow. Spatiotemporal systems of analysis include economic activities of region, mixed social spaces, and development.

Alternatively, analysis may focus on production, exchange, distribution, and consumption of items of economic activity. Allowing parameters of space-time and item to vary, a geographer may also examine material flow, commodity flow, population flow and information flow from different parts of the economic activity system. Through analysis of flow and production, industrial areas, rural and urban residential areas, transportation site, commercial service facilities and finance and other economic centers are linked together in an economic activity system.

Economic geography is the subfield of human geography which studies economic activity and factors affecting them. It can also be considered a subfield or method in economics. There are four branches of economic geography. There is, primary sector, Secondary sector, Tertiary sector, and Quaternary sector.

Economic geography takes a variety of approaches to many different topics, including the location of industries, economies of agglomeration (also known as "linkages"), transportation, international trade, development, real estate, gentrification, ethnic economies, gendered economies, core-periphery theory, the economics of urban form, the relationship between the environment and the economy (tying into a long history of geographers studying culture-environment interaction), and globalization.

(fingleton 2001)

2.2.5 Porters Competitiveness Theory

Porter's theory stated that a nation's competitiveness in an industry depends on the capacity of the industry to innovate and upgrade. His theory focused on explaining why some nations are more competitive in certain industries.

Porter Diamond is a model that emphasizes the competitive advantage of an industry or business that makes it work better than other competitors in a region or country. Also known as the Porter Diamond Theory of National Advantage, the model explains why certain industries thrive in particular nations.

Companies use this model to analyze the competitive environment in foreign markets before entering them.

The model outlines factors that determine the relative strength of entities, which drives them to become better than the rest. Besides some of the attributes that are available and identifiable in the environment itself, businesses have the liberty to create their own strengths to empower their presence and become an entity of national importance.

The unique Porter Diamond framework consists of four attributes/factors. If all these four factors are favorable, companies will innovate and stay competitive. This domestic competitiveness prepares them to excel in international markets as well. Besides, the role of government and chance or unpredictable external events also influence competitive advantage.(carrie 2020)

2.3 Empirical Review

The Hinterlands remains a fundamental component in the port and maritime industry and this has led to several studies with empirical studies related to maritime cluster development in the recent past. However, most of the studies failed to address the crucial issues about maritime clustering in Nigeria and had knowledge gaps which they could not address as well. For example, Vassilios and Dimitrios (2010) did a study on Analysis of Seaport Cluster Models for the Development and Competitiveness of Maritime Sectors: The Case of Piraeus. The study investigated the factors that contribute into the decisions of firms from key maritime sectors to establish or locate in a specific area that develops into a network of firms. It also has the aim to investigate and benchmark the circumstances under which a network of firms around a major port develops into a competitive Seaport Cluster. The study use primary data source from firms within maritime clusters in Piraeus to develop agent based models for simulating the networking process within maritime clusters and managing their life cycle. The result of the study provided insight of firm survival strategies within the cluster, optimum timing for new entrants in the cluster and over all cluster management (Vassilios and Dimitrios 2010)

In another study, Notteboom and Rodrigue (2014) did a study in title 'Re-Assessing Port-Hinterland Relationships in the Context of Global Commodity Chains". The study note that given the tremendous changes in logistics, ports are coping with a very flexible environment; several major challenges in contemporary maritime transportation, particularly over the hinterland has received renewed attention in recent years, necessitating the emergence of maritime clusters as approaches towards solving them (Notteboom and Rodrigue, 2014). The study also used primary data sourced from survey to determine that, the maritime component of the global freight transportation system has become very dynamic and efficient following the creation of maritime clusters. As large segments of freight distribution systems are becoming more closely integrated, port-hinterland relationships have become a fundamental component of freight distribution. It may even been argued, and as paradoxically as it sounds, that contemporary improvements in maritime shipping are mainly derived from improvements in inland transport systems (Notteboom and Rodrigue, 2014). The current technological and commercial context indicates important changes in the conceptualization of hinterlands. Among the most significant forces that are shaping hinterlands, the fragmentation of Global Commodity Chains (GCC) can be considered as particularly relevant (Notteboom and Rodrigue, 2014).

Chu-Wan (2006) in a different study on Comparative Analysis on World's Major Maritime Clusters investigated the differences in the creation motives, operation modalities and performance of maritime clusters. The main purpose of this paper was to examine the world major maritime clusters to understand their purpose, economic significance in national economy and characteristics by focusing on Dutch Maritime Network, Norwegian Maritime Cluster, London Maritime Service Cluster, and Hong Kong Maritime Cluster and suggest some implication for Port of Gwangyang to establish Maritime Cluster. The article is organized as follow: the next section as a literature review gives a basic concept of cluster and the emergence backgrounds of maritime cluster approach (Chu-Wan 2006). The study also used primary data obtained from survey to determine that clusters are developed for varied reasons by various economies and that each maritime cluster in the identified regions has performed optimally as agents on economic growth and development in the regions they operated

Chu-Wan (2006). The findings of other studies such as the works of Minh Hoang Choi, and Park, (20170 and Chan-Young and Jong-kyoung(2012), corroborates the results of Chu-wang (2006).

2.4 Literature Gap

From the aforementioned empirical studies, the following knowledge gaps have been identified in line with the objectives of this study and which this study is seeking to address: no studies have been able to provide knowledge of the relationships between maritime cluster creation and haulage operations from seaports to hinterland regions. Similarly, the effects of maritime clusters development on demand for shipping services from hinterland regions is yet to be empirical modeled in Nigeria. These are the knowledge the gaps which the study intends.

CHAPTER THREE

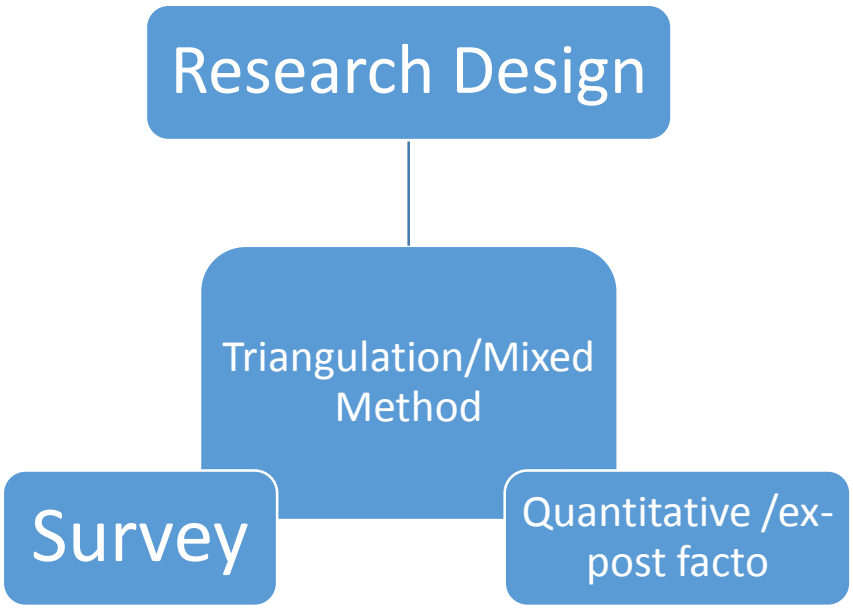
METHODOLGY

3.2 Description of the Study Area

The study area of the research is the port-based maritime clusters in Nigeria with specific concentration on the Onne oil and gas free zone in Rivers state Nigeria, the Calabar free trade zone in Cross-River state Nigeria and the Appapa port zone in Lagos, the Warri port in Delta zone and the Rivers Port.. These constitute the port-based maritime clusters in Nigeria. Therefore the study area of the research is the Nigeria port-based maritime clusters playing host to the maritime, shipping and the allied operating in each of the zones over the years.

3.2 Research Design

The study will use a mixed research design method also called the triangulation method. This consists of the use of ex-post facto (quantitative) research design and survey. The ex-post facto quantitative design involve the use of secondary data obtained from each of the port-based maritime-clusters identified above while the use of survey constitute the use of primary data sourced from each of the maritime clusters identified in the study. Secondary data on shipping export and import trade to and from the hinterland regions in the six geopolitical zones of Nigeria and the FCT Abuja, respectively to the or from the seaports-based maritime clusters, were obtained from Nigeria port Authority (NPA) statistical reports, were used. Similarly, secondary data of the Gross Domestic Product contribution of the various maritime cluster business components of: maritime transport, fishery, marine insurance, offshore oil and gas, marine tourism, port logistics sector, ship operations, and haulage were obtained from the Central bank of Nigeria annual statistical reports. Primary data on the factors motivating the companies operating in each maritime cluster to join and/or invest in the cluster will be obtained from survey administered to a cross section of sample population of maritime companies operating in the port-based maritime clusters. Each secondary dataset will be a time series data covering a period years.



Source: Prepared by the Authors

Fig 3.1

3.3 Sources of Data

This research will rely upon secondary and primary sources of data for the study. Secondary data constitute of data generated from secondary means such as Nigerian Ports Authority annual reports, the shipping companies and allied companies operating in the maritime clusters, the Nigeria Shippers Council, and the Central Bank of Nigeria publications as aforementioned under research design. Primary data will be sourced from survey of the maritime and allied companies operating in the maritime clusters. The responses of the sampled population of the management staff of the companies will form the primary data sources for purposes of the study.

3.4 Population Covered by the Survey and Sample Size

The three port-based maritime clusters and trade free zones in Nigeria used in the study have management authorities and multiple shipping and allied organizations operating in each zone.

However, we are unable to determine specifically the population of the management staff of the maritime, shipping and allied companies operating in each maritime cluster for purposes of population sampling. Thus we used the Z score formula for unknown population to determine the sample size while adopting a purposive random sampling method in which the members of staff in the management cadre of the maritime, shipping and the allied organizations operating in each of the maritime clusters are randomly sampled in the survey, interviewed and questionnaires administered.

The determination of sample of unknown population using Z score is given as:

$N = Z2(P)\ (1\text{-}P)\ /C2$ ---------- (3.1)

Where Z = standard normal deviation set at 95% confidence interval =1.96

P = percentage picking a choice or response =50%

C = confidence interval =0.05

Therefore $N = (1.96)2(0.5)(1\text{-}0.5)/(0.05)2$

$N= 0.9604/0.0025$

$N= 384.16$

$=384$

The sample population will be about 384 staff in the management cadre of the companies and organizations operating in the identified maritime clusters in Nigeria. Questionnaire will be used as survey instrument to obtain data for determining what significant factors influence the decision of the companies to join or invest in the maritime clusters.

3.4.1 Validity Test

Validity test is a measure and explanation of how well the collected data accurately covers the real purpose of the survey and/or investigation (Ghauri and Gronhaug, 2005). Validity test ensures that, the survey instrument (questionnaire) measure basically what is intended to be measured and is of various types (Field, 2005). The study will test the face and content validity of the survey instrument defined by Straub, Boudreau and Grefen (2004) as the degree to which the questions in a survey instrument

reflect the content universe to which the instrument will be generalized. Thus, content validity test evaluates content of questionnaires (survey instruments) to ensure that only questions (items) that are essential are allowed while undesirable questions and items are struck out. The study will adopt a quantitative approach to test the validity of the survey instrument in which content validity questionnaires will be sent out to professionals in same field of research for responses (Hamed, 2016). Each item in the questionnaire will be assessed based on a three point scale: not necessary, useful but not essential, and essential.

The content validity ratio (CVR) will thus be determined by using Lawshe's (1975) method: $\mathrm{CVR} = \frac{ne-(N/2)}{N/2} - - - - - - - - - - (3.2)$

Where CVR =content validity ratio, n_e = number of experts or panel members indicating essential, N is the total number of experts or panel members. Note items in the survey instrument that are non-significant at critical level will be eliminated.

However, to retain an item in the survey instrument based on the CVR is dependent on the population and/or size of the panel of experts sampled.

3.4.2 Testing Reliability of the Instrument

Reliability assesses repeatability and consistency of the responses to the survey instrument (Oladimeji, 2013). For example, a response to survey instrument and/or measurement is said to be reliable if it produces the same output or almost the same result when repeated under the same or similar conditions. Testing for reliability is important as it refers to the consistency across the parts of a measuring instrument. Huck, (2007) writes that, a measurement has high internal consistency and reliability if the items of the measurement "hang together" and measure the same construct. To measure the reliability and internal consistency of the survey instrument, we used the Cronbach Alpha coefficient.

It was determined after administering the survey instrument once to overcome the problems associated with testing over multiple time periods. Reliability was thus determined using the slit-half reliability index and the Cronbach Alpha index. The split−half estimate will be done by dividing up the test into two parts first half of the items/second half of the items), administering the two forms to the same group of individuals in the population and correlating the responses. The coefficient alpha is the mean (average) of all possible split−half estimates while the existence of differences between the two was used to assess reliability.

To estimate coefficient alpha (*a*), we use:

$a = n/(n - 1)[1 - \text{Sum Var } (Y_i)/\text{Var } (X)]$ ---------- (3.3)

Where n = Number of items

Sum Var(Y_i) = Sum of item variances

Var(X) = Composite variance.

Since many respondents, about 384 raters rated significance of identified factors in company's decision to invest in maritime clusters in Nigeria, the inter-rater-reliability was also be measured by using the correlation method to compare the correlation between the different responses of the raters (respondents) as with test- retest reliability method.

For decision purposes, the higher the reliability value, the more reliable the measure. Reliability values of 0.70 or higher is most acceptable (Nunnally and Bernstein; 1994). Hinton et al. (2004) suggest four cut-off points for reliability as follows: excellent reliability (0.90 and above), high reliability (0.70-0.90), moderate reliability (0.50-0.70) and low reliability (0.50 and below).

3.5 Method of Data Analysis

The study will employ multiple methods in analyzing the data obtained in line with the objectives of the study. Firstly, it will use the Factor Analysis method to investigate and determine the first

objective and the eight (last) objective of the study which seeks to determine the significant factors that influence the decision of maritime and shipping companies to invest in maritime clusters. Secondly, it method of multiple regression analysis will be used to estimate the significances of the contributions of components of maritime clusters to the GDP of the maritime sector in Nigeria. Thirdly, the multiple regression analysis methods corresponding to the log-log multiple regression analysis was used to address objectives two, objective three, objective four, objective five, objective six and objective seven, which seeks to determine the effects of the performance of maritime cluster business components on the development of the shipping export and import capacities of the hinterland regions in the six geopolitical zones in Nigeria. Finally, the Eigen test corresponding to the Factor Analysis method was used to test the first study hypothesis while the ANOVA or F-test and t-test corresponding to the multiple regression analysis were used to test the remaining objectives of the study.

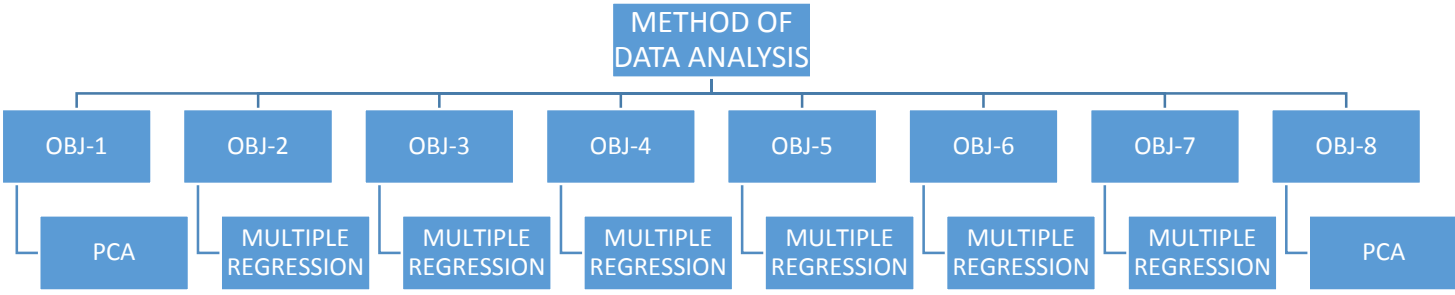


Fig 3.2 Source: Prepared by author

3.5.1 Factor Analysis

Factor analysis is a statistical method used to describe variability among observed, correlated variables in terms of a potentially lower number of unobserved variables called factors/attributes. For example, it is possible that variations in six observed variables mainly reflect the variations in two unobserved (underlying) variables. Factor analysis searches for such joint variations in response to unobserved latent variables. The observed variables are modeled as linear combinations of the potential factors, plus "error" terms. Factor analysis aims to find independent latent variables. The theory behind factor analytic methods is that the information gained about the interdependencies between observed variables can be used later to reduce the set of variables in a dataset. Proponents of factor analysis believe that it helps to deal with data sets where there are large numbers of observed variables that are thought to reflect a smaller number of underlying/latent variables. It allows researchers to investigate concepts that are not easily measured directly by collapsing a large number of variables into a few interpretable underlying factors. Factor analysis was used in this study as a data reduction technique to determine the significance and/or extent to which each of the factors (based on extensive literature review) that influence most maritime and shipping company's decision to invest in or join a maritime

cluster in Nigeria as well as to establish the determinant maritime-cluster business component that contributes most to the maritime sector development in Nigeria.

3.5.2 Multiple Regression and Correlation Analytical Tool

The contribution of the maritime transport sector to development in the economy is represented by the Gross Domestic Product (GDP) contribution of the maritime transport sector (GDPMRT). Other key business components of the maritime clusters such as: shipping operations (SHPTR), fishing & aquaculture (FISHR), offshore oil and gas operations (GPDOILGAS), marine insurance (INSURANCE), port logistics services (POREV), marine haulage (FREIGHTHAUL), and maritime tourism & recreation (TOURISM), all make contributions to the overall development of the economy and the hinterland operations, since hinterland depend on the port-based clusters for sustenance and facilitation of trade operations. Therefore, the influence of the contributions of each of the identified business components of the maritime clusters to the development hinterland regions, can be assessed using multiple regression analysis.

The model specification is as shown below:

$$\mathbf{Y= \alpha+b_1X_1+b_2X_3+\ldots..b_nX_n}$$

Here Y is the dependent variable

$X_1\ldots$ Xn are the n independent variables.

$$\mathbf{Y= \alpha+b_1X_1+b_2X_3+\ldots..b_nX_n}$$

The model specifications for the effects of the maritime-clusters on the development of export shipping operations in the hinterlands in the geopolitical zones are as follows:

$$\mathbf{\textit{LogSEEXP} = b_0 + b_1\textit{LogGDPMRT} + b_2\textit{LogSHPTR} + b_3\textit{LogGDPFISHR} + b_4\textit{LogGDPOILGAS} + b_5\textit{LogINSURANCE} + b_6\textit{LogPOREV} + b_7\textit{LogFREIGHTHAUL} + b_8\textit{LogTOURISM} + e.} \quad \mathbf{(1)}$$

$$\mathbf{\textit{LogSSEXP} = b_0 + b_1\textit{LogGDPMRT} + b_2\textit{LogSHPTR} + b_3\textit{LogGDPFISHR} + b_4\textit{LogGDPOILGAS} + b_5\textit{LogINSURANCE} + b_6\textit{LogPOREV} + b_7\textit{LogFREIGHTHAUL} + b_8\textit{LogTOURISM} + e.} \quad \mathbf{(2)}$$

$$\mathbf{\textit{LogSWEXP} = b_0 + b_1\textit{LogGDPMRT} + b_2\textit{LogSHPTR} + b_3\textit{LogGDPFISHR} + b_4\textit{LogGDPOILGAS} + b_5\textit{LogINSURANCE} + b_6\textit{LogPOREV} + b_7\textit{LogFREIGHTHAUL} + b_8\textit{LogTOURISM} + e.} \quad \mathbf{(3)}$$

$$LogNWEXP = b_0 + b_1 LogGDPMRT + b_2 LogSHPTR + b_3 LogGDPFISHR + b_4 LogGDPOILGAS + b_5 LogINSURANCE + b_6 LogPOREV + b_7 LogFREIGHTHAUL + b_8 LogTOURISM + e. \quad (4)$$

$$LogNCEXP = b_0 + b_1 LogGDPMRT + b_2 LogSHPTR + b_3 LogGDPFISHR + b_4 LogGDPOILGAS + b_5 LogINSURANCE + b_6 LogPOREV + b_7 LogFREIGHTHAUL + b_8 LogTOURISM + e. \quad (5)$$

Where:
b_0 = regression constant

$b_1, b_2, \ldots\ldots b_9$ = coefficients of regression.

