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The Effectiveness of Security in Marine Terminal Facility

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***Abstract**: Mobility has been a necessity for man since the dawn of existence. This need sparked the methodical growth of all modes of transportation, from footpaths to highways, from rivers and streams to the sea, and from trains to the skies. In any socioeconomic system, the development of transportation is one of the key catalysts for boosting and speeding up the pace of economic, social, political, and strategic development. On the global maritime agenda in recent years, the issue of maritime security has gained a great deal of importance. One of the difficulties in this area is how to handle security effectively, such as by facilitating the efficient movement of commodities while also enhancing supply chain security. Another problem is how to enhance security without impairing organizational effectiveness and efficiency. As contemporary social and economic necessities have changed, so has the necessity for architectural adaptability. This study aims to examine strategies that when put into action or implemented in the industrial zones and terminals of ports have established a framework that enables the effectiveness and efficiency of security in maritime transportation and ports and to strengthen ties and partnerships between ports and the local communities they serve. Data was gathered from primary sources such as field investigations, and evaluations of existing marine terminals. Secondary sources included websites, documentation, journals, surveys, and other sources. Some adaptable strategies, when used properly, have improved the terminals. In my opinion, I believe this study will provide a long-term solution to the issue of security effectiveness in the marine port building.*

***Keywords:** Security, Effectiveness, Adaptability, Marine Terminal, Maritime Transportation*

1.0 Introduction

Marine transportation moves more than 10 billion metric tons of containers, solids, and liquid bulk cargo annually across the world's oceans, driving between 80% and 90% of all trade (Walker *et al*., 2019). People and goods have traveled by sea across oceans and between continents throughout history. The topic of maritime security has grown significantly in importance on the global maritime agenda in recent years. One of the challenges in this regard is how to improve security without compromising organizational effectiveness and efficiency, or how to manage security efficiently, such as by supporting the efficient movement of goods while also strengthening supply chain security. "Transporting people and cargo by sea is known as shipping (The Geography of Transport Systems, 2019)". "Maritime shipping, sometimes referred to as the "backbone of global trade," is in charge of moving most of the raw materials, components, and completed goods that power the economy (The Geography of Transport Systems, 2019)". The second half of the 20th century was the heyday of international maritime transport, with globalization of trade flows, growing market integration, and considerable technological improvements all playing a part (The Geography of Transport Systems, 2019). Terrorist incidents have significantly disrupted this scenario and have important policy repercussions. The importance of sea transport security is mandated by this form of transportation's significant vulnerability to terrorist attacks, given the routes, volume, and wide range of shipping commodities that are extremely diverse and enormous and whose origin, description, and ownership are not always totally traceable. Any break in the maritime transport chain brought on by hostile foreign actions may have a severe effect on the world economy as well. This study's primary objective is to determine how advantageous adaptable strategies, such as infrastructure, tools, and proper zoning of the many facilities necessary at ports, may increase the efficacy of maritime security. A review of the literature on factors influencing a port's location, inland waterways, goals, functions, and social benefits serves as the introduction to the study.

1.1 Definition of Terms

Effectiveness is the extent to which objectives are attained ('doing the right things') (Erlendsson, 2002).

Security is the quality or state of not being threatened, afraid, or anxious (Merriam-Webster Dictionary, 2023).

Terminal is a location where the loading and unloading of passengers or cargo takes place, such as a bus or train terminus (Marine Insight, 2023).

Marine Terminals are a portion of the port where commodities and cargo can be loaded into ships and unloaded in the event that a ship approaches the port (Marine Insight, 2023).

Ports are harbor locations where marine terminal buildings move cargo and people from ships to land vehicles (Rodrigue and Notteboom, 2020).