GDPMRT = maritime sector GDP

SHPTR = contribution of shipping operators in the cluster

FISHRA = contributions of fishing and aquaculture operators

GDPOILGAS= offshore oil and gas contribution

INSURANCE = marine insurance contribution

POREV= port logistics services contribution

FREIGHTHAUL = road haulage contribution

TOURISM = maritime tourism & recreation contributions

SEEXP = shipping export capacity of the South-East hinterland

SSEXP = = shipping export capacity of the South-South hinterland

SWEXP = = shipping export capacity of the South-West hinterland

NWEXP = = shipping export capacity of the North-west hinterland

NCEXP = = shipping export capacity of the North-central hinterland.

Similarly, the effects of maritime clusters performance on the shipping import capacities of each og the hinterland regions in the six geopolitical zones was modeled as shown below

$$LogSEIMP = b_0 + b_1 LogGDPMRT + b_2 LogSHPTR + b_3 LogGDPFISHR + b_4 LogGDPOILGAS + b_5 LogINSURANCE + b_6 LogPOREV + b_7 LogFREIGHTHAUL + b_8 LogTOURISM + e. \quad (6)$$

$$LogSSIMP = b_0 + b_1LogGDPMRT + b_2LogSHPTR + b_3LogGDPFISHR + b_4LogGDPOILGAS + b_5LogINSURANCE + b_6LogPOREV + b_7LogFREIGHTHAUL + b_8LogTOURISM + e. \quad (7)$$

$$LogSWIMP = b_0 + b_1LogGDPMRT + b_2LogSHPTR + b_3LogGDPFISHR + b_4LogGDPOILGAS + b_5LogINSURANCE + b_6LogPOREV + b_7LogFREIGHTHAUL + b_8LogTOURISM + e. \quad (8)$$

$$LogNWIMP = b_0 + b_1LogGDPMRT + b_2LogSHPTR + b_3LogGDPFISHR + b_4LogGDPOILGAS + b_5LogINSURANCE + b_6LogPOREV + b_7LogFREIGHTHAUL + b_8LogTOURISM + e. \quad (9)$$

$$LogNEIMP = b_0 + b_1LogGDPMRT + b_2LogSHPTR + b_3LogGDPFISHR + b_4LogGDPOILGAS + b_5LogINSURANCE + b_6LogPOREV + b_7LogFREIGHTHAUL + b_8LogTOURISM + e. \quad (10)$$

$$LogNCIMP = b_0 + b_1LogGDPMRT + b_2LogSHPTR + b_3LogGDPFISHR + b_4LogGDPOILGAS + b_5LogINSURANCE + b_6LogPOREV + b_7LogFREIGHTHAUL + b_8LogTOURISM + e. \quad (11)$$

$$LogABIIMP = b_0 + b_1LogGDPMRT + b_2LogSHPTR + b_3LogGDPFISHR + b_4LogGDPOILGAS + b_5LogINSURANCE + b_6LogPOREV + b_7LogFREIGHTHAUL + b_8LogTOURISM + e. \quad (12)$$

Where:

SEIMP = shipping import capacity of the South-East hinterland region

SSIMP = shipping import capacity of the South-south hinterland region

SWIMP = shipping import capacity of the South-west hinterland

NWIMP = shipping import capacity of the north-west hinterland region

NCIMP = shipping import capacity of the north-central hinterland region

NEIMP = shipping import capacity of the north- East hinterland region

ABJIMP = shipping import capacity of the federal Capital territory (FCT), Abuja

The hypotheses were tested using the the corresponding ANOVA (F-test) and t-test from the output of the regression result.

CHAPTER FOUR
RESULTS AND DISCUSSION

Under this section, the data obtained is presented, analyzed and the result of the study is discussed.

The chapter is organized into four sections namely: data present, results and discussion, and policy implications

4.1 **Data Presentation**

Table4.1: The National Contributions and Performance of the Maritime Business Components of Nigeria's Port-Based Maritime Clusters

Year	GDPmrt₦ Millions	SHP_{trf}	$GDP_{fishing}$ ₦000,000	$GDP_{o\&g}$ ₦Million	$GDP_{mrtinsurance}$ ₦000,000	POREV N000,000	Freight serv./haulage (₦M)	TOUR NMillions
2003	2550	4,315.00	81010	1,588009	7,219.71	2804	6870	24670
2004	2750	4,553.00	99000	2,460550	7,959.76	3010	7850	76130
2005	2970	4,586.00	129260	3,281470	10,983.38	3180	8960	99520
2006	3210	4,800.00	149640	4,044970	10,493.41	3370	10220	124430
2007	3540	4,644.00	163990	4,363630	10,757.81	3580	11790	157310
2008	3590	4,477.00	193750	5,270010	16,510.25	3800	12100	185860
2009	3780	4,620.00	221180	4,297070	17,191.14	4010	12280	213730
2010	4230	4,962.00	249710	8,402680	21,264.62	4230	15980	245760
2011	5040	5,232.00	284330	11,039410	22,558.84	3810	16860	694770
2012	5570	4,837.00	322260	11,315030	20,338.20	3750	18960	779350
2013	6220	5,369.00	366790	10,296330	21,387.20	3920	21690	917320
2014	7150	5,333.00	425250	9,616490	21,428.10	4260	24920	1,051220
2015	8070	5,014.00	476140	5,990420	21,051.20	4620	27730	1,197440
2016	8920	4,373.00	455600	5,367320	19,534.95	4690	28860	1,361070
2017	9430	4,292.00	441300	10,355950	24,249.95	4750	20630	1,573520
2018	9860	4,009.00	842110	13,423870	23,208.40	4880	20870	1,787490
2019	10120	3,814.00	1,212390	12,400430	25,918.89	5036	22410	2,328370
2020	8600	4,473.00	1,657910	10,195630	25,771.39	4868	21540	3,052570

Source: Nigeria Statistical Report. (ii) Central Bank of Nigeria Statistical Report. (iii) Nigeria ports Authority statistical reports.

The table 4.1 above presents the data collected to shows the performance and contributions of individual maritime cluster business components, operational in the port-based maritime clusters in Nigeria between 2003 and 2020, covering a period of 18 years. It indicates the Gross Domestic Product (GDP) contribution of the maritime transport sector, the GDP contribution of the fishery sector, the GDP contribution of the offshore oil and gas sector, the GDP contribution of the maritime haulage sector, the GDP contribution of the marine tourism sector, the GDP contribution of the marine insurance business sector and port revenue showing the contribution of the port logistics sector. The GDP contributions of the various maritime business components provides evidence of the activities areas that firms located in the port-based maritime clusters in Nigeria operate. The table4.2 also shows the ship traffic through Nigeria ports, which suggests the level of ship operation activities of shipping companies operating in the port-based maritime clusters in Nigeria over the years. Table4.2 above was investigated further to understand the performance of the individual maritime business components in the port-based clusters in Nigeria.

Table4.2: Major Destination Hinterland Regions for Shipping Import Trade Handled in Nigeria Port based Maritime Clusters

South East (SE)	South-South (SS)	South-West (SW)	North-East (NE)	North-Central (NC)	North-West (NW) (M/tons)	Abuja (ABJ) (M/tons)
7431012	24989135	10953779	72580.2	148237.8	1661467	163563.5
7878100	24706894	10912845	72580.2	153251.6	1664752	165123.7
8670850	26013165	13310279	89168	179720	2039594	122981.6
6565616	20119467	14409735	97534	196400.3	2229554	174735.1
6738544	19477788	9599020	63885	148576.4	1474293	180234.3
7322018	19012032	15567828	105679	211584.7	2416305	165069
9694651	27137960	16126642	109537	218011.8	2503666	173039.6
7890596	22668500	14162063	95624.5	200955.2	2192659	178525.9
8708937	26479507	14492044	97507.3	212524.6	2239068	167401.6
8906802	28627658	14749330	99036.3	210286.2	2272320	165890.1

8312722	28669729	14178053	95552.8	207309	2195286	162403.7
9042477	32618142	13258720	88574.8	216924.5	2051230	173579
8701625	29272307	13096957	87616.6	208040.9	2024747	177477.7
8245222	26618686	14844656	100187	233065.5	2309786	177538.8
8116281	25148071	14878237	100120	226705.7	2306451	60526.34
9341584	33250795	14288677	95559.1	233676.1	2212739	426353.9
5874101	34357179	655702.1	75624.5	89805.63	59023.22	60526.34
28214445	1.61E+08	4618834	65624.5	87435.78	58001.5	426353.9

Source: NPA statistical reports

Table4.2 is the dataset collected for the study, showing the major destination hinterlands for in the six geopolitical zones, for all imports handled in the port based maritime clusters in Nigeria between 2003 and 2020. It shows the import capacities of the identified hinterlands regions in the geopolitical regions that received the imports into the seaports over the period and serves as an indication of the influence of the port based maritime cluster business components on the import shipping trade capacities of the hinterlands. Table 4.2 is used for subsequent analysis to investigate the influence of the maritime clusters on the import capacities and capabilities of the import shipping trade destination hinterlands regions in Nigeria.. The hinterland destinations for the imports into ports include: South-East hinterland regions, South-South hinterland region, South-West region hinterland region, North-east hinterland region, North-central hinterland region, North-west hinterland region and the Federal capital territory, Abuja.

Table4.3: Major Destination Hinterland States for Shipping Import Trade Handled in Nigeria Port based Maritime Clusters

Year	Abia	Kano	Anambr	Lagos	Oyo	Ogun	Kaduna	Plateau	Bauchi	ABJ	A/ibom	Bayelsa	C/R	Delta	Enugu	Imo	River	Edo
2003	4367845	1371063	2606352	6860258	3338688	754834	290403.9	148237.8	72580.2	144175.8	677317.5	437610.4	538009.1	1286324	240387.8	216426.9	21927846	122028
2004	4738048	1374353	2677371	6819323	3338688	754834	290398.4	153251.6	72580.2	140397.2	687363.9	408641.1	586058.4	1212223	260581.1	202099.7	21697593	115016
2005	5123423	1682840	3047310	8281203	4101729	927347	356754.6	179720	89168	163563.5	711401.6	433641	594451.9	882299.8	285652.8	214463.8	23308301	83069.8
2006	3605829	1839348	2611830	8908819	4486563	1014353	390206	196400.3	97534	165123.7	672784.3	368635.5	609038.5	1020618	165642.3	182314.3	17351671	96720.2
2007	4389386	1218685	2016459	5995906	2938710	664404	255607.6	148576.4	63885	122981.6	705722.4	355116.8	674524.8	970423	157070.9	175628.4	16680059	91941.6
2008	4396320	1993520	2604426	9607532	4861234	1099062	422785.9	211584.7	105679	174735.1	688105	367389.2	633801.5	774420.8	139575	181697.9	16475341	72975.2
2009	5378970	2065446	3757325	9948748	5038708	1139186	438219.7	218011.8	109537	180234.3	696615	374054.8	639242.1	1019503	373361.2	184994.5	24311958	96587.1
2010	4652020	1810087	2830951	8768839	4398728	994495	382571.5	200955.2	95624.5	165069	748154.5	385783.9	704554.9	1112455	216830.5	190795.3	19612053	105499
2011	5103290	1848957	3132835	8992631	4485337	1014076	390111	212524.6	97507.3	173039.6	857008.4	429569.4	821014.3	1732618	260362.5	212450.1	22474178	165120
2012	5133708	1876087	3280702	9163682	4555670	1029978	396232.3	210286.2	99036.3	178525.9	848533	457564.6	776460.9	2759984	266097.3	226295.5	23521018	264098
2013	4635184	1812998	3247708	8788874	4395430	993749	382288.2	207309	95552.8	167401.6	816122.1	404326.2	787211.8	5470713	229864.3	199965.7	20665501	525855
2014	5152028	1696844	3386329	8263101	4074441	921178	354386.1	216924.5	88574.8	165890.1	1027622	456935.2	1050173	5515929	278135.9	225984.3	24037513	529969
2015	5135287	1674197	3103861	8155383	4030362	911212	350549.8	208040.9	87616.6	162403.7	953495	439022.5	957415.8	4167804	245351	217125.2	22354571	399999
2016	4793170	1908960	3054341	9194101	4608609	1041946	400826.4	233065.5	100187	173579	961770.1	409050.4	1003898	4050341	195408.5	202302.1	19804818	388809
2017	4793039	1905886	2906473	9231454	4605532	1041251	400564.7	226705.7	100120	177477.7	943710.4	439555.7	941897.8	1788261	199380.5	217389	20864206	170440
2018	5370988	1830411	3464133	8899147	4395716	993814	382327.9	233676.1	95559.1	177538.8	1095138	481987.5	1124786	5482748	268089	238374.2	24539486	526650
2019	3385479	58934.95	1998615	655702.1	4361234	899062	88.27	89805.63	75624.5	60526.34	1146850	464035.3	1223901	7064940	260511.7	229495.7	23778083	679369
2020	17638644	57379.73	7780806	4618834	3861234	1019062	621.77	87435.78	65624.5	426353.9	3887582	3268713	2232641	8518554	1178403	1616592	1.43E+08	806366

Source: NPA statistical report

Table4.3 is the dataset collected for the study, showing the major destination hinterlands states in the regions, for all imports handled in the port-based maritime clusters in Nigeria between 2003 and 2020. It shows the import capacities of each of the hinterland states in the regions that received the imports into the seaports over the period. It indicates the capacities of the each of the hinterland states in the regions and serves as an indication of the influence of the port-based maritime cluster business components on the import shipping trade capacities of the hinterlands states. Table 4.3 is used for subsequent analysis to investigate the influence of the maritime clusters on the import capacities of destination hinterlands states in regions in Nigeria. The hinterland states and destinations for the imports into ports include: Abia, Kano, Lagos, Anambra, Oyo, Ogun, Kaduna, plateau, Bauchi, Bayelsa, Rivers, Delta, Akwa-ibom, Cross-River, Edo, Abuja, etc.

Table4.4: Originating Hinterland Regions of Export Trade Handled in Port-Based Maritime Clusters in Nigeria

Year	South-east (SE) (M/tons)	South-south (SS) (M/tons)	South-west (SW) (m/tons)	North-central (NC) (m/tons)	North-west (NW) (m/tons)
2003	361270.4	7910262	436139.9	2076.31	64596.22
2004	429077.6	8610995	451870.5	2154.61	67032.45
2005	479258.5	8963526	504925.2	2407.59	74902.8
2006	239478	5378621	451424.2	2149.07	66859.97
2007	249603.6	5092573	553714.8	2640.23	82140.46
2008	210062.9	4228253	605665.5	2887.94	89847.07
2009	1697260	12277494	6308222	30031.2	934304.1
2010	382005.3	7136273	656244.5	3129.11	97350.18
2011	462189.9	9161342	680201.5	3243.34	100904.1
2012	241755.3	9719532	629762.6	2998.08	93273.49
2013	248537.4	12351326	636201.6	3033.54	94376.91
2014	243306	13721746	615733.5	2935.95	91340.59
2015	205651.6	10568943	862224.6	4104.75	127703.2
2016	304580.4	8372618	1012022	4825.53	150127.8

2017	350366.1	5842208	1046373	4989.33	155223.7
2018	965376.1	13381044	3754308	17872.93	556046.7
2019	975297.1	15096041	3779540	18021.65	560673.4
2020	3792443	1.69E+08	3607354	17200.63	535130.6

Source: NPA statistical report

Table4.4 is the dataset collected for the study, showing the major originating hinterland regions in the geopolitical zones, for all exports handled in the port-based maritime clusters in Nigeria between 2003 and 2020. It shows the export potentials of the hinterlands regions in the geopolitical regions from where exports handled in the ports originated over the period and serves as an indication of the influence of the port-based maritime cluster business components on the export potentials of the hinterlands regions. Table 4.4 is used for subsequent analysis to investigate the influence of the maritime clusters on the export capacities of the export originating hinterlands regions in Nigeria.

Table4.5: Origin Hinterland States of Export Trade Handled in Port Based Maritime Clusters in Nigeria

Year	LAGOS	OGUN	OYO	KANO	KAD	ANAMBR	PLATEAU	RIVERS	A/IBOM	ABIA	DELTA	EDO	C/RIVER	ENUGU
2003	335669.7	87204.9	13265.3	58828.7	5767.52	134147	2076.31	6315432	18771.03	181023.7	1425638	128644.9	21776.41	46099.66
2004	348329.3	89775.6	13765.59	61047.41	5985.04	132938	2154.61	7074752	21615.53	235627.6	1343719	145732	25176.72	60512.04
2005	389227.1	100316.3	15381.82	68215.05	6687.75	145378.8	2407.59	7805287	21596.45	265249.7	970498.1	141017	25127.78	68629.98
2006	347433.1	90260.96	13730.17	60890.33	5969.64	125860.3	2149.07	4118179	23424.8	92610.71	1129974	79680.05	27362.25	21006.99
2007	426837.1	110009.6	16868.13	74806.49	7333.97	142826.2	2640.23	3885735	26855.92	87748.5	1074147	74394.38	31441.23	19028.9
2008	466883.9	120330.9	18450.74	81825.01	8022.06	153325.5	2887.94	3272496	24655.89	48138.79	852564.4	49714.68	28822	8598.6
2009	4855045	1261311	191866	850884.1	83420.01	1119338	30031.2	10872756	24807.26	457314.8	1128420	222516.8	28994.3	120607.4
2010	505873.2	130379.7	19991.55	88658.2	8691.98	163006.5	3129.11	5727664	27796.54	175982.9	1232535	115754.4	32523.25	43015.87
2011	524340.7	135139.4	20721.37	91894.76	9009.29	174533.3	3243.34	6994772	32734.16	230606.3	1929081	166428.4	38326.56	57050.42
2012	484689	125919.2	19154.38	84945.5	8327.99	157060.1	2998.08	6413744	30049	70882.88	3085439	155087.5	35212.44	13812.35
2013	490422.9	126397.7	19380.97	85950.4	8426.51	159923.2	3033.54	5892957	9382.43	70908.89	6143526	294743.6	10717.14	17705.31
2014	474644.9	122331.2	18757.44	83185.18	8155.41	161057.1	2935.95	7226330	3747.66	65075.53	6191587	296087.5	3994.66	17173.41
2015	663600.5	172399.3	26224.76	116301.1	11402.07	191607.9	4104.75	5682436	2249.06	11320.26	4673158	208785.1	2315.4	2723.52
2016	780127.9	201063.9	30829.8	136723.5	13404.26	202557.1	4825.53	3597388	1215.3	80247.49	4542422	230389.3	1202.92	21775.76
2017	806608.4	207888.8	31876.27	141364.4	13859.25	213619.1	4989.33	3675651	23353.54	110769.5	1991243	124570.9	27389.38	25977.53
2018	2889457	750663.1	114188.2	506399.7	49647.03	695282.1	17872.93	6799039	38798.21	217711.7	6152809	344904.6	45493.36	52382.34
2019	2913500	750902	115138.3	510613.3	50060.13	699932.8	18021.65	6624321	51793.16	223768.3	7937022	421998.7	60905.56	51595.99
2020	2780768	716692.8	109892.9	487351.1	47779.52	3542827	17200.63	1.59E+08	68965.8	203786	9420713	478772.8	59298.04	45830.05

Source: NPA statistical Report.

Table4.5 is the dataset collected for the study, showing the major export originating hinterlands states in the regions, from which export trade handled in the port-based maritime clusters in Nigeria between 2003 and 2020 originated. It shows the export capacities of each of the hinterland states in the regions that generated the export trade handled in the ports over the period. It indicates the export capacities of each of the hinterland states in the regions and serves as an indication of the influence of the port-based maritime cluster business components on the export shipping capacities of the hinterlands states. Table 4.5 is used for subsequent analysis to investigate the influence of the maritime clusters on the export capacities of hinterlands states in regions in Nigeria

Table4.6: Descriptive Statistics of Destination of Imports from ports to Hinterland Regions

	N	Range	Minimum	Maximum	Sum
SE	18	22340343.54	5874101.30	28214444.84	165655583.63
SS	18	142329869.23	19012032.37	161341901.60	610508917.26
SW	18	15470939.70	655702.10	16126641.80	224103400.50
NORTHEAST	18	45652.10	63885.00	109537.10	1611991.44
NC	18	146240.35	87435.78	233676.13	3382511.64
NW	18	2445664.39	58001.50	2503665.89	33910941.15
ABJ	18	365827.56	60526.34	426353.90	3321324.02
Valid N (listwise)	18				

Descriptive Statistics

	Mean	Std. Deviation
SE	9203087.9794	4849170.41980
SS	33917162.0700	32105065.13078
SW	12450188.9167	4003231.34279
NORTHEAST	89555.0800	13755.06125
NC	187917.3133	44843.74590
NW	1883941.1750	716439.39817
ABJ	184518.0011	95278.52629
Valid N (listwise)		

Source: Authors calculation. Source: Authors calculation

The result on table4.6 above shows the average tons of shipping import trade moved to each of the hinterland regions from the port-based maritime clusters in Nigeria between 2003 and 2020. The tables indicates that average tons of shipping import trade hauled to the south-east and south-south hinterlands for examples, are 9203087.98 metric tons and 33917162.07 metric tons respectively with respective standard deviations of 4849170.42 and 32105065.131. The south-west and north-east hinterland regions have averages 12450188.92 metric tons and 89555.08 metric tons of shipping import trade delivered to it per annum from the port-based maritime clusters, between 2003 and 2020 respectively.

The average tons of shipping import trade moved to each of the north-central and north-west hinterland regions are 187917.31 metric tons and 1883941.12 metric tons respectively with respective standard deviations of 44843.76 and 716439.39. the average tonnage of shipping import trade delivered from the seaports to the Federal Capital Territory Abuja, hinterland region between 2003 and 2020 is 184518.001 metric tons with standard deviation of 95278.53. This indicates the influence of the port-based maritime clusters on the shipping import capacities of the hinterland regions in the geopolitical zones of Nigeria. Figure4.1 below is a bar chart presenting the pictorial view of the tons of influence of the maritime clusters on the import shipping trade capacities of the hinterland regions in Nigeria.

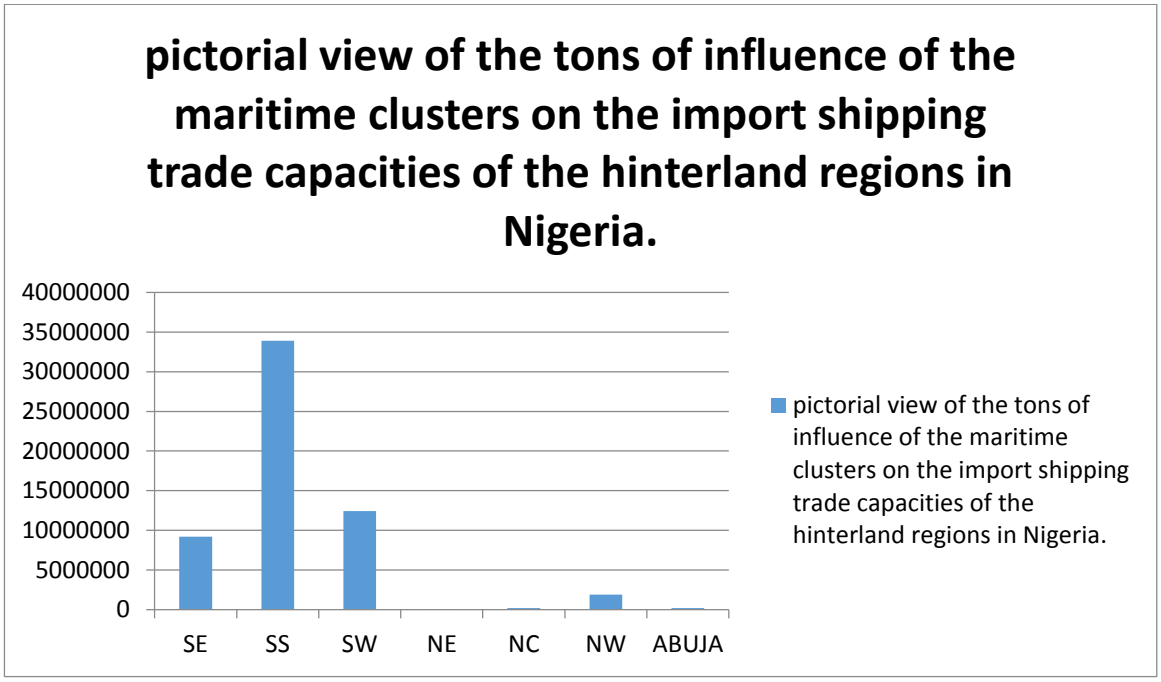


Figure4.1: Import capacities of the hinterland regions influenced by maritime clusters. Source: prepared by author.

Table4.7: Originating Hinterlands Regions of Export Shipping Trade to Port based Maritime Clusters in Nigeria

	N	Range	Minimum	Maximum	Sum
SE	18	3586791.31	205651.64	3792442.95	11837519.15
SS	18	164889266.69	4228253.31	169117520.00	326930317.71
SW	18	5872082.10	436139.90	6308222.00	26591927.75
NC	18	27954.89	2076.31	30031.20	126701.79
NW	18	869707.89	64596.22	934304.11	3941833.66
ABJ	18	.00	.00	.00	.00
Valid N (listwise)	18				

Descriptive Statistics

	Mean	Std. Deviation
SE	657639.9528	869973.49177
SS	18162795.4283	37804728.26504
SW	1477329.3194	1686700.29613
NC	7038.9883	8032.77291
NW	218990.7589	249908.48711
ABJ	.0000	.00000
Valid N (listwise)		

Source: Authors calculation

The result on table4.7 above shows the average tons of shipping export trade moved from each of the hinterland regions to the port-based maritime clusters in Nigeria between 2003 and 2020. The tables indicates that average tons of shipping export trade hauled from the south-east and south-south hinterlands for examples, are 657639.95 metric tons and 18162795.43 metric tons respectively with respective standard deviations of 869973.49 and 37804728.27. The south-west and north-central hinterland regions have averages 1477329.33 metric tons and 7038.99 metric tons of of shipping export trade delivered from it to the port-based maritime clusters, between 2003 and2020 respectively. The average tons of export shipping trade moved from the north-west hinterland regions is 218990.76 metric tons with standard deviation of 249908.49. The nort-east and the FCT Abuja have no record of export shipping trade that originated from the hinterlands to the port-based maritime clusters over the period. This indicates the influence of the port-based maritime clusters on the export shipping capacities of the hinterland regions in the geopolitical zones of Nigeria. Figure4.2 below is a bar chart presenting the pictorial view of the tons of influence of the maritime clusters on the export shipping capacities of the hinterland regions in Nigeria.

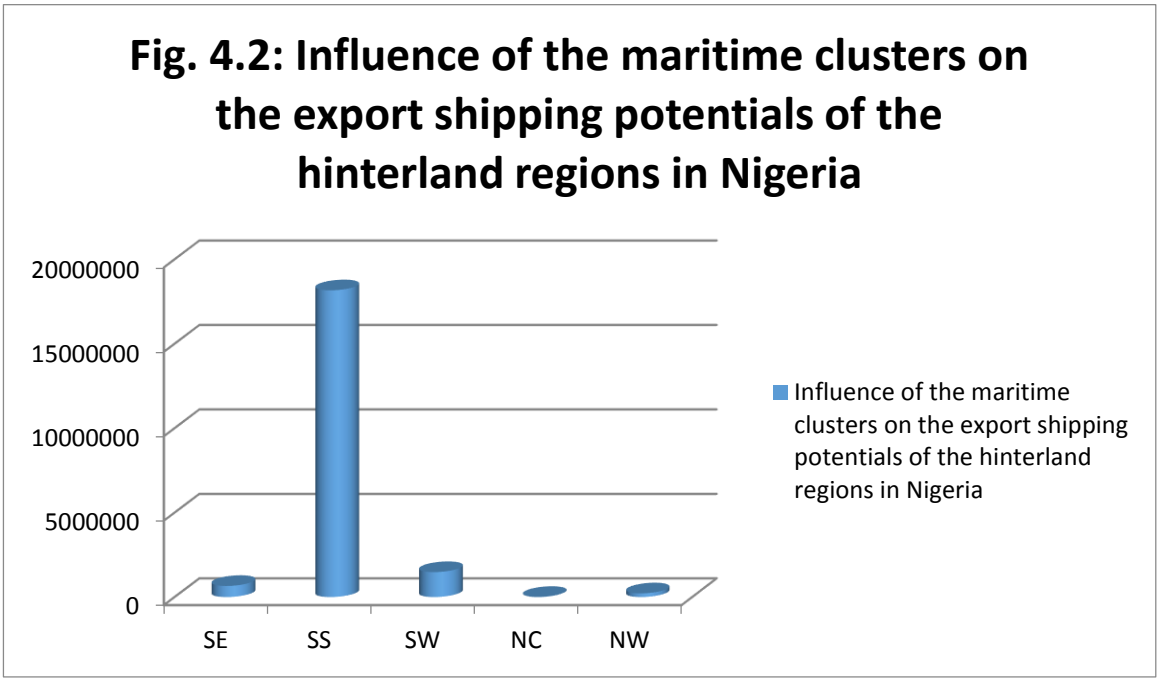


Figure4.2. Source: Authors calculation

Table4.8: Natural Log Transformation of Table4.1

Year	LogGDP MRT	LogSHP$_{trf}$	LogGDP FISHR	LogGDPO&G	LogGDPI NSUR	LogPOREV	LogFreightHa	LogMTOUR
2003	7.84	8.37	11.3	14.28	8.88	7.94	8.83	10.11
2004	7.92	8.42	11.5	14.72	8.98	8.01	8.97	11.24
2005	8	8.43	11.77	15	9.3	8.06	9.1	11.51
2006	8.07	8.48	11.92	15.21	9.26	8.12	9.23	11.73
2007	8.17	8.44	12.01	15.29	9.28	8.18	9.38	11.97
2008	8.19	8.41	12.17	15.48	9.71	8.24	9.4	12.13
2009	8.24	8.44	12.31	15.27	9.75	8.3	9.42	12.27
2010	8.35	8.51	12.43	15.94	9.96	8.35	9.68	12.41
2011	8.53	8.56	12.56	16.22	10.02	8.25	9.73	13.45
2012	8.63	8.48	12.68	16.24	9.92	8.23	9.85	13.57
2013	8.74	8.59	12.81	16.15	9.97	8.27	9.98	13.73
2014	8.87	8.58	12.96	16.08	9.97	8.36	10.12	13.87
2015	9	8.52	13.07	15.61	9.95	8.44	10.23	14

2016	9.1	8.38	13.03	15.5	9.88	8.45	10.27	14.12
2017	9.15	8.36	13	16.15	10.1	8.47	9.93	14.27
2018	9.2	8.3	13.64	16.41	10.05	8.49	9.95	14.4
2019	9.22	8.25	14.01	16.33	10.16	8.52	10.02	14.66
2020	9.06	8.41	14.32	16.14	10.16	8.49	9.98	14.93

Source: Authors calculation

Table4.8 shows the natural log transformation of table4.1 on the performance of the maritime clusters business components in Nigeria. The transformation was done in order to make the atble4.1 amenable for use in modeling the relationships expressed in the objectives of the study and to get all the variables in the same unit.

Table4.9: Natural Log Transformation of Table4.2 on Destination Hinterland Regions of Imports from Port-based Maritime Clusters

LogSE (South East)	LogSS (South-South)	LogSW (South-West)	LogNE (North-East)	LogNC (North-Central)	LogNW (North-West)	LogABI (Abuja)
15.82	17.03	16.21	11.19	11.91	14.32	12
15.88	17.02	16.21	11.19	11.94	14.33	12.01
15.98	17.07	16.4	11.4	12.1	14.53	11.72
15.7	16.82	16.48	11.49	12.19	14.62	12.07
15.72	16.78	16.08	11.06	11.91	14.2	12.1
15.81	16.76	16.56	11.57	12.26	14.7	12.01
16.09	17.12	16.6	11.6	12.29	14.73	12.06
15.88	16.94	16.47	11.47	12.21	14.6	12.09
15.98	17.09	16.49	11.49	12.27	14.62	12.03
16	17.17	16.51	11.5	12.26	14.64	12.02
15.93	17.17	16.47	11.47	12.24	14.6	12
16.02	17.3	16.4	11.39	12.29	14.53	12.06
15.98	17.19	16.39	11.38	12.25	14.52	12.09

15.93	17.1	16.51	11.51	12.36	14.65	12.09
15.91	17.04	16.52	11.51	12.33	14.65	11.01
16.05	17.32	16.47	11.47	12.36	14.61	12.96
15.59	17.35	13.39	11.23	11.41	10.99	11.01
17.16	18.9	15.35	11.09	11.38	10.97	12.96

Source: NPA statistical reports

Table4.9 shows the natural log transformation of table4.2 on the destination hinterland regions of import shipping trade from port-based maritime clusters in Nigeria. The transformation was done in order to make the atble4.1 amenable for use in modeling the relationships expressed in the objectives of the study and to get all the variables in the same unit.

Table4.10: Natural Log Transformation of Table4.4 Originating Hinterland Regions of Export from the Port Based Maritime Clusters

Year	LogSE (south-east)	LogSS (South-south)	LogSW (South-west)	LogNC (North-central)	LogNW (North-west)
2003	12.8	15.88	12.99	7.64	11.08
2004	12.97	15.97	13.02	7.68	11.11
2005	13.08	16.01	13.13	7.79	11.22
2006	12.39	15.5	13.02	7.67	11.11
2007	12.43	15.44	13.22	7.88	11.32
2008	12.26	15.26	13.31	7.97	11.41
2009	14.34	16.32	15.66	10.31	13.75
2010	12.85	15.78	13.39	8.05	11.49
2011	13.04	16.03	13.43	8.08	11.52
2012	12.4	16.09	13.35	8.01	11.44
2013	12.42	16.33	13.36	8.02	11.46
2014	12.4	16.43	13.33	7.98	11.42
2015	12.23	16.17	13.67	8.32	11.76

2016	12.63	15.94	13.83	8.48	11.92
2017	12.77	15.58	13.86	8.52	11.95
2018	13.78	16.41	15.14	9.79	13.23
2019	13.79	16.53	15.15	9.8	13.24
2020	15.15	18.95	15.1	9.75	13.19

Source: Authors calculation

Table4.10 shows the natural log transformation of table4.2 on the originating hinterland regions of export shipping trade handled in the port-based maritime clusters in Nigeria. The transformation was done in order to make the atble4.1 amenable for use in modeling the relationships expressed in the objectives of the study and to get all the variables in the same unit.

Table-4.11: Respondents rating of the Influences of identified Decision Factors on Firms Decision to Locate Operational Offices around Seaport Zones/Maritime Clusters in Nigeria

S/No. of Respondents	All scores in %										
	RlC	EII	FGPolicy	TPCO	APS	EAC	EIC	HDC	GS	SIC	RTB
1	10	15	20	10	10	15	10	10	20	10	15
2	15	15	15	10	10	10	10	10	15	10	15
3	15	10	20	15	15	15	5	5	15	5	10
4	20	10	15	15	5	20	10	20	25	10	10
5	10	10	15	20	10	15	10	10	30	10	10
6	10	15	15	10	10	10	10	10	30	10	15
7	10	15	10	10	15	15	10	10	25	10	15
8	15	10	20	10	5	15	5	15	30	5	10
9	20	5	15	15	5	20	10	20	25	10	5
10	15	5	20	20	10	15	10	15	30	10	5
11	10	15	15	15	10	10	10	10	30	10	15
12	10	15	10	10	15	15	10	5	20	10	15
13	15	10	20	10	5	15	5	10	30	5	10
14	20	5	15	15	5	20	10	5	25	10	5
15	15	5	20	20	10	15	10	5	30	10	5
16	10	15	15	15	10	10	10	15	30	10	15
17	10	15	10	10	15	15	10	15	25	10	15
18	15	10	20	10	5	15	5	10	30	5	10
19	20	5	15	15	5	20	10	10	25	10	5
20	15	5	20	20	10	15	10	5	30	10	5
21	10	15	20	15	10	15	10	5	20	10	15
22	15	15	15	10	10	10	10	15	25	10	15
23	15	10	20	15	15	15	5	15	20	5	10
24	20	10	15	15	5	20	10	10	25	10	10

25	10	10	15	20	10	15	10	10	20	10	10
26	10	15	15	10	10	10	10	15	15	10	15
27	10	15	10	10	15	15	10	15	10	10	15
28	15	5	20	10	10	15	10	10	30	10	5
29	10	15	20	15	10	15	10	15	20	10	15
30	15	15	15	10	10	10	10	10	25	10	15
31	15	10	20	15	15	15	5	15	20	5	10
32	20	10	15	15	5	20	10	15	25	10	10
33	10	10	15	20	10	15	10	20	30	10	10
34	10	15	15	10	10	10	10	10	30	10	15
35	10	15	10	10	15	15	10	10	25	10	15
36	15	5	20	10	10	15	10	10	30	10	5
37	10	15	15	15	10	10	10	15	30	10	15
38	10	15	10	10	15	15	10	10	25	10	15
39	15	10	20	10	5	15	5	5	30	5	10
40	20	5	15	15	5	20	10	5	25	10	5
41	15	5	20	20	10	15	10	10	30	10	5
42	10	15	20	15	10	15	10	10	20	10	15
43	15	15	15	10	10	10	10	10	25	10	15
44	15	10	20	15	15	15	5	15	20	5	10
45	20	10	15	15	5	20	10	5	25	10	10
46	10	10	15	20	10	15	10	10	30	10	10
47	10	15	15	10	10	10	10	10	30	10	15
48	10	15	10	10	15	15	10	10	25	10	15
49	15	5	20	10	10	15	10	10	30	10	5
50	10	15	20	15	10	15	10	15	20	10	15
51	15	15	15	10	10	10	10	10	25	10	15
52	10	15	20	15	10	15	10	15	20	10	15
53	15	15	15	10	10	10	10	10	25	10	15
54	15	10	20	15	15	15	5	15	20	5	10
55	20	10	15	15	5	20	10	15	25	10	10
56	10	10	15	20	10	15	10	20	30	10	10
57	10	15	15	10	10	10	10	10	30	10	15
58	10	15	10	10	15	15	10	10	25	10	15
59	15	10	20	10	5	15	5	10	30	5	10
60	20	5	15	15	5	20	10	15	25	10	5
61	10	15	20	10	10	15	10	10	20	10	15
62	15	15	15	10	10	10	10	10	15	10	15
63	15	10	20	15	15	15	5	5	15	5	10
64	20	10	15	15	5	20	10	20	25	10	10
65	10	10	15	20	10	15	10	10	30	10	10
66	10	15	15	10	10	10	10	10	30	10	15
67	10	15	10	10	15	15	10	10	25	10	15
68	15	10	20	10	5	15	5	15	30	5	10
69	20	5	15	15	5	20	10	20	25	10	5
70	15	5	20	20	10	15	10	15	30	10	5
71	10	15	15	15	10	10	10	10	30	10	15
72	10	15	10	10	15	15	10	5	20	10	15
73	15	10	20	10	5	15	5	10	30	5	10
74	20	5	15	15	5	20	10	5	25	10	5