2.0 Relevant Literature Review

2.1 Port Terminal Evolution and Development

According to Rodrigue and Notteboom (2020), ports serve as meeting places for the transportation of people and goods between land and sea. While the marine domain can encompass a wide geographic area related to international trade, the land domain is connected to the region and vicinity of ports. The word "port" is derived from the Latin word 'portus', which means "gate" or "gateway" (Marine Insight, 2023). Historically, ports began as secure fishing grounds, and those in strategic positions developed into trading centers, many of which were built with open access and trade protection in mind. They thus became the centers of urbanization, with a number of them emerging as the first port cities and contributing significantly to the economic prosperity of their districts (Marine Insight, 2023). According to Irchia (2006), port development may be seen in an order where one event leads to another, where the stages build upon each other, and where one event leads to another. This is because port logistic infrastructure from 19th-century port towns was brought into use in the 21st century. More than any other sort of terminal combined, ports serve as terminals for the most freight. In order to handle freight, port infrastructure must enable transhipment activities both on ships and ashore, facilitating the convergence of maritime and land transportation systems. In many regions of the world, ports served as the hub from which inland transportation networks, particularly rail, were established.

2.2 Criteria that Determine Port Terminal Location

According to Rodrigue and Notteboom (2020), a port's location is defined by four main factors:

Figure 2.1: The Main Factors That Define A Port Location

Source: Rodrigue and Notteboom (2020)

a. Maritime Access

This refers to the location's actual ability to accommodate ship operations. As regular ship operations cannot handle changes of more than 3 meters, it also includes the tidal range, which is the difference between high and low tide. In order to accommodate modern cargo ships, channel and berth depths are also crucial (Rodrigue and Notteboom, 2020).

b. Maritime Interface

This shows how much acreage is accessible to support maritime operations, specifically how much of the shoreline has good maritime access. Since ports are linear entities, this quality is essential. Even if a port location offers great marine access, such as deepwater waterways, there might not be enough land available to ensure its continued growth and expansion. Many ports now demand more land usage due to containerization (Rodrigue and Notteboom, 2020).

c. Infrastructures and Equipment

Infrastructures, including piers, basins, stacking or storage facilities, warehouses, and machinery like cranes, are required at the port site, all of which require significant capital outlays. These infrastructures also have a footprint, which needs to be accessible to allow for port growth. It has become difficult to keep up with the investment needs of modern port operations, especially when you consider containerization, which requires a sizable amount of terminal area to run.

Modern container terminals depend on a special mix of infrastructure, such as portainers, stacking yards served by gantry cranes, and the trucks used to transport containers across the terminal, like straddle carriers (Rodrigue and Notteboom, 2020).

d. Land Access

Its expansion and significance are guaranteed by the port's proximity to industrial complexes and markets. This necessitates effective inland distribution infrastructure, such as rail unit trains, river barges, and roadways able to handle significant truck traffic. Congestion is getting worse at land entry ports that are close to heavily populated areas. Construction of larger ships, such as tankers, bulk carriers, and containerships, has been prompted by economies of scale.

2.3 Nigerian Inland Waterways

For Nigeria's economy, environment, and quality of life, inland waterway transportation is a key component of its multimodal transportation system. Nigeria's greatest underutilized mode of transportation is its inland waterways. Major rivers, coastal creeks, and lagoons are all part of Nigeria's interior waterways system, which is crucial to the nation's economic growth (Marine Insight, 2023).

Inland Waterways Definition

Inland waters are aquatic-influenced environments located within land boundaries (Convention on Biological Diversity, 2023). This includes those located in coastal areas, even where they are adjacent to marine environments.

Inland waters are also referred to as any waterways (such as lakes, canals, rivers, watercourses, inlets, and bays) that are located on a state's territory as opposed to the open seas or marginal waters that border another state and are subject to a variety of sovereign powers of the neighboring state (Merriam-Webster Dictionary, 2023).

Inland ground waterways are places where it is possible to transport people and commodities using inland waterway vessels because of the hydrological conditions and water infrastructure present. Navigable rivers, navigable lakes, and unnatural waterways (canals, lakes, and controlled river segments) are all examples of inland waterways (Statistic Poland, 2023).