75	15	5	20	20	10	15	10	5	30	10	5
76	10	15	15	15	10	10	10	15	30	10	15
77	10	15	10	10	15	15	10	15	25	10	15
78	15	10	20	10	5	15	5	10	30	5	10
79	20	5	15	15	5	20	10	10	25	10	5
80	15	5	20	20	10	15	10	5	30	10	5
81	10	15	20	15	10	15	10	5	20	10	15
82	15	15	15	10	10	10	10	15	25	10	15
83	15	10	20	15	15	15	5	15	20	5	10
84	20	10	15	15	5	20	10	10	25	10	10
85	10	10	15	20	10	15	10	10	20	10	10
86	10	15	15	10	10	10	10	15	15	10	15
87	10	15	10	10	15	15	10	15	10	10	15
88	15	5	20	10	10	15	10	10	30	10	5
89	10	15	20	15	10	15	10	15	20	10	15
90	15	15	15	10	10	10	10	10	25	10	15
91	15	10	20	15	15	15	5	15	20	5	10
92	20	10	15	15	5	20	10	15	25	10	10
93	10	10	15	20	10	15	10	20	30	10	10
94	10	15	15	10	10	10	10	10	30	10	15
95	10	15	10	10	15	15	10	10	25	10	15
96	15	5	20	10	10	15	10	10	30	10	5
97	10	15	15	15	10	10	10	15	30	10	15
98	10	15	10	10	15	15	10	10	25	10	15
99	15	10	20	10	5	15	5	5	30	5	10
100	20	5	15	15	5	20	10	5	25	10	5
101	15	5	20	20	10	15	10	10	30	10	5
102	10	15	20	15	10	15	10	10	20	10	15
103	15	15	15	10	10	10	10	10	25	10	15
104	15	10	20	15	15	15	5	15	20	5	10
105	20	10	15	15	5	20	10	5	25	10	10
106	10	10	15	20	10	15	10	10	30	10	10
107	10	15	15	10	10	10	10	10	30	10	15
108	10	15	10	10	15	15	10	10	25	10	15
109	15	5	20	10	10	15	10	10	30	10	5
110	10	15	20	15	10	15	10	15	20	10	15
111	15	15	15	10	10	10	10	10	25	10	15
112	10	15	20	15	10	15	10	15	20	10	15
113	15	15	15	10	10	10	10	10	25	10	15
114	15	10	20	15	15	15	5	15	20	5	10
115	20	10	15	15	5	20	10	15	25	10	10
116	10	10	15	20	10	15	10	20	30	10	10
117	10	15	15	10	10	10	10	10	30	10	15
118	10	15	10	10	15	15	10	10	25	10	15
119	15	10	20	10	5	15	5	10	30	5	10
120	20	5	15	15	5	20	10	15	25	10	5
121	10	15	20	10	10	15	10	10	20	10	15
122	15	15	15	10	10	10	10	10	15	10	15
123	15	10	20	15	15	15	5	5	15	5	10
124	20	10	15	15	5	20	10	20	25	10	10

125	10	10	15	20	10	15	10	10	30	10	10
126	10	15	15	10	10	10	10	10	30	10	15
127	10	15	10	10	15	15	10	10	25	10	15
128	15	10	20	10	5	15	5	15	30	5	10
129	20	5	15	15	5	20	10	20	25	10	5
130	15	5	20	20	10	15	10	15	30	10	5
131	10	15	15	15	10	10	10	10	30	10	15
132	10	15	10	10	15	15	10	5	20	10	15
133	15	10	20	10	5	15	5	10	30	5	10
134	20	5	15	15	5	20	10	5	25	10	5
135	15	5	20	20	10	15	10	5	30	10	5
136	10	15	15	15	10	10	10	15	30	10	15
137	10	15	10	10	15	15	10	15	25	10	15
138	15	10	20	10	5	15	5	10	30	5	10
139	20	5	15	15	5	20	10	10	25	10	5
140	15	5	20	20	10	15	10	5	30	10	5
141	10	15	20	15	10	15	10	5	20	10	15
142	15	15	15	10	10	10	10	15	25	10	15
143	15	10	20	15	15	15	5	15	20	5	10
144	20	10	15	15	5	20	10	10	25	10	10
145	10	10	15	20	10	15	10	10	20	10	10
146	10	15	15	10	10	10	10	15	15	10	15
147	10	15	10	10	15	15	10	15	10	10	15
148	15	5	20	10	10	15	10	10	30	10	5
149	10	15	20	15	10	15	10	15	20	10	15
150	15	15	15	10	10	10	10	10	25	10	15
151	15	10	20	15	15	15	5	15	20	5	10
152	20	10	15	15	5	20	10	15	25	10	10
153	10	10	15	20	10	15	10	20	30	10	10
154	10	15	15	10	10	10	10	10	30	10	15
156	10	15	10	10	15	15	10	10	25	10	15
157	15	5	20	10	10	15	10	10	30	10	5
158	10	15	15	15	10	10	10	15	30	10	15
159	10	15	10	10	15	15	10	10	25	10	15
160	15	10	20	10	5	15	5	5	30	5	10
161	20	5	15	15	5	20	10	5	25	10	5
162	15	5	20	20	10	15	10	10	30	10	5
163	10	15	20	15	10	15	10	10	20	10	15
164	15	15	15	10	10	10	10	10	25	10	15
165	15	10	20	15	15	15	5	15	20	5	10
166	20	10	15	15	5	20	10	5	25	10	10
167	10	10	15	20	10	15	10	10	30	10	10
168	10	15	15	10	10	10	10	10	30	10	15
169	10	15	10	10	15	15	10	10	25	10	15
170	15	5	20	10	10	15	10	10	30	10	5
171	10	15	20	15	10	15	10	15	20	10	15
172	15	15	15	10	10	10	10	10	25	10	15
173	10	15	20	15	10	15	10	15	20	10	15
174	15	15	15	10	10	10	10	10	25	10	15
175	15	10	20	15	15	15	5	15	20	5	10

176	20	10	15	15	5	20	10	15	25	10	10
177	10	10	15	20	10	15	10	20	30	10	10
178	10	15	15	10	10	10	10	10	30	10	15
179	10	15	10	10	15	15	10	10	25	10	15
180	15	10	20	10	5	15	5	10	30	5	10
181	20	5	15	15	5	20	10	15	25	10	5
182	10	15	20	10	10	15	10	10	20	10	15
183	15	15	15	10	10	10	10	10	15	10	15
184	15	10	20	15	15	15	5	5	15	5	10
185	20	10	15	15	5	20	10	20	25	10	10
186	10	10	15	20	10	15	10	10	30	10	10
187	10	15	15	10	10	10	10	10	30	10	15
188	10	15	10	10	15	15	10	10	25	10	15
189	15	10	20	10	5	15	5	15	30	5	10
190	20	5	15	15	5	20	10	20	25	10	5
191	15	5	20	20	10	15	10	15	30	10	5
192	10	15	15	15	10	10	10	10	30	10	15
193	10	15	10	10	15	15	10	5	20	10	15
194	15	10	20	10	5	15	5	10	30	5	10
195	20	5	15	15	5	20	10	5	25	10	5
196	15	5	20	20	10	15	10	5	30	10	5
197	10	15	15	15	10	10	10	15	30	10	15
198	10	15	10	10	15	15	10	15	25	10	15
199	15	10	20	10	5	15	5	10	30	5	10
200	20	5	15	15	5	20	10	10	25	10	5
201	15	5	20	20	10	15	10	5	30	10	5
202	10	15	20	15	10	15	10	5	20	10	15
203	15	15	15	10	10	10	10	15	25	10	15
204	15	10	20	15	15	15	5	15	20	5	10
205	20	10	15	15	5	20	10	10	25	10	10
206	10	10	15	20	10	15	10	10	20	10	10
207	10	15	15	10	10	10	10	15	15	10	15
208	10	15	10	10	15	15	10	15	10	10	15
209	15	5	20	10	10	15	10	10	30	10	5
210	10	15	20	15	10	15	10	15	20	10	15
211	15	15	15	10	10	10	10	10	25	10	15
212	15	10	20	15	15	15	5	15	20	5	10
213	20	10	15	15	5	20	10	15	25	10	10
214	10	10	15	20	10	15	10	20	30	10	10
215	10	15	15	10	10	10	10	10	30	10	15
216	10	15	10	10	15	15	10	10	25	10	15
217	15	5	20	10	10	15	10	10	30	10	5
218	10	15	15	15	10	10	10	15	30	10	15
219	10	15	10	10	15	15	10	10	25	10	15
220	15	10	20	10	5	15	5	5	30	5	10
221	20	5	15	15	5	20	10	5	25	10	5
222	15	5	20	20	10	15	10	10	30	10	5
223	10	15	20	15	10	15	10	10	20	10	15
224	15	15	15	10	10	10	10	10	25	10	15
225	15	10	20	15	15	15	5	15	20	5	10

226	20	10	15	15	5	20	10	5	25	10	10
227	10	10	15	20	10	15	10	10	30	10	10
228	10	15	15	10	10	10	10	10	30	10	15
229	10	15	10	10	15	15	10	10	25	10	15
230	15	5	20	10	10	15	10	10	30	10	5
231	10	15	20	15	10	15	10	15	20	10	15
232	15	15	15	10	10	10	10	10	25	10	15
233	10	15	20	15	10	15	10	15	20	10	15
234	15	15	15	10	10	10	10	10	25	10	15
235	15	10	20	15	15	15	5	15	20	5	10
236	20	10	15	15	5	20	10	15	25	10	10
237	10	10	15	20	10	15	10	20	30	10	10
238	10	15	15	10	10	10	10	10	30	10	15
239	10	15	10	10	15	15	10	10	25	10	15
240	15	10	20	10	5	15	5	10	30	5	10
241	20	5	15	15	5	20	10	15	25	10	5

Source: Field Survey.

Table 4.11 above shows the data obtained from field survey indicating each of the respondents rating of the influences of the identified decision factors on Firms decision to locate operational offices in Seaport Zones/Maritime Clusters in Nigeria. This data was used to determine the determinant decision factors that influence most, a firm's decision to locate offices and operational bases in seaport-based maritime clusters in Nigeria. As already explained in chapter three of this work, about eleven(11) factors were identified from literature sources to influence firms decision to join or locate its base in maritime zone which include: Reduced labour cost and access to professional workers (RLC), Favourable government policy (GFpolicy), Access to Transport and logistics services and production cost optimization (TPCO), availability of adequate port site and operational space (APS), Ease of administration and coordination of business divisions (EAC), Economies of scale and infrastructure condition (EIC), achieving higher service/product demand conditions (HDC), Guaranteed security (GS), availability of supporting and related industries-cooperation (SIC) and Reduced Tax burden experiences-tax exemption, etc. Table4.1 was analyzed using the factor analysis methods and the SPSS software, in order to address the first objective of the study.

4.2 Results and Discussion of Findings

The results from the analysis carried out to actualize the objectives of the research are presented and findings discussed in this section. The results are organized under different sections in line with the objectives and hypotheses of the study as follows:

Table4.12: Determinant Maritime Business Components influencing Maritime Clusters Development in Nigeria

	Mean	Std. Deviation	Analysis N
GDPOILGAS	6523082.3333	4122516.22354	21
GDMARITIME	5378.5714	2781.78052	21
GDPFISHER	378034.7619	405989.50246	21
GDINSURANCE	16152.2467	7661.05878	21
GDPPORTLOG	3883.2381	732.56521	21
GDPMRTHAULAGE	15513.3333	7684.21130	21
GDPMARINETOURISM	75822.3810	861938.14529	21

Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.904	84.346	84.346	5.904	84.346	84.346
2	.556	7.948	92.294			
3	.318	4.542	96.836			
4	.105	1.502	98.338			
5	.092	1.312	99.651			
6	.020	.284	99.935			
7	.005	.065	100.000			

Source: Authors calculation. Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Table 4.12 shows the results of the principal component factor analysis (PCA) conducted to determine the Determinant Maritime Business Components influencing Maritime Clusters Development in Nigeria. The results of the study, as shown in Table 4.12, indicate that oil offshore oil and gas business component in Nigeria maritime clusters has a mean contribution of about 6523082.333billion naira over the period while the maritime transport business component has a mean Gross Domestic Product (GDP) contribution of about 5378.5714billion naira with standard deviation of 2781.78052.

The fishery, marine insurance and port logistics business components of the maritime clusters each has mean output contributions of 378034.7619billion naira, 16152.24 billion naira and 3883.238 billion naira with respective standard deviations of 405989.50, 7661.058, and 732.565. the maritime haulage

and marine tourism business components have mean output contributions of 15513.33billion naira and 75822.38billion naira respectively with respective standard deviations of 7684.21 and 861938.14.

The results of the PCA further reveal that the determinant Maritime Business Components influencing Maritime Clusters Development in Nigeria the most is the offshore oil and gas operations which has Eigen values of 5.904 and is responsible for about 84.346% of the outputs of the maritime sector in Nigeria. Since the offshore oil and gas business component of the maritime clusters have Eigen value greater than one (5.904> 1), we assert that it is the determinant Maritime Business Components influencing Maritime Clusters Development in Nigeria. The implementation is that there is urgent need for investment in the other sub-sectors of the maritime sector such as marine transportation, marine tourism, marine insurance, fishery, etc business component, in order to get them to product acceptable higher levels of output that can measure equal to that of the offshore oil and gas business component. The result further indicate the under-development consequently, poor performance of the other maritime cluster business components, when compared with the offshore oil and gas sub-sector

Table4.13: Effects of Maritime Clusters development on Export shipping Trade Capacity of the South-East Hinterland Regions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.909[a]	.826	.671	.45794	2.951

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.933	8	1.117	5.325	.011[b]
	Residual	1.887	9	.210		
	Total	10.820	17			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.952	32.105		.123	.905
	LOGGDPMRT	-.115	1.562	-.070	-.074	.943
	LOGSHPTR	1.914	2.749	.223	.696	.504
	LOGGDPFISHR	1.328	.559	1.366	2.374	.042
	LOGGDPOILGAS	-1.224	.589	-.942	-2.078	.067
	LOGINSURANCE	1.768	1.261	.907	1.402	.194
	LOGPOREV	.987	2.827	.217	.349	.735
	LOGFREIGHTHAUL	-3.595	1.440	-1.987	-2.496	.034
	LOGTOURISM	.431	.605	.742	.712	.494

a. Dependent Variable: LOGSE

Table4.13 examined the effects of maritime cluster development on the development of the export shipping trade capacity of the South-east hinterland regions in Nigeria. The result of the study shows a coefficient of determination of 0.909, which indicates the existence of strong positive correlation between export shipping trade capacity of the south-east hinterland region and the performance of maritime cluster business components measured by the GDP of the maritime transport sector, the GDP of the fishery sector, the ship traffic calls to the clusters, the GDP of the offshore oil and gas sector, and GDP of the marine insurance business component, the port revenue generated, the GDP of marine haulage (road freight) sector and the GDP contribution of the marine tourism sector.

The equation showing the influence of maritime cluster on the development on the export shipping capacity of the South-east hinterland region is:

LogSEXP = 3.952 – 0.115LogGDPMRT +1.914LogSHPTR + 1.328LogGDPFISHR - 1.224LogGDPOILGAS + 1.768LogINSURANCE + 0.987LogPOREV –3.595LogFREIGHTHAUL + 0.431LogTOURISM + e

This implies that a 1% change in the GDP contribution of the maritime transport sector leads to a 0.115% decrease in the export shipping trade from the south-east hinterland region while 1% increase in the ship traffic calls to the port-based maritime clusters leads to a 1.914% increase in the export shipping trade from the south-east hinterland region. Similarly, a 1% increase in GDP performance of the marine fishery business component leads to a 1.328% increase in the tonnage of export shipping trade originating from the south-east hinterland region while a unit percentage increase in GDP contribution of the offshore oil and gas sector leads to a 1.224% decline in the tonnage of export shipping trade from the south-east region. For the marine insurance business component of maritime clusters, a unit percentage increase in the GDP contribution increases the export shipping trade volume from the south-east by 1.768% while a unit change in port revenue increases the export shipping trade volume from the south-east by 0.987%. a 1% increase in the GDP contribution of the marine haulage cluster business component led to a decline of 33.595% in the export shipping trade capacity of the south-east hinterland region while for the marine tourism cluster business component, a 1% increase in

the GDP contribution causes a 0.431% increase in the export shipping trade from the south-east region.

The r-square which measures the explanatory power of the model is 0.826, indicating that about 83% variations in the export shipping trade from the south-east hinterland region, is explained by the performances and GDP contributions of the maritime cluster business components. The significances of the effects of the individual business components of the maritime clusters is examined under the subsequent sections on test of hypotheses below.

Table4.14: Percentage of Shipping Export Trade Originating from Hinterland States in the South-East Regions

State	N	Range	Minimum	Maximum	Sum	Mean	Std.dev.	Percentage%
ANAMBRA	18	3416966.63	125860.27	3542826.90	8315219.58	461956.6433	815646.09642	75.0%
ABIA	18	445994.52	11320.26	457314.78	2828773.45	157154.0806	107948.32546	21.33%
ENUGU	18	117883.88	2723.52	120607.40	693526.12	38529.2289	28456.97451	3.7%

Source: Authors calculation

The result of table4.14 above indicates that the Anambra state hinterland generates about 75% of total export shipping trade from the south-east hinterland over the period covered in the study. Abia state hinterland region generated about 21.33% of the total export trade from the region while the hinterland regions in Enugu state generated about 3.7% of the total export trade from the region to the port-based maritime clusters in Nigeria over the period

Figure 4.3: Distribution of exports from the south-east hinterland states. Prepared by the author

Table4.15: Effects of Maritime Clusters on shipping Import Trade Capacity of the South-East Hinterland Regions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.847[a]	.717	.466	.23668	3.004

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.279	8	.160	2.854	.040[b]
	Residual	.504	9	.056		
	Total	1.783	17			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.948	16.593		.298	.772
	LOGGDPMRT	-.052	.807	-.078	-.065	.950
	LOGSHPTR	2.395	1.421	.686	1.686	.126
	LOGGDPFISHR	.585	.289	1.483	2.025	.074
	LOGGDPOILGAS	-.693	.304	-1.313	-2.275	.049
	LOGINSURANCE	.624	.652	.789	.957	.364
	LOGPORTS	-.470	1.461	-.255	-.322	.755
	LOGFREIGHTHAUL	-1.186	.744	-1.614	-1.592	.146
	LOGTOURISM	.306	.313	1.297	.978	.354

a. Dependent Variable: LOGSE

Table4.15 examined the effects of maritime cluster development on the import shipping trade capacity of the South-east hinterland regions in Nigeria. The result of the study shows a coefficient of determination of 0.847, which indicates the existence of 84% strong positive correlation between import shipping trade capacity of the south-east hinterland region and the performance of maritime cluster business components measured by the GDP of the maritime transport sector, the GDP of the

fishery sector, the ship traffic calls to the clusters, the GDP of the offshore oil and gas sector, and GDP of the marine insurance business component, the port revenue generated, the GDP of marine haulage (road freight) sector and the GDP contribution of the marine tourism sector.

The equation showing the influence of maritime cluster development on the on the import shipping trade capacity of the South-east hinterland region is:

LogSEIMP = 4.948 – 0.052LogGDPMRT +2.395LogSHPTR + 0.585LogGDPFISHR – 0.693LogGDPOILGAS + 0.624LogINSURANCE – 0.470LogPOREV –1.186LogFREIGHTHAUL + 0.306LogTOURISM + e

This implies that a 1% increase in the GDP contribution of the maritime transport sector leads to a 0.52% decrease in the import shipping trade to the south-east hinterland region while 1% increase in the ship traffic calls to the port-based maritime clusters leads to a 2.395% increase in the import shipping trade to the south-east hinterland region. Similarly, a 1% increase in GDP performance of the marine fishery business component leads to a .585% increase in the tonnage of import shipping trade delivered to the south-east hinterland region while a unit percentage increase in GDP contribution of the offshore oil and gas sector leads to a 0.693% decline in the tonnage of import shipping trade delivered to the south-east region. For the marine insurance business component of maritime clusters, a unit percentage increase in the GDP contribution increases the import shipping trade volume to the south-east by 0.624% while a unit change in port revenue decreases the import shipping trade volume to the south-east by 0.470%. A 1% increase in the GDP contribution of the marine haulage business component led to a decline of 1.186% in the import shipping trade capacity of the south-east hinterland region while for the marine tourism cluster business component, a 1% increase in the GDP contribution causes a 0.306% increase in the import shipping trade from the south-east region.

The r-square which measures the explanatory power of the model is 0.717, indicating that about 72% variations in the import shipping trade delivered to the south-east hinterland region from the port-based maritime clusters, is explained by the performances and GDP contributions of the maritime cluster business components. The significances of the effects of the individual business components of the maritime clusters are examined under the section on test of hypotheses below.

Table4.16: Percentage of Shipping Import Trade to Hinterland States in the South-East Regions

State	N	Range	Minimum	Maximum	Sum	Mean	Std.dev.	Percentage%
ABIA	18	14253164.80	3385478.70	17638643.50	97792654.4	5432925.245	3094813.69	59.03%
ANAMBRA	18	5782191.20	1998615.20	7780806.40	57507829	3194879.412	1233315.60	34.72%
ENUGU	18	1038827.96	139574.98	1178402.94	5220705.19	290039.1772	228341.907	3.15%
IMO	18	1440963.60	175628.40	1616592.00	5134394.60	285244.1444	332763.383	3.09%

Source: Authors calculation

The result of table4.16 above indicates that the Abia state hinterland receives about 59.03% of total import shipping trade delivered to the south-east hinterland over the period covered in the study. Anambra state hinterland region received about 34.72% of the total import trade from the region while the hinterland regions in Enugu and Imo states received about 3.15% and 3.09% of the total import trade to the region, from the port-based maritime clusters in Nigeria over the period

Table4.17: Effects of Maritime Clusters on Export shipping Trade Capacity of the South-South Hinterland Regions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.962[a]	.925	.858	.29665	2.799

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.749	8	1.219	13.848	.000[b]
	Residual	.792	9	.088		
	Total	10.541	17			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.472	20.797		.023	.982
	LOGGDPMRT	.207	1.012	.127	.205	.842
	LOGSHPTR	4.602	1.781	.542	2.585	.029
	LOGGDPFISHR	2.275	.362	2.371	6.277	.000
	LOGGDPOILGAS	-1.269	.381	-.990	-3.328	.009
	LOGINSURANCE	.981	.817	.510	1.201	.260
	LOGPORTS	-3.309	1.831	-.738	-1.807	.104
	LOGFREIGHTHAUL	-1.828	.933	-1.024	-1.959	.082
	LOGTOURISM	.133	.392	.232	.340	.742

a. Dependent Variable: LOGSS

Table4.17 examined the effects of maritime cluster development on the development of the export shipping trade capacity of the South-south hinterland regions in Nigeria. The result of the study shows a coefficient of determination of 0.962, which indicates the existence of 96% strong positive correlation between export shipping trade capacity of the south-south hinterland region and the performance of maritime cluster business components measured by the GDP of the maritime transport sector, the GDP of the fishery sector, the ship traffic calls to the clusters, the GDP of the offshore oil and gas sector, and GDP of the marine insurance business component, the port revenue generated, the GDP of marine haulage (road freight) sector and the GDP contribution of the marine tourism sector between 2003 and 2020.

The equation showing the influence of maritime cluster on the on the development of the export shipping trade capacity of the South-south hinterland region is:

LogSSEXP = 0.472 + 0.207LogGDPMRT +4.602LogSHPTR + 2.275LogGDPFISHR – 1.269LogGDPOILGAS + 0.981LogINSURANCE – 3.309LogPOREV – 1.828LogFREIGHTHAUL + 0.133LogTOURISM + e

This implies that a 1% increase in the GDP contribution of the maritime transport sector leads to a 0.207% increase in the export shipping trade from the south-south hinterland region while 1% increase in the ship traffic calls to the port-based maritime clusters leads to a 4.602% increase in the export shipping trade from the south-south hinterland region. Similarly, a 1% increase in GDP performance of the marine fishery business component leads to a 2.275% increase in the tonnage of export shipping trade generated from the south-south hinterland region while a unit percentage increase in GDP contribution of the offshore oil and gas sector leads to a 1.269% decline in the tonnage of export shipping trade from the south-south region. For the marine insurance business component of maritime clusters, a unit percentage increase in the GDP contribution increases the export shipping trade volume from the south-south by 0.981% while a unit change in port revenue decreases the export shipping trade volume from the south-south by 3.309%. A 1% increase in the GDP contribution of the marine haulage business component led to a decline of 1.828% in the export shipping trade capacity of the south-south hinterland region while for the marine tourism cluster business component, a 1% increase

in the GDP contribution causes a 0.133% increase in the export shipping trade from the south-south region.

The r-square which measures the explanatory power of the model is 0.925, indicating that about 93% variations in the export shipping trade generated from the south-south hinterland region to the port-based maritime clusters, is explained by the performances and GDP contributions of the maritime cluster business components. The significances of the effects of the individual business components of the maritime clusters are examined under the section on test of hypotheses below.

Table4.18: Percentage of Shipping Export Trade Originating from Hinterland States in the South-South Regions

State	N	Range	Minimum	Maximum	Sum	Mean	Std.dev.	Percentage%
RIVERS	18	155817273.70	3272496.30	159089770.00	261068709.30	14503817.1833	36131762.05656	79.9%
AKWAIBOM	18	67750.50	1215.30	68965.80	451811.74	25100.6522	16774.84482	0.14%
DELTA	18	8568148.90	852564.44	9420713.34	61224494.44	3401360.8022	2742299.10267	18.8%
EDO	18	429058.14	49714.68	478772.82	3679222.83	204401.2683	120696.31245	1.13%
CROSSRIVER	18	59702.64	1202.92	60905.56	506079.40	28115.5222	16924.07422	0.03%

Source: Authors calculation

The result on table4.18 indicates that the hinterland regions of Rivers State generate about 79.9% of total exports from the south-south region to the seaports. This is followed by Delta state with about 18.8% of total exports generated and Edo state which generates about 1.13%.

Table4.19: Effects of Maritime Clusters Development on shipping Import Trade Capacity of the South-South Hinterland Regions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.954[a]	.909	.828	.19157	2.808

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.307	8	.413	11.265	.001[b]
	Residual	.330	9	.037		
	Total	3.637	17			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9.728	13.430		.724	.487
	LOGGDPMRT	.201	.653	.210	.308	.765
	LOGSHPTR	2.508	1.150	.503	2.181	.057
	LOGGDPFISHR	1.222	.234	2.168	5.222	.001
	LOGGDPOILGAS	-.754	.246	-1.001	-3.059	.014
	LOGINSURANCE	.558	.528	.494	1.059	.317
	LOGPORTS	-1.797	1.183	-.682	-1.519	.163
	LOGFREIGHTHAUL	-1.204	.603	-1.148	-1.998	.077
	LOGTOURISM	.154	.253	.458	.610	.557

a. Dependent Variable: LOGSS

Table4.19 examined the effects of maritime cluster development on the import shipping trade capacity of the South-SOUTH hinterland regions in Nigeria. The result of the study shows a coefficient of determination of 0.954, which indicates the existence of 95% strong positive correlation between import shipping trade capacity of the south-south hinterland region and the performance of maritime cluster business components measured by the GDP of the maritime transport sector, the GDP of the fishery sector, the ship traffic calls to the clusters, the GDP of the offshore oil and gas sector, and GDP of the marine insurance business component, the port revenue generated, the GDP of marine haulage (road freight) sector and the GDP contribution of the marine tourism sector.

The equation showing the influence of maritime cluster development on the import shipping trade capacity of the South-south hinterland region is:

LogSEIMP = 9.728 + 0.201LogGDPMRT +2.508LogSHPTR + 1.222LogGDPFISHR – 0.754LogGDPOILGAS + 0.558LogINSURANCE – 1.797LogPOREV –1.204LogFREIGHTHAUL + 0.154LogTOURISM + e

This implies that a 1% increase in the GDP contribution of the maritime transport sector leads to a 0.201% increase in the import shipping trade to the south-south hinterland region while 1% increase in the ship traffic calls to the port-based maritime clusters leads to a 2.508% increase in the import shipping trade to the south-south hinterland region. Similarly, a 1% increase in GDP performance of the marine fishery business component leads to a 1.222% increase in the tonnage of import shipping trade delivered to the south-south hinterland region while a unit percentage increase in GDP contribution of the offshore oil and gas sector leads to a 0.754% decline in the tonnage of import

shipping trade delivered to the south-south region. For the marine insurance business component of maritime clusters, a unit percentage increase in the GDP contribution increases the import shipping trade volume to the south-south by 0.558% while a unit change in port revenue decreases the import shipping trade volume to the south-south by 1.797%. A 1% increase in the GDP contribution of the marine haulage business component led to a decline of 1.204% in the import shipping trade capacity of the south-south hinterland region while for the marine tourism cluster business component, a 1% increase in the GDP contribution causes a 0.154% increase in the import shipping trade delivered to the south-south region.

The r-square which measures the explanatory power of the model is 0.909, indicating that about 91% variations in the import shipping trade delivered to the south-south hinterland region from the port-based maritime clusters, is explained by the performances and GDP contributions of the maritime cluster business components. The significances of the effects of the individual business components of the maritime clusters are examined under the section on test of hypotheses below.

Table4.20: Percentage of Shipping Import Trade to Hinterland States in the South-South Regions

State	N	Range	Minimum	Maximum	Sum	Mean	Std.dev.	Percentage%
AKWAIBOM	18	3214797.20	672784.30	3887581.50	18125294.70	1006960.8167	735014.90687	2.97%
BAYELSA	18	2913596.20	355116.80	3268713.00	10381632.50	576757.3611	672840.13231	1.7%
CROSSRIVER	18	1694631.90	538009.10	2232641.00	15899080.90	883282.2722	393660.92781	2.6%
DELTA	18	7744132.87	774420.83	8518553.70	54830158.24	3046119.9022	2452255.00524	8.98%
RIVERS	18	126152705.90	16475340.60	142628046.50	506032241.00	28112902.2778	28693216.49918	82.89%
EDO	18	733390.66	72975.24	806365.90	5240509.92	291139.4400	234727.06777	0.86%

Source: Authors calculation

The result of table4.19 above indicates that the River state hinterlands receives about 82.89% of total import shipping trade delivered to the south-south hinterland regions over the period covered in the study. This is followed by Delta state which received about 8.98% of total import trade to the region from the port-based maritime clusters over the period. Akwa-Ibom, Cross-River, Bayelsa and Edo

states received 2.9%, 2.6%, 1.7% and o.86% of import trade delivered to the south-south hinterland regions over the period.

Table4.21: Effects of Maritime Clusters on Export shipping Trade Capacity of the South-West Hinterland Regions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.872[a]	.760	.547	.57810	2.965

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.544	8	1.193	3.570	.038[b]
	Residual	3.008	9	.334		
	Total	12.552	17			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.218	40.529		.129	.900
	LOGGDPMRT	-.477	1.972	-.268	-.242	.814
	LOGSHPTR	-.981	3.470	-.106	-.283	.784
	LOGGDPFISHR	.659	.706	.630	.933	.375
	LOGGDPOILGAS	-.873	.743	-.624	-1.174	.270
	LOGINSURANCE	1.548	1.592	.738	.972	.356
	LOGPORTS	3.237	3.569	.661	.907	.388
	LOGFREIGHTHAUL	-1.964	1.818	-1.008	-1.080	.308
	LOGTOURISM	.259	.764	.413	.338	.743

a. Dependent Variable: LOGSW

Table4.21 examined the effects of maritime cluster on the development of the export shipping trade capacity of the South-west hinterland regions in Nigeria. The result of the study shows a coefficient of determination of 0.872, which indicates the existence of 87% strong positive correlation between export shipping trade capacity of the south-west hinterland region and the performance of maritime cluster business components measured by the GDP of the maritime transport sector, the GDP of the fishery sector, the ship traffic calls to the clusters, the GDP of the offshore oil and gas sector, and GDP of the marine insurance business component, the port revenue generated, the GDP of marine haulage (road freight) sector and the GDP contribution of the marine tourism sector between 2003 and 2020. The equation showing the influence of maritime cluster on the on the development of the export shipping trade capacity of the South-west hinterland region is:

LogSWEXP = 5.218 - 0.477LogGDPMRT - 0.981LogSHPTR + 0.659LogGDPFISHR – 0.873LogGDPOILGAS + 1.547LogINSURANCE + 3.237LogPOREV – 1.964LogFREIGHTHAUL + 0.260LogTOURISM + e

This implies that a 1% increase in the GDP contribution of the maritime transport sector leads to a 0.479% decrease in the export shipping trade from the south-west hinterland region while 1% increase in the ship traffic calls to the port-based maritime clusters leads to a 0.982 decline in the export shipping trade from the south-west hinterland region. Similarly, a 1% increase in GDP performance of the marine fishery business component leads to a 0.659% increase in the tonnage of export shipping trade generated from the south-west hinterland region while a unit percentage increase in GDP contribution of the offshore oil and gas sector leads to a 0.873% decline in the tonnage of export shipping trade from the south-west region. For the marine insurance business component of maritime clusters, a unit percentage increase in the GDP contribution increases the export shipping trade volume from the south-west by 1.547% while a unit change in port revenue increases the export shipping trade volume from the south-west by3.2%. A 1% increase in the GDP contribution of the marine haulage business component led to a decline of 1.964% in the export shipping trade capacity of the south-west hinterland region while for the marine tourism cluster business component, a 1% increase in the GDP contribution causes a 0.260% increase in the export shipping trade from the south-west region.

The r-square which measures the explanatory power of the model is 0.761, indicating that about 76% variations in the export shipping trade generated from the south-west hinterland region to the port-based maritime clusters, is explained by the performances and GDP contributions of the maritime cluster business components. The significances of the effects of the individual business components of the maritime clusters are examined under the section on test of hypotheses below.

Table4.22: Percentage of Shipping Export Trade Originating from Hinterland States in the South-West Regions

State	N	Range	Minimum	Maximum	Sum	Mean	Std.dev.	Percentage%
LAGOS	18	4519375.30	335669.70	4855045.00	20483457.70	1137969.8722	1298631.70711	77.02%
OGUN	18	1174106.10	87204.90	1261311.00	5298986.36	294388.1311	336751.35224	19.92%
OYO	18	178600.70	13265.30	191866.00	809483.69	44971.3161	51320.49307	3.05%

Source: Authors calculation

The result on table4.22 indicates that the hinterland regions of Lagos State generate about 79.02% of total exports from the south-west region to the seaports. This is followed by Ogun state with about 19.92% of total exports generated in the south-west region and Oyo state which generates about 3.05% of the total export trade of the region.

Table4.23: Effects of Maritime Clusters on shipping Import Trade Capacity of the South-West Hinterland Regions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.765[a]	.586	.217	.66827	3.222

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.679	8	.710	1.590	.252[b]
	Residual	4.019	9	.447		
	Total	9.698	17			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-28.725	46.851		-.613	.555
	LOGGDPMRT	1.229	2.279	.786	.539	.603
	LOGSHPTR	4.559	4.011	.560	1.137	.285
	LOGGDPFISHR	-1.599	.816	-1.738	-1.959	.082
	LOGGDPOILGAS	-.299	.859	-.243	-.348	.736
	LOGINSURANCE	.484	1.840	.263	.263	.798
	LOGPORTS	2.923	4.126	.679	.708	.497
	LOGFREIGHTHAUL	-1.362	2.102	-.795	-.648	.533
	LOGTOURISM	.386	.883	.702	.437	.672

a. Dependent Variable: LOGSW

Table4.23 examined the effects of maritime cluster development on the import shipping trade capacity of the South-west hinterland regions in Nigeria. The result of the study shows a coefficient of determination of 0.765, which indicates the existence of 76% strong positive correlation between import shipping trade capacity of the south-west hinterland region and the performance of maritime cluster business components measured by the GDP of the maritime transport sector, the GDP of the fishery sector, the ship traffic calls to the clusters, the GDP of the offshore oil and gas sector, and GDP of the marine insurance business component, the port revenue generated, the GDP of marine haulage (road freight) sector and the GDP contribution of the marine tourism sector.

The equation showing the influence of maritime cluster development on the import shipping trade capacity of the South-west hinterland region is:

LogSEIMP = -28.725 + 1.229LogGDPMRT +4.559LogSHPTR – 1.559LogGDPFISHR – 0.299LogGDPOILGAS + 0.484LogINSURANCE+ 2.923LogPOREV –1.362LogFREIGHTHAUL + 0.386LogTOURISM + e

This implies that a 1% increase in the GDP contribution of the maritime transport sector leads to a 1.229% increase in the import shipping trade to the south-west hinterland region while 1% increase in the ship traffic calls to the port-based maritime clusters leads to a 4.559% increase in the import shipping trade to the south-west hinterland region. Similarly, a 1% increase in GDP performance of the marine fishery business component leads to a 1.559% decrease in the tonnage of import shipping trade delivered to the south-west hinterland region while a unit percentage increase in GDP contribution of the offshore oil and gas sector leads to a 0.299% decline in the tonnage of import shipping trade delivered to the south-west region. For the marine insurance business component of maritime clusters, a unit percentage increase in the GDP contribution increases the import shipping trade volume to the south-west by 0.484% while a unit change in port revenue increases the import shipping trade volume to the south-south by 2.923%. A 1% increase in the GDP contribution of the marine haulage business component led to a decline of 1.362% in the import shipping trade capacity of the south-west hinterland region while for the marine tourism cluster business component, a 1% increase in the GDP contribution causes a 0.386% increase in the import shipping trade delivered to the south-west region.

The r-square which measures the explanatory power of the model is 0.586, indicating that about 59% variations in the import shipping trade delivered to the south-west hinterland region from the port-based maritime clusters, is explained by the performances and GDP contributions of the maritime cluster business components. The significances of the effects of the individual business components of the maritime clusters are examined under the section on test of hypotheses below.

Table4.23: Percentage of Shipping Import Trade to Hinterland States in the South-West Regions

State	N	Range	Minimum	Maximum	Sum	Mean	Std.dev.	Percentage%
LAGOS	18	9293045.70	655702.10	9948747.80	141153535.60	7841863.0889	2253287.41667	62.98%
OYO	18	2099998.00	2938710.00	5038708.00	75876613.00	4215367.3889	550047.19940	33.85
OGUN	18	474782.00	664404.00	1139186.00	17213843.90	956324.6611	124259.19096	3.16%

Source: Authors calculation

The result of table4.23 above indicates that the Lagos state hinterlands receives about 62.98% of total import shipping trade delivered to the south-west hinterland regions over the period covered in the study. This is followed by Oyo state which received about 33.85% of total import trade to the region from the port-based maritime clusters over the period. Ogun States received 3.16%, of import trade delivered to the south-west hinterland regions over the period.

Table4.24: Effects of Maritime Clusters on Export shipping Trade Capacity of the North-West Hinterland Regions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.872[a]	.761	.548	.57755	2.965

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.546	8	1.193	3.577	.037[b]
	Residual	3.002	9	.334		
	Total	12.548	17			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.318	40.491		.082	.936
	LOGGDPMRT	-.479	1.970	-.270	-.243	.813
	LOGSHPTR	-.982	3.467	-.106	-.283	.783
	LOGGDPFISHR	.659	.706	.629	.933	.375
	LOGGDPOILGAS	-.873	.743	-.624	-1.175	.270
	LOGINSURANCE	1.547	1.591	.738	.973	.356
	LOGPORTS	3.239	3.566	.662	.908	.387
	LOGFREIGHTHAUL	-1.964	1.817	-1.008	-1.081	.308
	LOGTOURISM	.260	.763	.415	.340	.742

a. Dependent Variable: LOGNW

Table4.24 examined the effects of maritime cluster on the development of the export shipping trade capacity of the North-west hinterland regions in Nigeria. The result of the study shows a coefficient of determination of 0.872, which indicates the existence of 87% strong positive correlation between

export shipping trade capacity of the North-west hinterland region and the performance of maritime cluster business components measured by the GDP of the maritime transport sector, the GDP of the fishery sector, the ship traffic calls to the clusters, the GDP of the offshore oil and gas sector, and GDP of the marine insurance business component, the port revenue generated, the GDP of marine haulage (road freight) sector and the GDP contribution of the marine tourism sector between 2003 and 2020.