2.3.1 The National Inland Waterways Authority (NIWA)

By an act of the National Assembly, CAP 47, Laws of the Federation of Nigeria, 2004 (Decree No. 13 of 1997), the National Inland Waterways Authority (NIWA), formerly the Federal Ministry of Transport's Inland Waterways Department (IWD), was transformed into an authority. Its main duty is to develop and improve Nigeria's inland waterways for navigation. 28 out of the 36 states that make up the Federation can be connected by water, but only around 30% of these enormous resources—or roughly 3,800 km of waterways—are navigable, according to NIWA statistics. According to NIWA, at least 17 of the 28 states are reachable; the rivers Niger and Benue provide access to the following states: Adamawa, Anambra, Bauchi, Bayelsa, Benue, Delta, Edo, Gombe, Kebbi, Kogi, Kwara, Niger, Nasarawa, Plateau, Rivers, Sokoto, and Taraba. Additionally, five continental neighbors with open river channels include the Benin Republic, Equatorial Guinea, Cameroon, Chad, and Niger. Utilizing waterways raises security concerns. Among the causes of the numerous accidents on waterways in littoral states are overcrowding of vessels, subpar watercraft, and submerged wrecks above and below the surface.

2.3.2 Objectives of the National Inland Waterways Authority (NIWA)

1. Improve and broaden the navigable interior rivers.
2. Give people and business goods a means of transit for escape.
3. Fulfill the main transportation program's objectives with regard to inland waterways.

2.3.3 Functions of Inland Waterways

5. Traffic control on the country's waterways.
6. Planning a ferry route.
7. Issuing and overseeing permits for piers, terminals, and jetties, as well as inland traffic.
8. Alert law enforcement to any border mailers using inland waterways.
9. Offer building, building maintenance, and dockyard services.
10. Weeds that grow in water, such as clear water hyacinth.

Research Questions

This study examines a few elements and pieces of equipment that are crucial in the marine terminal in comparison to other port auxiliary facilities, with the ultimate goal of stating the importance of security engaged in the maritime industry as well as the state's economic standing. Thus, the following topics have been covered, and chapter four would include more topics in these areas:

6) What is Port Terminal Evolution and Development?
7) What are the criteria that determine the port terminal's location?
8) What are Nigerian Inland Waterways?
9) What are some security measures and equipment that aid security in marine terminals?

3.0 Methodology

This chapter discusses the research methodology. The goal of this study is to ascertain how crucial security is at maritime terminal facilities. This study looked at and analyzed a systematic analysis approach of pertinent tools, structures, appropriate zoning, and other adequate innovations and technologies that have been implemented in current marine terminal facilities that are environmentally friendly to improve and also resolve security in marine terminal facilities. The study studied and contrasted the results of numerous implemented port security measures and their effects on improving security in marine terminals. The data was acquired by reviewing existing works and studies on the efficiency of port security measures in marine terminal facilities.

4.0 Findings & Discussions

In order to enhance and address security in marine terminal facilities, this chapter examined the effects of applicable equipment, structures, proper zoning, and other suitable innovations and technologies that have been adopted in modern marine terminal facilities. These facilities are environmentally beneficial.

4.1 Effectiveness of Security in Marine Terminal Facilities: Applicable Current Port Security Measures, Their Effects, And Advantages

The following is a discussion of some current applicable security methods, structures and equipment, their effects and advantages, which are creative and environmentally friendly to improve and resolve security at marine terminals and port facilities:

i. **Proper zoning of all auxiliary port facilities in respect to the facilities at the Marine Terminal:** All port facilities should be appropriately zoned in accordance with the port building requirements. This ensures the benefits of protecting the environment, preventing congestion of the port's activities, enforcing control over its usage, and enabling a more effective arrangement on the port that improves security.

ii. **Maritime Access:** This is a reference to the area's actual capacity to handle ship activities. All necessary ship activities should be able to be accommodated for and managed in the site area. This will help a country's security and influence in the globe, provide it the ability to engage in international trade, which can strengthen its economy and generate jobs, and let it explore the sea for scientific purposes, which can develop its knowledge and innovation.