The equation showing the influence of maritime cluster on the on the development of the export shipping trade capacity of the North-west hinterland region is:

LogNWEXP = 3.318 - 0.479LogGDPMRT - 0.982LogSHPTR + 0.659LogGDPFISHR – 0.873LogGDPOILGAS + 1.547LogINSURANCE + 3.29LogPOREV – 1.964LogFREIGHTHAUL + 0.260LogTOURISM + e

This implies that a 1% increase in the GDP contribution of the maritime transport sector leads to a 0.479% decrease in the export shipping trade from the North-west hinterland region while 1% increase in the ship traffic calls to the port-based maritime clusters leads to a 0.982 decline in the export shipping trade from the North-west hinterland region. Similarly, a 1% increase in GDP performance of the marine fishery business component leads to a 0.659% increase in the tonnage of export shipping trade generated from the North-west hinterland region while a unit percentage increase in GDP contribution of the offshore oil and gas sector leads to a 0.873% decline in the tonnage of export shipping trade from the North-west region. For the marine insurance business component of maritime clusters, a unit percentage increase in the GDP contribution increases the export shipping trade volume from the North-west by 1.547% while a unit change in port revenue increases the export shipping trade volume from the North-west by 3.2%. A 1% increase in the GDP contribution of the marine haulage business component led to a decline of 1.964% in the export shipping trade capacity of the south-west hinterland region while for the marine tourism cluster business component, a 1% increase in the GDP contribution causes a 0.260% increase in the export shipping trade from the North-west region.

The r-square which measures the explanatory power of the model is 0.761, indicating that about 76% variations in the export shipping trade generated from the North-west hinterland region to the port-

based maritime clusters, is explained by the performances and GDP contributions of the maritime cluster business components. The significances of the effects of the individual business components of the maritime clusters are examined under the section on test of hypotheses below.

Table4.25: Percentage of Shipping Export Trade Originating from Hinterland States in the North-West Regions

State	N	Range	Minimum	Maximum	Sum	Mean	Std.dev.	Percentage%
KANO	18	792055.40	58828.70	850884.10	3589884.23	199438.0128	227595.22895	91.7%
KADUNA	18	77652.49	5767.52	83420.01	351949.43	19552.7461	22313.25817	8.93%

Source: Authors calculation

The result on table4.25 indicates that the hinterland regions of Kano state generate about 91.7% of total exports from the North-west region to the seaports. This is followed by Kaduna state with about 8.93% of total exports generated in the North-west region between 2003 and 2020.

Table4.26: Effects of Maritime Clusters on shipping Import Trade Capacity of the North-West Hinterland Regions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.905[a]	.818	.657	.68218	3.209

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.879	8	2.360	5.071	.013[b]
	Residual	4.188	9	.465		
	Total	23.068	17			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-27.162	47.826		-.568	.584
	LOGGDPMRT	2.224	2.327	.922	.956	.364
	LOGSHPTR	2.465	4.095	.196	.602	.562
	LOGGDPFISHR	-3.192	.833	-2.249	-3.830	.004
	LOGGDPOILGAS	.544	.877	.287	.620	.551
	LOGINSURANCE	.244	1.879	.086	.130	.899
	LOGPORTS	3.825	4.211	.577	.908	.387
	LOGFREIGHTHAUL	-.099	2.146	-.038	-.046	.964
	LOGTOURISM	.012	.902	.014	.013	.990

a. Dependent Variable: LOGNW

Table4.26 examined the effects of maritime cluster development on the import shipping trade capacity of the North-west hinterland regions in Nigeria. The result of the study shows a coefficient of determination of 0.905, which indicates the existence of 91% strong positive correlation between import shipping trade capacity of the North-west hinterland region and the performance of maritime

cluster business components measured by the GDP of the maritime transport sector, the GDP of the fishery sector, the ship traffic calls to the clusters, the GDP of the offshore oil and gas sector, and GDP of the marine insurance business component, the port revenue generated, the GDP of marine haulage (road freight) sector and the GDP contribution of the marine tourism sector.

The equation showing the influence of maritime cluster development on the import shipping trade capacity of the North-west hinterland region is:

LogNWIMP = -27.162 + 2.224LogGDPMRT +2.465LogSHPTR – 3.192LogGDPFISHR + 0.544LogGDPOILGAS + 0.244LogINSURANCE + 3.825LogPOREV –0.099LogFREIGHTHAUL + 0.012LogTOURISM + e

This implies that a 1% increase in the GDP contribution of the maritime transport sector leads to a 2.224% increase in the import shipping trade to the North-west hinterland region while 1% increase in the ship traffic calls to the port-based maritime clusters leads to a 2.465% increase in the import shipping trade to the North-west hinterland region. Similarly, a 1% increase in GDP performance of the marine fishery business component leads to a 3.192% decrease in the tonnage of import shipping trade delivered to the North-west hinterland region while a unit percentage increase in GDP contribution of the offshore oil and gas sector leads to a 0.544% increase in the tonnage of import shipping trade delivered to the North-west region. For the marine insurance business component of maritime clusters, a unit percentage increase in the GDP contribution increases the import shipping trade volume to the south-west by 0.244% while a unit change in port revenue increases the import shipping trade volume to the south-south by 3.825%. A 1% increase in the GDP contribution of the marine haulage business component led to a decline of 0.099% in the import shipping trade capacity of the north-west hinterland region while for the marine tourism cluster business component, a 1% increase in the GDP contribution causes a 0.012% increase in the import shipping trade delivered to the north-west region.

The r-square which measures the explanatory power of the model is 0.818, indicating that about 82% variations in the import shipping trade delivered to the north-west hinterland region from the port-based maritime clusters, is explained by the performances and GDP contributions of the maritime

cluster business components. The significances of the effects of the individual business components of the maritime clusters are examined under the section on test of hypotheses below.

Table4.27: Percentage of Shipping Import Trade to Hinterland States in the North- West Regions

State	N	Range	Minimum	Maximum	Sum	Mean	Std.dev.	Percentage%
KANO	18	2008066.51	57379.73	2065446.24	28025997.08	1556999.8378	588635.42496	82.65%
KADUNA	18	438131.38	88.27	438219.65	5884944.07	326941.3372	127819.68953	17.35%

Source: Authors calculation

The result of table4.27 above indicates that the Kano state hinterlands receives about 82.65% of total import shipping trade delivered to the north-west hinterland regions over the period covered in the study. This is followed by Kaduna state which received about 17.35%of total import trade to the region from the port-based maritime clusters over the period.

Table4.28: Effects of Maritime Clusters on Export shipping Trade Capacity of the North-Central Hinterland Regions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.872[a]	.761	.548	.57755	2.965

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.546	8	1.193	3.577	.037[b]
	Residual	3.002	9	.334		
	Total	12.548	17			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.119	40.491		-.003	.998
	LOGGDPMRT	-.479	1.970	-.270	-.243	.813
	LOGSHPTR	-.982	3.467	-.106	-.283	.783
	LOGGDPFISHR	.659	.706	.629	.933	.375
	LOGGDPOILGAS	-.873	.743	-.624	-1.175	.270
	LOGINSURANCE	1.547	1.591	.738	.973	.356
	LOGPORTS	3.239	3.566	.662	.908	.387
	LOGFREIGHTHAUL	-1.964	1.817	-1.008	-1.081	.308
	LOGTOURISM	.260	.763	.415	.340	.742

a. Dependent Variable: LOGNC

Table4.28 examined the effects of maritime cluster on the development of the export shipping trade capacity of the North-central hinterland regions in Nigeria. The result of the study shows a coefficient of determination of 0.872, which indicates the existence of 87% strong positive correlation between

export shipping trade capacity of the North-central hinterland region and the performance of maritime cluster business components measured by the GDP of the maritime transport sector, the GDP of the fishery sector, the ship traffic calls to the clusters, the GDP of the offshore oil and gas sector, and GDP of the marine insurance business component, the port revenue generated, the GDP of marine haulage (road freight) sector and the GDP contribution of the marine tourism sector between 2003 and 2020.

The equation showing the influence of maritime cluster on the on the development of the export shipping trade capacity of the North-central hinterland region is:

LogNWEXP = -0.119 - 0.479LogGDPMRT - 0.982LogSHPTR + 0.659LogGDPFISHR – 0.873LogGDPOILGAS + 1.547LogINSURANCE + 3.239LogPOREV – 1.964LogFREIGHTHAUL + 0.260LogTOURISM + e

This implies that a 1% increase in the GDP contribution of the maritime transport sector leads to a 0.479% decrease in the export shipping trade from the North-central t hinterland region while 1% increase in the ship traffic calls to the port-based maritime clusters leads to a 0.982 decline in the export shipping trade from the North-central hinterland region. Similarly, a 1% increase in GDP performance of the marine fishery business component leads to a 0.659% increase in the tonnage of export shipping trade generated from the North-central hinterland region while a unit percentage increase in GDP contribution of the offshore oil and gas sector leads to a 0.873% decline in the tonnage of export shipping trade from the North-central region. For the marine insurance business component of maritime clusters, a unit percentage increase in the GDP contribution increases the export shipping trade volume from the North-west by 1.547% while a unit change in port revenue increases the export shipping trade volume from the North-central by 3.2%. A 1% increase in the GDP contribution of the marine haulage business component led to a decline of 1.964% in the export shipping trade capacity of the south-central hinterland region while for the marine tourism cluster business component, a 1% increase in the GDP contribution causes a 0.260% increase in the export shipping trade from the North-central region.

The r-square which measures the explanatory power of the model is 0.761, indicating that about 76% variations in the export shipping trade generated from the North-central hinterland region to the port-

based maritime clusters, is explained by the performances and GDP contributions of the maritime cluster business components. The significances of the effects of the individual business components of the maritime clusters are examined under the section on test of hypotheses below.

Table4.29: Percentage of Shipping Export Trade Originating from Hinterland States in the North-Central Regions

State	N	Range	Minimum	Maximum	Sum	Mean	Std.dev.	Percentage %
PLATEAU	18	27954.89	2076.31	30031.20	126701.79	7038.988	8032.77291	100%

The result on table4.25 indicates that the hinterland regions of plateau state generate the 100% total exports from the North-central region to the seaports-based maritime clusters in Nigeria.

Table4.30: Effects of Maritime Clusters on shipping Import Trade Capacity of the North-Central Hinterland Regions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.857[a]	.734	.498	.21068	3.176

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.103	8	.138	3.106	.056[b]
	Residual	.399	9	.044		
	Total	1.502	17			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.943	14.770		.064	.950
	LOGGDPMRT	.553	.719	.899	.770	.461
	LOGSHPTR	.445	1.265	.139	.352	.733
	LOGGDPFISHR	-.867	.257	-2.395	-3.370	.008
	LOGGDPOILGAS	.088	.271	.182	.324	.753
	LOGINSURANCE	.332	.580	.458	.573	.581
	LOGPORTS	1.033	1.301	.610	.794	.448
	LOGFREIGHTHAUL	-.020	.663	-.030	-.030	.977
	LOGTOURISM	.050	.278	.232	.180	.861

a. Dependent Variable: LOGNC

Table4.30 examined the effects of maritime cluster development on the import shipping trade capacity of the North-central hinterland regions in Nigeria. The result of the study shows a coefficient of determination of 0.857, which indicates the existence of 86% strong positive correlation between import shipping trade capacity of the North-central hinterland region and the performance of maritime cluster business components measured by the GDP of the maritime transport sector, the GDP of the fishery sector, the ship traffic calls to the clusters, the GDP of the offshore oil and gas sector, and GDP

of the marine insurance business component, the port revenue generated, the GDP of marine haulage (road freight) sector and the GDP contribution of the marine tourism sector.

The equation showing the influence of maritime cluster development on the import shipping trade capacity of the North-central hinterland region is:

LogNWIMP = 0.943 + 0.553LogGDPMRT +0.445LogSHPTR – 0.867LogGDPFISHR + 0.088LogGDPOILGAS + 0.332LogINSURANCE + 1.033LogPOREV –0.020LogFREIGHTHAUL + 0.050LogTOURISM + e

This implies that a 1% increase in the GDP contribution of the maritime transport sector leads to a 0.553% increase in the import shipping trade to the North-central hinterland region while 1% increase in the ship traffic calls to the port-based maritime clusters leads to a 0.445% increase in the import shipping trade to the North-central hinterland region. Similarly, a 1% increase in GDP performance of the marine fishery business component leads to a 0.876% decrease in the tonnage of import shipping trade delivered to the North-central hinterland region while a unit percentage increase in GDP contribution of the offshore oil and gas sector leads to a 0.088% increase in the tonnage of import shipping trade delivered to the North-central t region. For the marine insurance business component of maritime clusters, a unit percentage increase in the GDP contribution increases the import shipping trade volume to the nortth-central by 0.332% while a unit change in port revenue increases the import shipping trade volume to the south-central by 1.033%. A 1% increase in the GDP contribution of the marine haulage business component led to a decline of 0.020% in the import shipping trade capacity of the north-central t hinterland region while for the marine tourism cluster business component, a 1% increase in the GDP contribution causes a 0.050% increase in the import shipping trade delivered to the north-central region.

The r-square which measures the explanatory power of the model is 0.734, indicating that about 82% variations in the import shipping trade delivered to the north-central hinterland region from the port-based maritime clusters, is explained by the performances and GDP contributions of the maritime cluster business components. The significances of the effects of the individual business components of the maritime clusters are examined under the section on test of hypotheses below.

Table4.31: Percentage of Shipping Import Trade to Hinterland States in the North- Central Regions

State	N	Range	Minimum	Maximum	Sum	Mean	Std.dev.	Percentage%
PLATEAU	18	146240.35	87435.78	233676.13	3382511.64	187917.3133	44843.74590	100%

The result of table4.31 above indicates that the plateau state hinterlands receives about 100%of total import shipping trade delivered to the north-central hinterland regions over the period covered in the study between 2003 and 2020.

Table4.32: Effects of Maritime Clusters on shipping Import Trade Capacity of the North-East Hinterland Regions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.805[a]	.647	.334	.13368	2.847

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.295	8	.037	2.065	.150[b]
	Residual	.161	9	.018		
	Total	.456	17			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	14.788	9.372		1.578	.149
	LOGGDPMRT	-.054	.456	-.159	-.118	.908
	LOGSHPTR	-.577	.802	-.327	-.720	.490
	LOGGDPFISHR	-.404	.163	-2.026	-2.476	.035
	LOGGDPOILGAS	-.084	.172	-.317	-.491	.635
	LOGINSURANCE	.740	.368	1.851	2.010	.075
	LOGPORTS	-.034	.825	-.037	-.042	.968
	LOGFREIGHTHAUL	.040	.421	.107	.094	.927
	LOGTOURISM	.082	.177	.685	.463	.655

a. Dependent Variable: LOGNE

Table4.30 examined the effects of maritime cluster development on the import shipping trade capacity of the North-east hinterland regions in Nigeria. The result of the study shows a coefficient of determination of 0.805, which indicates the existence of 81% strong positive correlation between import shipping trade capacity of the North-east hinterland region and the performance of maritime cluster business components measured by the GDP of the maritime transport sector, the GDP of the fishery sector, the ship traffic calls to the clusters, the GDP of the offshore oil and gas sector, and GDP of the marine insurance business component, the port revenue generated, the GDP of marine haulage (road freight) sector and the GDP contribution of the marine tourism sector.

The equation showing the influence of maritime cluster development on the import shipping trade capacity of the North-east hinterland region is:

LogNWIMP = 14.788 - 0.054LogGDPMRT- 0.577LogSHPTR – 0.404LogGDPFISHR + 0.084LogGDPOILGAS + 0.740LogINSURANCE - 0.034LogPOREV + 0.040LogFREIGHTHAUL + 0.082LogTOURISM + e

This implies that a 1% increase in the GDP contribution of the maritime transport sector leads to a 0.054% decrease in the import shipping trade to the North-east hinterland region while 1% increase in the ship traffic calls to the port-based maritime clusters leads to a 0.577% decrease in the import shipping trade to the North-east hinterland region. Similarly, a 1% increase in GDP performance of the marine fishery business component leads to a 0.404% decrease in the tonnage of import shipping trade delivered to the North-east hinterland region while a unit percentage increase in GDP contribution of the offshore oil and gas sector leads to a 0.084% increase in the tonnage of import shipping trade delivered to the North-east t region. For the marine insurance business component of maritime clusters, a unit percentage increase in the GDP contribution increases the import shipping trade volume to the north-east by 0.740% while a unit change in port revenue decreases the import shipping trade volume to the south-east by 0.034%. A 1% increase in the GDP contribution of the marine haulage business component led to a increase of 0.040% in the import shipping trade capacity of the north-east hinterland region while for the marine tourism cluster business component, a 1% increase in the GDP contribution causes a 0.082% increase in the import shipping trade delivered to the north-east region.

The r-square which measures the explanatory power of the model is 0.647, indicating that about 65% variations in the import shipping trade delivered to the north-east hinterland region from the port-based maritime clusters, is explained by the performances and GDP contributions of the maritime cluster business components. The significances of the effects of the individual business components of the maritime clusters are examined under the section on test of hypotheses below.

Table4.33: Percentage of Shipping Import Trade to Hinterland States in the North-East Regions

State	N	Range	Minimum	Maximum	Sum	Mean	Std.dev.	Percentage%
BAUCHI	18	45652.10	63885.00	109537.10	1611991.44	89555.0800	13755.06125	100%

Source: Authors calculation

The result of the study on table4.35 indicates the 100% of the total import shipping trade delivered to the north-east hinterlands over the period went to Bauchi state.

Table4.34: Effects of Maritime Clusters on shipping Import Trade Capacity of the Abuja Hinterland Regions

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.583[a]	.340	-.247	.53709	3.252

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.337	8	.167	.579	.773[b]
	Residual	2.596	9	.288		
	Total	3.933	17			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-14.895	37.655		-.396	.702
	LOGGDPMRT	-.833	1.832	-.837	-.455	.660
	LOGSHPTR	2.415	3.224	.466	.749	.473
	LOGGDPFISHR	1.054	.656	1.799	1.607	.142
	LOGGDPOILGAS	.202	.691	.258	.292	.777
	LOGINSURANCE	-1.326	1.479	-1.129	-.896	.393
	LOGPORTS	1.172	3.316	.428	.353	.732
	LOGFREIGHTHAUL	.371	1.690	.340	.219	.831
	LOGTOURISM	-.246	.710	-.704	-.347	.736

a. Dependent Variable: LOGABI

Table4.34 examined the effects of maritime cluster development on the import shipping trade capacity of the federal Capita Territory (FCT) Abuja. The result of the study shows a coefficient of determination of 0.583, which indicates the existence of 58% weak positive correlation between import shipping trade capacity of the FCT hinterland and the performance of maritime cluster business components measured by the GDP of the maritime transport sector, the GDP of the fishery sector, the ship traffic calls to the clusters, the GDP of the offshore oil and gas sector, and GDP of the marine insurance business component, the port revenue generated, the GDP of marine haulage (road freight) sector and the GDP contribution of the marine tourism sector.

The equation showing the influence of maritime cluster development on the import shipping trade capacity of the TCT Abuja hinterland region is:

LogNWIMP = -14.895 -0.833LogGDPMRT - 2.415LogSHPTR + 1.054LogGDPFISHR + 0.202LogGDPOILGAS – 1.326LogINSURANCE + 1.172LogPOREV +0.371LogFREIGHTHAUL - 0.246LogTOURISM + e

This implies that a 1% increase in the GDP contribution of the maritime transport sector leads to a 0.833% decrease in the import shipping trade to the FCT Abuja hinterland while 1% increase in the ship traffic calls to the port-based maritime clusters leads to a 2.415% decrease in the import shipping trade to the FCT Abuja hinterland. Similarly, a 1% increase in GDP performance of the marine fishery business component leads to a 1.045% increase in the tonnage of import shipping trade delivered to the Abuja hinterland while a unit percentage increase in GDP contribution of the offshore oil and gas sector leads to a 0.202% increase in the tonnage of import shipping trade delivered to Abuja. For the marine insurance business component of maritime clusters, a unit percentage increase in the GDP contribution decreases the import shipping trade volume to the Abuja by 1.326% while a unit change in port revenue increases the import shipping trade volume to FCT Abuja by 1.172%. A 1% increase in the GDP contribution of the marine haulage business component led to increase of 0.371% in the import shipping trade capacity of the FCT Abuja hinterland while for the marine tourism cluster business component, a 1% increase in the GDP contribution causes a 0.246% decrease in the import shipping trade delivered to the north-central region.

The r-square which measures the explanatory power of the model is 0.340, indicating that about 34% variations in the import shipping trade delivered to the FCT Abuja hinterland from the port-based maritime clusters, is explained by the performances and GDP contributions of the maritime cluster business components. The significances of the effects of the individual business components of the maritime clusters are examined under the section on test of hypotheses below.

Table4.34: The significant factors that contributes into the decision of firms to locate investments in maritime clusters in Nigeria

	Mean	Std. Deviation	Analysis N
GS	25.1667	4.83767	240
FGPolicy	16.2500	3.37664	240
EAC	14.6667	3.15123	240
RlC	13.5833	3.66958	240
TPCO	13.4167	3.60052	240
HDC	11.4167	3.99704	240
EII	11.3333	3.86668	240
RTB	11.3333	3.86668	240
APS	9.8333	3.41871	240
EIC	9.1667	1.86728	240
SIC	9.1667	1.86728	240

Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.992	36.289	36.289	2.992	36.289	36.289
2	2.244	20.404	56.693	2.244	20.404	56.693
3	1.241	10.479	67.972	1.241	11.279	67.972
4	1.145	10.205	78.377	1.145	10.405	78.377
5	1.039	9.537	86.914	1.03	9.537	
6	.643	5.848	92.763			
7	.419	3.812	96.575			
8	.254	2.313	98.887			
9	.122	1.113	100.000			
10	2.480E-016	2.255E-015	100.000			
11	4.413E-018	4.012E-017	100.000			

SOURCE: Authors calculation. Extraction Method:
Principal Component Analysis.[a]

a. 5 components extracted.

Table 4.35 shows the results of the principal component factor analysis (PCA) conducted to determine the significant factors that contribute into the decision of firms to locate investments in maritime clusters in Nigeria. The results of the study, as shown in Table 4.20, indicate that Guaranteed security of investment (GS), which involves the safety and security of financial, infrastructure investment as well as investment in human capita that a firm has made in the location/region of the maritime clusters, , has a mean value of 25.1667% with standard deviation of 4.837. Favourable Government policy (FG Policy) which has to do with the policies such as tax exemptions and tax holidays for firms located in the marine clusters such as the oil and gas free zones, etc.; has a mean score of 16.25% with standard deviation of 3.337. The ease of administration and coordination of the business divisions of a firm from the cluster location (EAC) has a mean value of 14.6667% with standard deviation of

3.15133. Reduced labour cost and access to professionals (RLC) and Access to transport cum optimization of logistics and production cost (TPCO) each have mean scores of 13.13.5833% and 13.4167% respectively with respective standard deviations of 3.66958 and 3,60032.

Achieving higher service and product demand (HDC), benefiting from exchange of research information, ideas and innovation (EII) and reduced tax burden experiences (RTB) each has respective mean scores of 11.4167%, 11.3333% and 11.3333% with standard deviations of 3.60052, 3.99704, and 3.86668 respectively. The mean value of availability of adequate port operational sites (APS), economies of scale and infrastructural conditions (EIC), and availability of supporting and related industries is 9.8333%, 9.1667% and 9.1667% respectively with respective standard deviations of 3.41871, 1.86728 and 1.86728.

The results of the PCA further reveal that the significant factors that contributes into the decision of firms to locate investments in maritime clusters in Nigeria include: Guaranteed security of investment (GS) , Favourable Government policy (FGPolicy), The ease of administration and coordination of the business divisions of a firm from the cluster location (EAC), Reduced labour cost and access to professionals (RLC) and Access to transport cum optimization of logistics and production cost (TPCO), with each having Eigen values of2.992, 2.244, 1.241, 1.145, and 1.039.

Since each of the identified significant factors in the decision of firms to locate and operate in maritime clusters have Eigen values greater than one (Eigen value > 1), we assert that they (five of them) constitute the detainment decision factors that significantly influence maritime firms decision to operate in the seaport-based maritime clusters in Nigeria. The implementations of the significant factors have implications on the decision of firms to operate in any of the seaport based maritime zones/clusters in Lagos, Onne, Rivers, Warri and Calabar. Note that other factor with their respective Eigen values of less than 1 (Eigen < 1); are not significant factors considered by maritime firms in locating operational units within the maritime clusters in Nigeria.

4.3: Test of Hypotheses

Table4.35: Test of hypothesis H_{01}: There is no determinant maritime cluster business component that contribute significantly to maritime sector Development in Nigeria

Maritime cluster business components	Initial Eigen values	Decision
GDPOILGAS GDMARITIME	5.904	Significant, Reject H_{02}
GDPFISHER	.556	Not significant
GDINSURANCE	.318	Not significant
GDPPORTLOG	.105	Not significant
GDPMRTHAULAGE	.092	Not significant
GDPMARINETOURISM	.020	Not significant
	.005	Not significant

Source: Author's calculation. Reject *null hypothesis if Eigen value ≥ 1; Accept null hypothesis if Eigen value. < 1.*

The test of hypothesis H_{02}indicate that the offshore oil and gas maritime business component has Eigen values greater than 1 (5.904>1). We reject the null hypothesis $H_{02}$and accept the alternative that there is a determinant maritime cluster business component that contribute significantly to maritime sector Development in Nigeria.

Table4.36: Test of H_{02a}:There is no significant Effect of Maritime Clusters development on Export shipping Trade Capacity of the South-East Hinterland Regions

Hypotheses	F-cal.	F-critical	p-value/sig.	Decision
H_{02a}	5.325	2.68	0.011	Reject H_{02a}
Variable	**t-cal.**	**t-critical**	**p-value/sig.**	**Decision**
LogGDPMRT	-.074	1.83	.943	Not significant
LogSHPTR	.696	1.83	.504	Not significant
LogGDPFISHR	2.374	1.83	.042	significant
LogGDPOILGAS	-2.078	1.83	.067	significant
LogINSURANCE	1.402	1.83	.194	Not significant
LOGPOREV	.349	1.83	.735	Not significant

LOGFREIGHTHAUL	-2.496	1.83	.034	significant
LogTOURISM	.712	1.83	.494	Not significant

Source: Authors calculation. Reject *null hypotheses if F-cal> f-critical; Reject null hypotheses if F-cal.< F-critical*

The test of hypothesis H_{02a} shown in table4.36 shows F-score of 5.325, F-critical of 3.68, and p-value of 0.011. Since F-score is greater than F-critical, (5,325>2.68), we reject null hypothesis H_{02a}. We conclude that there is significant effect of maritime cluster development on the export shipping trade capacity of the south-east hinterland region in Nigeria between 2005 and 2019. Similarly, t-test was conducted to investigate the significance of the effects of the individual maritime cluster business components which include GDP contribution of the maritime transport, the ship traffic calls to the maritime clusters, the GDP contribution of the ocean fishery sector, the GDP contribution of the offshore oil and gas sector, the GDP contribution of the marine insurance business component, the port revenue generated over the period, the GDP contribution of the marine haulage sector and the GDP contribution of the marine tourism sector on the development of the export shipping capacity of the south-east hinterland region over the period between 2003 and 2020 covered in the study. The result shows that only the GDP contribution of the marine fishery business component, the GDP contribution of the offshore oil and gas business component and the GDP contribution of the marine haulage/freight sector have significant effects on the development of the export shipping capacity of the south-east hinterland region with each having have t-cal. greater than 1.83 (i.e.:2.374>1.83; 2.078>1.83 and 2.496>1.83).

Table4.37: Test of H_{02b}:There is no significant Effect of Maritime Clusters development on Import shipping Trade Capacity of the South-East Hinterland Regions

Hypotheses	**F-cal.**	**F-critical**	**p-value/sig.**	**Decision**
H_{02b}	2.854	2.68	.040b	Reject ***H_{02b}***
Variable	**t-cal.**	**t-critical**	**p-value/sig.**	**Decision**
LogGDPMRT	-0.065	1.83		Not significant

LogSHPTR	1.686	1.83	0.950	Not significant
LogGDPFISHR	2.025	1.83	0.026	significant
LogGDPOILGAS	-2.275	1.83	0.074	significant
LogINSURANCE	0.957	1.83	0.049	Not significant
LOGPOREV	-0.322	1.83	0.364	Not significant
LOGFREIGHTHAUL	-1.592	1.83	0.755	Not significant
LogTOURISM	0.978	1.83	0.146	Not significant
			0.354	

Source: Authors calculation. Reject *null hypotheses if F-cal> f-critical; Reject null hypotheses if F-cal.< F-critical*

The test of hypothesis H_{02a} shown in table4.37 shows F-score of 2.854, F-critical of 2.68, and p-value of 0.040. Since F-score is greater than F-critical, (2.854>2.68), we reject null hypothesis H_{02b}. We conclude that there is significant effect of maritime cluster development on the import shipping trade capacity of the south-east hinterland region in Nigeria between 2005 and 2019. Similarly, t-test was conducted to investigate the significance of the effects of the individual maritime cluster business components which include GDP contribution of the maritime transport, the ship traffic calls to the maritime clusters, the GDP contribution of the ocean fishery sector, the GDP contribution of the offshore oil and gas sector, the GDP contribution of the marine insurance business component, the port revenue generated over the period, the GDP contribution of the marine haulage sector and the GDP contribution of the marine tourism sector on the development of the export shipping capacity of the south-east hinterland region over the period between 2003 and 2020 covered in the study. The result shows that only the GDP contribution of the marine fishery sector and the GDP contribution of the offshore oil and gas sector have significant effects on the development of the import shipping capacity of the south-east hinterland region with each having have t-cal. greater than 1.83 (i.e.:2.025>1.83; 2.275>1.83).

Table4.38: Test of H_{03a}:There is no significant relationship between port-based Maritime Cluster operations and the development of Export shipping Trade Capacity in the South-South Hinterland Region

Hypotheses	**F-cal.**	**F-critical**	**p-value/sig.**	**Decision**
H_{03a}	**13.848**	2.68	0.000[b]	Reject ***H_{03a}***
Variable	**t-cal.**	**t-critical**	**p-value/sig.**	**Decision**
LogGDPMRT	0.205	1.83	0.842	Not significant
LogSHPTR	2.585	1.83	0.029	Significant
LogGDPFISHR	6.277	1.83	0.000	Significant
LogGDPOILGAS	-3.328	1.83	0.009	Significant
LogINSURANCE	1.201	1.83	0.260	Not significant
LOGPOREV	-1.807	1.83	0.104	Not significant
LOGFREIGHTHAUL	-1.959	1.83	0.082	Not significant
LogTOURISM	0.340	1.83	0.742	Not significant

Source: Authors calculation. Reject *null hypotheses if F-cal> f-critical; Reject null hypotheses if F-cal.< F-critical*

The test of hypothesis H_{03a} shown in table4.38 shows F-score of 13.848, F-critical of 2.68, and p-value of 0.000. Since F-score is greater than F-critical, (13.848>2.68), we reject the null hypothesis H_{03a}. We conclude that there is significant relationship between maritime clusters operations and the development of export shipping capacity in the south-south hinterland region in Nigeria between 2005 and 2019. Similarly, t-test was conducted to investigate the significance of the effects of the individual maritime cluster business components which include GDP contribution of the maritime transport, the ship traffic calls to the maritime clusters, the GDP contribution of the ocean fishery sector, the GDP contribution of the offshore oil and gas sector, the GDP contribution of the marine insurance business component, the port revenue generated over the period, the GDP contribution of the marine haulage sector and the GDP contribution of the marine tourism sector on the development of the export shipping capacity of the south-east hinterland region over the period between 2003 and 2020 covered in the study. The result shows that only the GDP contribution of the marine fishery sector, the ship

traffic calls to the ports and the e GDP contribution of the offshore oil and gas sector have significant effects on the development of the export shipping capacity of the south-south hinterland region with each having have t-cal. greater than 1.83 (i.e.:2.585>1.83; 6.27>1.83 and 3.328>1.83).

Table4.39: Test of H_{03b}:There is no significant relationship between port-based **Maritime Cluster operations and the development of import shipping Trade Capacity in the South-South Hinterland Region**

Hypotheses	**F-cal.**	**F-critical**	**p-value/sig.**	**Decision**
H_{03b}	11.262	2.68	0.001[b]	Reject ***H_{03b}***
Variable	**t-cal.**	**t-critical**	**p-value/sig.**	**Decision**
LogGDPMRT	0.308	1.83	0.765	Not significant
LogSHPTR	2.181	1.83	0.057	Significant
LogGDPFISHR	5.222	1.83	0.001	Significant
LogGDPOILGAS	-3.059	1.83	0.014	Significant
LogINSURANCE	1.059	1.83	0.317	Not significant
LOGPOREV	-1.519	1.83	0.163	Not significant
LOGFREIGHTHAUL	-1.998	1.83	0.077	Significant
LogTOURISM	0.610	1.83	0.557	Not significant

Source: Authors calculation. Reject *null hypotheses if F-cal> f-critical; Reject null hypotheses if F-cal.< F-critical*

The test of hypothesis H_{03b} shown in table4.39 shows F-score of 11.262, F-critical of 2.68, and p-value of 0.001. Since F-score is greater than F-critical, (11.262>2.68), we reject the null hypothesis H_{03b}. We conclude that there is significant relationship between maritime clusters operations and the import shipping capacity in the south-south hinterland region in Nigeria between 2005 and 2019. Similarly, t-test was conducted to investigate the significance of the effects of the individual maritime cluster business components which include GDP contribution of the maritime transport, the ship traffic calls to the maritime clusters, the GDP contribution of the ocean fishery sector, the GDP contribution of the offshore oil and gas sector, the GDP contribution of the marine insurance business component, the

port revenue generated over the period, the GDP contribution of the marine haulage sector and the GDP contribution of the marine tourism sector on the development of the import shipping capacity of the south-south hinterland region over the period between 2003 and 2020 covered in the study. The result shows that the ship traffic calls to the ports, the GDP contribution of the marine fishery sector, the GDP contribution of the offshore oil and gas sector, and the GDP contribution of the marine haulage sector have significant effects on the import shipping capacity of the south-south region with each having t-cal.>t-critical.

Table4.40: Test of H_{04a}:There is no significant effect of **Maritime Cluster operations on the development of export shipping Trade Capacity in the South-west Hinterland Region**

Hypotheses	**F-cal.**	**F-critical**	**p-value/sig.**	**Decision**
H_{04a}	3.570	2.68	0.038[b]	Reject ***H_{04a}***
Variable	**t-cal.**	**t-critical**	**p-value/sig.**	**Decision**
LogGDPMRT	-0.242	1.83		Not significant
LogSHPTR	-0.283	1.83	0.814	Not Significant
LogGDPFISHR	0.933	1.83	0.784	Not Significant
LogGDPOILGAS	-1.174	1.83	0.375	Not Significant
LogINSURANCE	0.972	1.83	0.270	Not significant
LOGPOREV	0.907	1.83	0.356	Not significant
LOGFREIGHTHAUL	-1.080	1.83	0.388	Not Significant
LogTOURISM	0.338	1.83	0.308	Not significant

Source: Authors calculation. Reject *null hypotheses if F-cal> f-critical; Reject null hypotheses if F-cal.< F-critical*

The test of hypothesis H_{04a} shown in table4.40 shows F-score of 3.570, F-critical of 2.68, and p-value of 0.038. Since F-score is greater than F-critical, (3.570>2.68), we reject the null hypothesis H_{04a}. We conclude that there is significant effect of maritime clusters operations on the export shipping capacity in the south-west hinterland region in Nigeria between 2005 and 2019. Similarly, t-test was conducted to investigate the significance of the effects of the individual maritime cluster business components

which include GDP contribution of the maritime transport, the ship traffic calls to the maritime clusters, the GDP contribution of the ocean fishery sector, the GDP contribution of the offshore oil and gas sector, the GDP contribution of the marine insurance business component, the port revenue generated over the period, the GDP contribution of the marine haulage sector and the GDP contribution of the marine tourism sector on the development of the import shipping capacity of the south-west hinterland region over the period between 2003 and 2020 covered in the study. The result none of the variables individually have significant effects on the import shipping trade capacity of the south-west hinterland region in Nigeria.

Table4.41: Test of H_{04b}:There is no significant effect of **Maritime Cluster operations on the import shipping Trade Capacity in the South-west Hinterland Region**

Hypotheses	**F-cal.**	**F-critical**	**p-value/sig.**	**Decision**
H_{04b}	1.590	2.68	0.252	Accept ***H_{04b}***
Variable	**t-cal.**	**t-critical**	**p-value/sig.**	**Decision**
LogGDPMRT	0.539	1.83	0.603	Not significant
LogSHPTR	1.137	1.83	0.285	Not Significant
LogGDPFISHR	-1.959	1.83	0.082	Significant
LogGDPOILGAS	-0.348	1.83	0.736	Not Significant
LogINSURANCE	0.263	1.83	0.798	Not significant
LOGPOREV	0.708	1.83	0.497	Not significant
LOGFREIGHTHAUL	-0.648	1.83	0.533	Not Significant
LogTOURISM	0.437	1.83	0.672	Not significant

Source: Authors calculation. Reject *null hypotheses if F-cal> f-critical; Reject null hypotheses if F-cal.< F-critical*

The test of hypothesis H_{04b} shown in table4.41 shows F-score of 1.590, F-critical of 2.68, and p-value of 0.252. Since F-score is less than F-critical, (1.590>2.68), we accept the null hypothesis H_{04b}. We conclude that there is no significant effect of maritime clusters operations on the import shipping capacity in the south-west hinterland region in Nigeria between 2005 and 2019. Similarly, t-test was

conducted to investigate the significance of the effects of the individual maritime cluster business components reveal that only the marine fishery GDP contribution has significant effect on the development import shipping trade in the south-west region (1.959>1.83).

Table4.42: Test of H_{05a}:There is no significant Effects of Maritime Clusters on Export shipping Trade Capacity of the North-West Hinterland Regions

Hypotheses	**F-cal.**	**F-critical**	**p-value/sig.**	**Decision**
H_{05a}	5.071	2.68	0.013	Reject ***H_{05b}***
Variable	**t-cal.**	**t-critical**	**p-value/sig.**	**Decision**
LogGDPMRT	.956	1.83	.364	Not significant
LogSHPTR	.602	1.83	.562	Not Significant
LogGDPFISHR	-3.830	1.83	.004	Significant
LogGDPOILGAS	.620	1.83	.551	Not Significant
LogINSURANCE	.130	1.83	.899	Not significant
LOGPOREV	.908	1.83	.387	Not significant
LOGFREIGHTHAUL	-.046	1.83	.964	Not Significant
LogTOURISM	.013	1.83	.990	Not significant

Source: Authors calculation. Reject *null hypotheses if F-cal> f-critical; Reject null hypotheses if F-cal.< F-critical*

The test of hypothesis H_{05b} shown in table4.42 shows F-score of 5.071, F-critical of 2.68, and p-value of 0.013. Since F-score is greater than F-critical, (5.071>2.68), we reject the null hypothesis H_{05a}. We conclude that there is significant effect of maritime clusters operations on the development of import shipping capacity in the North-west hinterland region in Nigeria between 2005 and 2019. Similarly, t-test was conducted to investigate the significance of the effects of the individual maritime cluster business components reveal that only fishery contribution to the GDP has significant effect on the development of the import shipping capacity of the north-west hinterland region.

Table4.43: Test of H_{05b}:There is no significant Effects of Maritime Clusters on import shipping Trade Capacity of the North-West Hinterland Regions

Hypotheses	**F-cal.**	**F-critical**	**p-value/sig.**	**Decision**
H_{05a}	3.577	2.68	0.037	Reject ***H_{05a}***
Variable	**t-cal.**	**t-critical**	**p-value/sig.**	**Decision**
LogGDPMRT	-0.243	1.83	0.813	Not significant
LogSHPTR	-0.283	1.83	0.783	Not Significant
LogGDPFISHR	0.933	1.83	0.375	Not Significant
LogGDPOILGAS	-1.175	1.83	0.270	Not Significant
LogINSURANCE	0.973	1.83	0.356	Not significant
LOGPOREV	0.908	1.83	0.387	Not significant
LOGFREIGHTHAUL	-1.081	1.83	0.308	Not Significant
LogTOURISM	0.340	1.83	0.742	Not significant

Source: Authors calculation. Reject *null hypotheses if F-cal> f-critical; Reject null hypotheses if F-cal.< F-critical*

The test of hypothesis H_{05a} shown in table4.43 shows F-score of 3.577, F-critical of 2.68, and p-value of 0.037. Since F-score is greater than F-critical, (3.577>2.68), we accept the null hypothesis H_{05a}. We conclude that there is significant effect of maritime clusters operations on the development of export shipping capacity in the North-west hinterland region in Nigeria between 2005 and 2019. Similarly, t-test was conducted to investigate the significance of the effects of the individual maritime cluster business components reveal that none of them have significant effect on the development of the export shipping capacity of the north-west hinterland region.

Table4.44: Test of H_{06a}:There is no significant Effects of Maritime Clusters on Export shipping Trade Capacity of the North-Central Hinterland Regions

Hypotheses	**F-cal.**	**F-critical**	**p-value/sig.**	**Decision**
H_{06a}	3.577	2.68	0.037	Reject ***H_{06a}***
Variable	**t-cal.**	**t-critical**	**p-value/sig.**	**Decision**
LogGDPMRT	-.243	1.83	.813	Not significant
LogSHPTR	-.283	1.83	.783	Not Significant
LogGDPFISHR	.933	1.83	.375	Not Significant
LogGDPOILGAS	-1.175	1.83	.270	Not Significant
LogINSURANCE	.973	1.83	.356	Not significant
LOGPOREV	.908	1.83	.387	Not significant
LOGFREIGHTHAUL	-1.081	1.83	.308	Not Significant
LogTOURISM	.340	1.83	.742	Not significant

Source: Authors calculation. Reject *null hypotheses if F-cal> f-critical; Reject null hypotheses if F-cal.< F-critical*

The test of hypothesis H_{06a} shown in table4.44 shows F-score of 3.577, F-critical of 2.68, and p-value of 0.037. Since F-score is greater than F-critical, (3.577>2.68), we reject the null hypothesis H_{06a}. We conclude that there is significant effect of maritime clusters operations on the development of export shipping capacity in the North-central hinterland region in Nigeria between 2005 and 2019. Similarly, t-test was conducted to investigate the significance of the effects of the individual maritime cluster business components reveal that none of them have significant effect on the development of the export shipping capacity of the north-central hinterland region.

Table4.45: Test of H_{06b}:There is no significant Effects of Maritime Clusters on import shipping Trade Capacity of the North-Central Hinterland Regions

Hypotheses	**F-cal.**	**F-critical**	**p-value/sig.**	**Decision**
H_{06b}	3.106	2.68	0.056	Reject ***H_{06b}***
Variable	**t-cal.**	**t-critical**	**p-value/sig.**	**Decision**
LogGDPMRT	.770	1.83	.461	Not significant
LogSHPTR	.352	1.83	.733	Not Significant
LogGDPFISHR	-3.370	1.83	.008	Significant
LogGDPOILGAS	.324	1.83	.753	Not Significant
LogINSURANCE	.573	1.83	.581	Not significant
LOGPOREV	.794	1.83	.448	Not significant
LOGFREIGHTHAUL	-.030	1.83	.977	Not Significant
LogTOURISM	.180	1.83	.861	Not significant

Source: Authors calculation. Reject *null hypotheses if F-cal> f-critical; Reject null hypotheses if F-cal.< F-critical*

The test of hypothesis H_{06a} shown in table4.45 shows F-score of 3.106, F-critical of 2.68, and p-value of 0.056. Since F-score is greater than F-critical, (3.106>2.68), we reject the null hypothesis H_{06b}. We conclude that there is significant effect of maritime clusters operations on the development of import shipping capacity in the North-central hinterland region in Nigeria between 2005 and 2019. Similarly, t-test was conducted to investigate the significance of the effects of the individual maritime cluster business components reveal that only the GDP contribution of the fishery sub-sector has significant effect on the development of the import shipping capacity of the north-central hinterland region.

Table4.46: Test of H_{07}:There is no significant Effects of Maritime Clusters on import shipping Trade Capacity of the North-east Hinterland Regions

Hypotheses	**F-cal.**	**F-critical**	**p-value/sig.**	**Decision**
H_{06b}	2.065	2.68	0.150	Accept ***H_{07}***
Variable	**t-cal.**	**t-critical**	**p-value/sig.**	**Decision**
LogGDPMRT	-.118	1.83	.908	Not significant
LogSHPTR	-.720	1.83	.490	Not Significant
LogGDPFISHR	-2.476	1.83	.035	Significant
LogGDPOILGAS	-.491	1.83	.635	Not Significant
LogINSURANCE	2.010	1.83	.075	significant
LOGPOREV	-.042	1.83	.968	Not significant
LOGFREIGHTHAUL	.094	1.83	.927	Not Significant
LogTOURISM	.463	1.83	.655	Not significant

Source: Authors calculation. Reject *null hypotheses if F-cal> f-critical; Reject null hypotheses if F-cal.< F-critical*

The test of hypothesis H_{07} shown in table4.46 shows F-score of 2.065, F-critical of 2.68, and p-value of 0.150. Since F-score is less than F-critical, (2.065<2.68), we accept the null hypothesis H_{07}. We conclude that there is no significant effect of maritime clusters operations on the development of import shipping capacity in the North-east hinterland region in Nigeria between 2005 and 2019. Similarly, t-test was conducted to investigate the significance of the effects of the individual maritime cluster business components reveal that only the GDP contribution of the fishery sub-sector and the GDP contribution of the marine insurance sub-sector have significant effect on the development of the import shipping capacity of the north-east hinterland region.

Table4.47: Test of H_{08}:There is no significant factor that contributes into the decision of firms to locate investments in maritime clusters in Nigeria

Decision factors	Initial Eigen values	Decision
GS	2.992	Reject ***H_{01}***
FGPOLICY	2.244	Significant
AEC	1.241	Significant
RIC	1.145	Significant
TPCO	1.039	Significant
HDC	.643	***Not significant***
EII	.419	***Not significant***
RTB	.254	***Not significant***
APS	.122	***Not significant***
EIC	2.480E-016	***Not significant***
SIC	4.413E-018	***Not significant***

Source: Author's calculation. Reject null hypothesis if Eigen value ≥ 1; Accept null hypothesis if Eigen value. < 1.

The test of hypothesis H_{08} which is reveals that three decision factors with Eigen values greater than 1. Therefore we reject hypothesis H_{01} and accept the alternate that there are significant factor that influence a firms decision to locate operational offices in the maritime clusters in Nigeria. The results of the PCA further reveal that the significant factors that contributes into the decision of firms to locate investments in maritime clusters in Nigeria include: Guaranteed security of investment (GS) , Favourable Government policy (FGPolicy), The ease of administration and coordination of the business divisions of a firm from the cluster location (EAC), Reduced labour cost and access to professionals (RLC) and Access to transport cum optimization of logistics and production cost (TPCO), with each having Eigen values of 2.992, 2.244, 1p.241, 1.145, and 1.039.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study has been able to investigate for the first time, the influence of maritime cluster operations on the development of hinterland operations in Nigeria between 2003 and 2020. It equally estimated the elasticity coefficients of the export and import shipping trade operations in the hinterland regions of south-east, south-west, south-south, north-west, north-east, north central regions; and the Federal Capital Territory (FCT) Abuja as a result of variations in port-based maritime cluster operations in Nigeria.

In conclusion, the major findings of the study indicate that:

(i) The study findings reveal that the offshore oil and gas maritime business component of the maritime clusters has Eigen values greater than 1 (5.904>1) and constitute the determinant maritime cluster business component that contribute significantly to maritime sector Development in Nigeria.

(ii) Maritime cluster operations have significant effects in the development of export and import shipping capacities of the south-east, south-south, south-west, north-west, and north-central hinterland regions of Nigeria.

(iii) a 1% increase in the GDP contribution of the maritime transport sector leads to a 0.479% decrease in the export shipping trade from the south-west hinterland region while 1% increase in the ship traffic calls to the port-based maritime clusters leads to a 0.982 decline in the export shipping trade from the south-west hinterland region. Similarly, a 1% increase in GDP performance of the marine fishery business component leads to a 0.659% increase in the tonnage of export shipping trade generated from the south-west hinterland region while a unit percentage increase in GDP contribution of the offshore oil and gas sector leads to a 0.873% decline in the tonnage of export shipping trade from the south-west

region. For the marine insurance business component of maritime clusters, a unit percentage increase in the GDP contribution increases the export shipping trade volume from the south-west by 1.547% while a unit change in port revenue increases the export shipping trade volume from the south-west by 3.2%. A 1% increase in the GDP contribution of the marine haulage business component led to a decline of 1.964% in the export shipping trade capacity of the south-west hinterland region while for the marine tourism cluster business component, a 1% increase in the GDP contribution causes a 0.260% increase in the export shipping trade from the south-west region.

(iv) There is no significant effect of maritime clusters operations on the development of import shipping capacity in the North-east hinterland region in Nigeria between 2005 and 2019.

(v) There is significant relationship between maritime clusters operations and the import shipping capacity in the south-south hinterland region in Nigeria between 2005 and 2019.

(vi) The significant factors that contributes into the decision of firms to locate investments in maritime clusters in Nigeria include: Guaranteed security of investment (GS) , Favourable Government policy (FG Policy), ease of administration and coordination of the business divisions of a firm from the cluster location (EAC), Reduced labour cost and access to professionals (RLC) and Access to transport cum optimization of logistics and production cost (TPCO), with each having Eigen values of 2.992, 2.244, 1p.241, 1.145, and 1.039.

5.2 Recommendations

(i) Government policies such as policies creating free trade zones in maritime regions and tax exemption for new firms should be used to attract more maritime firms to locate in ort-based maritime clusters in Nigeria. The significant relationship between maritime sector development and export and import capabilities of hinterlands in Nigeria, suggest that the hinterland can guarantee the achievement of higher output in the maritime sector in necessary investment is made by Government to improve the export trade potentials of the hinterlands

(ii) Given that only few states in the hinterland regions participate significantly export shipping trade through the ports, Government is encouraged to develop export hubs in the hinterland locations, particularly in the north-east, north-central and FCT Abuja hinterland regions, where there exist almost none or very non-significant participation in the export shipping trade. This should be aimed at grooming willing exporters in the hinterland regions to develop their export potentials and position the hinterlands to contribute more to port sector development in Nigeria.

(iii) While seeking to maximize the contribution and performance of the offshore oil and gas business component of the maritime clusters, policies should developed to encourage the development , emergence and improvement in the contributions of other maritime cluster business components.

(iv) Since Guaranteed security of investment (GS) , Favorable Government policy (FGPolicy), the ease of administration and coordination of the business divisions of a firm from the cluster location (EAC), Reduced labour cost and access to professionals (RLC) and Access to transport cum optimization of logistics and production cost (TPCO), constitute the significant factors influencing maritime firms decision to locate maritime clusters for national development, the Government should prioritize the security of maritime investment in the port-based maritime clusters in order to attract more firms to locate in the clusters. This support the development drives of Government in the sector.

5.3 Contribution to Knowledge

The study has made useful contribution to the growth and development of knowledge in this area by developing various models of empirical relationship showing the effects of maritime cluster development on hinterland operations in Nigeria as follows:

(i) The equation showing the influence of maritime cluster development on the on the import shipping trade capacity of the South-east hinterland region is:

LogSEIMP = 4.948 – 0.052LogGDPMRT +2.395LogSHPTR + 0.585LogGDPFISHR – 0.693LogGDPOILGAS + 0.624LogINSURANCE – 0.470LogPOREV – 1.186LogFREIGHTHAUL + 0.306LogTOURISM + e

(ii) The equation showing the influence of maritime cluster on the on the development of the export shipping trade capacity of the South-south hinterland region is:

LogSSEXP = 0.472 + 0.207LogGDPMRT +4.602LogSHPTR + 2.275LogGDPFISHR – 1.269LogGDPOILGAS + 0.981LogINSURANCE – 3.309LogPOREV – 1.828LogFREIGHTHAUL + 0.133LogTOURISM + e

(iii) The equation showing the influence of maritime cluster on the on the development of the export shipping trade capacity of the South-west hinterland region is:

LogSWEXP = 5.218 - 0.477LogGDPMRT - 0.981LogSHPTR + 0.659LogGDPFISHR – 0.873LogGDPOILGAS + 1.547LogINSURANCE + 3.237LogPOREV – 1.964LogFREIGHTHAUL + 0.260LogTOURISM + e

(iv) The equation showing the influence of maritime cluster development on the import shipping trade capacity of the South-west hinterland region is:

LogSEIMP = -28.725 + 1.229LogGDPMRT +4.559LogSHPTR – 1.559LogGDPFISHR – 0.299LogGDPOILGAS + 0.484LogINSURANCE + 2.923LogPOREV –1.362LogFREIGHTHAUL + 0.386LogTOURISM + e

(v) The equation showing the influence of maritime cluster development on the import shipping trade capacity of the North-central hinterland region is:

LogNWIMP = 0.943 + 0.553LogGDPMRT +0.445LogSHPTR – 0.867LogGDPFISHR + 0.088LogGDPOILGAS + 0.332LogINSURANCE + 1.033LogPOREV –0.020LogFREIGHTHAUL + 0.050LogTOURISM + e

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APPENDIX I

Mr. EMMANUEL NWOSU NNADOZIE
Department of Maritime Management Technology,
Federal University of Technology, Owerri,
Nigeria
Tel: +234 (0) 7036644059

To whom it may concern,

Please accept our sincere gratitude to you for your taking time to read this letter and questionnaire.

We are conducting research for both academic and practical purposes on '**MARITIME CLUSTERS AND PORT-HINTERLAND OPERATIONS IN NIGERIA'**.
For this research, we prepared a questionnaire and checklist that we want you to kindly provide responses to, based on your experience in this industry. We would appreciate if you fill out the questionnaire yourself or pass it to someone that you suppose more appropriate.

Just in case that there are different people involved in implementing policies in maritime clusters (seaport clusters) in the Nigerian maritime industry .We would be very happy if you make an extra copy.
Once again, we appreciate your cooperation in advance. We look forward to your response at your earliest convenience.

Yours Sincerely,

NWOSU EMMANUEL NNADOZIE

Questionnaire for maritime cluster and port hinterland operations

Dear Sir/Madam,

This questionnaire is to enable use your responses to identify the major factors driving firms to locate in seaport related clusters in the Nigeria maritime industry.

Your replies will be treated with the strictest confidence and will not be released to any organization or individual. All information will be aggregated and published only anonymously. Please spare some time to complete the questionnaire and return it to the e-mail address below.

Thank you very much for your time and help.

Mr. EMMANUEL NWOSU
DMMT, Federal University Of Technology, Owerri
Nigeria

SECTION A: Kindly indicate which of the following port related clusters that your organization is located. Indicate the seaport cluster that is in closest proximity to you or your company.

Please put a tick (√) in the appropriate cell that applies to you.

Identification of Seaport Cluster Closest To Your Organization/You

Questions	Response (√)
Kindly indicate the port related clusters that your organization is located. Indicate the seaport cluster that is in closest proximity to you or your company	
Lagos/Apapa seaports/maritime cluster	
Onne/Rivers seaports/maritime cluster	
Warri/Delta seaports/maritime cluster	
Calabar seaport/maritime cluster	
Others: Please specify:	

SECTION A: FACTORS THAT DRIVES OF INFLUENCED YOUR ORGANIZATION TO LOCATE IN THE SEAPORT/MARITIME CLUSTER

2. Kindly rate the influences of the identified factors on decision of your firm to locate its operational offices around the seaport zone/maritime cluster.

Factors that influence firms decision to locate in a maritime cluster. scores (√)						
		1	2	3	4	5
RLC	Reduced labour cost and access to specialized professional workers					
EII	Benefit from exchange of research information, ideas and innovation (transfer and exchange of technology and knowledge)					
FGP	Favorable Government policy					
HAD	Hinterland Accessibility and density					
APS	Availability of adequate port sites and operational space.					
EAC	Ease of Administration and coordination of business divisions					
EIC	Economies of scale and infrastructure condition (availability and condition of factors).					
GS	Guaranteed Security					
RTB	Reduced Tax burdens experiences (tax exemption, tax haven, etc,.)					
TPCO	Transport and logistics Service/production cost optimization					
HDC	Achieving higher service/product Demand Conditions					
SIC	Availability of Supporting and Related Industries (cooperation)					

Note: 1 = lowest/least influence, 5 = highest influence.

SECTION B:

3. Firms located in proximity to the Lagos/Apapa seaport cluster are over the viewed as performing better economically than those in other seaport/maritime clusters in Nigeria.

Do you agree with this assertion? Indicate by ticking **(√)**

		(√)	**(√)**
Yes	Firms in Lagos seaport clusters record better economic performance		
No	Firms located in Lagos seaport cluster have no better economic performance		
Neutral	Undecided		

4. Given your experience in the Nigeria maritime industry, kindly score the economic performance of firms located in the various seaport clusters (assign weights to the performance of the port clusters in Nigeria economy)

Performance of the various seaport/maritime clusters in the Nigerian economy. scores (√)						
		1	2	3	4	5
	Percentage rate %	20%	40%	60%	80%	100%
LAC	Lagos/Apapa seaports/maritime cluster					
ORC	Onne/Rivers seaports/maritime cluster					
WDC	Warri/Delta seaports/maritime cluster					
CSC	Calabar seaport/maritime cluster					
OTR	Others: Please specify:					

Note: 1 = lowest/least performance, 5 = highest performance

SECTION C: CLUSTER BUSINESS COMPONENTS IDENTIFICATION

5. Kindly identify maritime cluster business components operational in your cluster location in Nigeria. Please tick (√) in the appropriate cell that applies to you.

Identification of Cluster business components operational in most seaport based maritime clusters in Nigeria.

Identify the Cluster business components operational in most seaport based maritime clusters in Nigeria.	Response (√)
shipping logistics and shipping operators (clearing, maritime transport & shipping companies, chandelling, etc.,)	

fishing and aquaculture operators	
marine insurance	
Marine equipment, shipbuilding, repair & scrapping operators	
port logistics service operators (terminal operations and port authority)	
road haulage operators	
maritime tourism & recreation	
Offshore oil and gas operators	
Others: Please specify:	

6. Kindly rate or assign weight to the dominance or preponderance of firms offering each of the identified maritime cluster business components in Nigeria seaport clusters.

Dominance of maritime cluster business types in seaport locations in Nigeria. scores (√)						
		1	2	3	4	5
SHP	shipping logistics and shipping operators (clearing, maritime transport & shipping companies, chandelling, etc.,)					
FAO	fishing and aquaculture operators					
MIO	marine insurance operators					
MESR	Marine equipment, shipbuilding, repair & scrapping operators					
PLS	port logistics service operators (terminal operations and port authority)					
RHO	road haulage operators					
MTR	maritime tourism & recreation					
OGP	Offshore oil and gas operators					
OTR	Others: Please specify:					

Note: 1 = lowest presence, 5 = highest dominance/presence.

SECTION D: PERCEIVED PERFORMANCE/CONTRIBUTION OF CLUSTER BUSINESS COMPONENT TYPES TO DEVELOPMENT OF MARITIME SECTOR IN NIGERIA

The Nigeria maritime sector over the years is a major contributor to the economic development of Nigeria. The contribution of the sector to Gross Domestic Product (GDP) in 2021 for example is about ₦; and each of the identified maritime cluster business components contributed in varied proportions. Kindly answer the question below on you perceived percentage contribution of each cluster business component to the development of the maritime sector in Nigeria.

6. Kindly rate or assign weight to each of the maritime cluster business components based on your perceived percentage performance/contribution of each cluster business component to the development of the maritime sector in Nigeria

Rate contribution of maritime clusters business components Nigerian. scores (√)						
		1	2	3	4	5
	Percentage rate %	20%	40%	60%	80%	100%
SHP	shipping logistics and shipping operators (clearing, maritime transport & shipping companies, chandelling, etc.,)					
FAO	fishing and aquaculture operators					
MIO	marine insurance operators					
MESR	Marine equipment, shipbuilding, repair & scrapping operators					
PLS	port logistics service operators (terminal operations and port authority)					
RHO	road haulage operators					
MTR	maritime tourism & recreation operators					
OGP	Offshore oil and gas operators					
OTR	Others: Please specify:					

Note: 1 = lowest/least contributor, 5 = highest contributor.