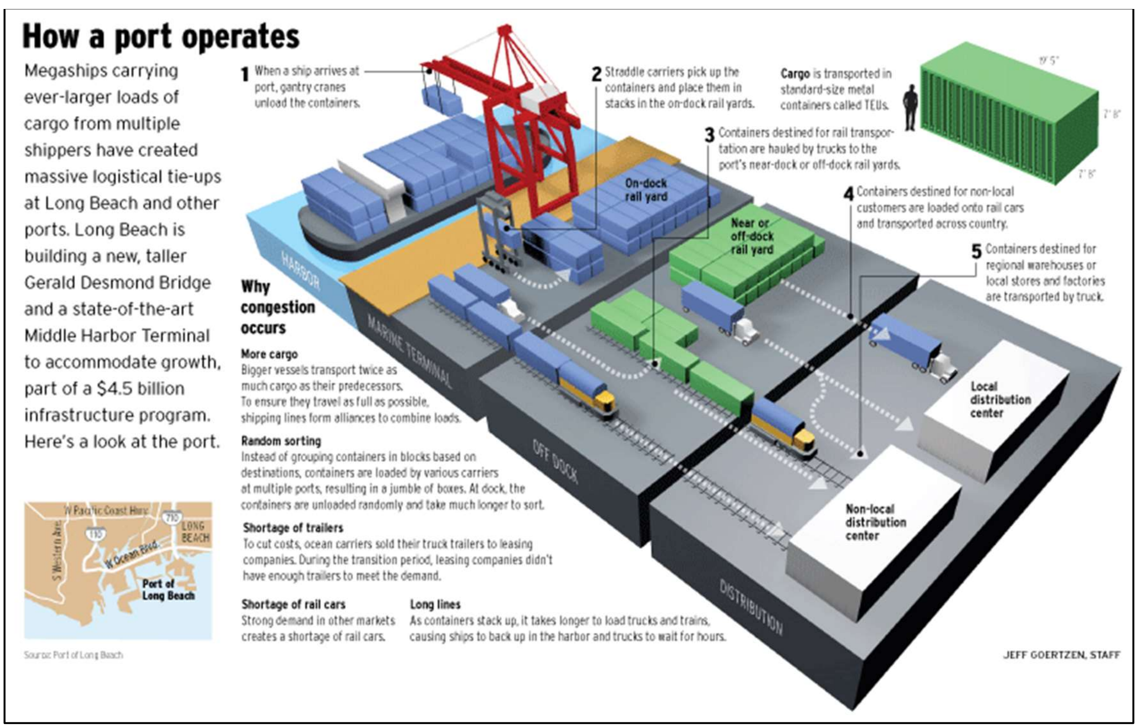

Figure 1.1: Schematic Image of Port of Long Beach Florida (Image Showing an Example of the zoning of How a Port operates at the Marine Terminal)

Source: ocregister.com, 2023

iii. **Land Access:** The port's proximity to commercial centers and markets ensures its growth and importance. Effective inland distribution infrastructure is required for this, including rail unit trains, river barges, and roads that can accommodate heavy vehicle traffic. Additionally, the congestion at the port facilities is resolved by doing this.

iv. **Land Reclamation Works:** Ensuring that the terminal building is erected on sturdy, landslide-resistant foundations. This includes breakwaters equipped to shield the port from the impacts of current and tide.

v. **Dredging of Access Channels and Basins**: Ensuring that a range of ship sizes and classes may be accommodated by the port's nautical profile. Having an access route that is less susceptible to obstruction. This makes it possible to remove obstacles from the port facility's access path.

vi. **Quay-Wall Construction and Maintenance**: Ensuring that quay walls can withstand additional tidal, seismic stresses and minor collisions.

vii. **Apron, Mooring Equipment and Fenders**: Ensuring that under challenging circumstances (such as strong winds and high tides), the dock can moor and secure ships.

viii. **Terminal Handling Equipment**: Making sure terminal equipment, including ship-to-shore cranes, gantry cranes, and yard equipment, can endure anticipated natural risks and be rapidly repaired in case of damage, breakage, or failure. Equipment (and work shifts) are available to address spikes in demand.

ix. **Electric Installations and Wiring**: Strengthening of the electrical distribution system, especially in relation to important facilities and equipment. Adjusting supplementary power production.

x. **Telecommunication Installations and Wiring**: Strengthening of the wireless and wired communications infrastructure. Setting up a backup communications network.

xi. **Paving of the Terminal**: Ensuring a terminal surface that is hardened and well-drained, especially in yard areas.

xii. **On-terminal Rail Facilities** (if present): Ascertain that train yards and spurs can withstand anticipated natural dangers.

xiii. **Roads on the Terminal**: Ensuring that alternate paths are available and that all elements of the terminal are still accessible.

xiv. **Warehouses and Technical Buildings**: Ensuring that structures are resilient to a variety of anticipated natural disasters.

xv. **Fencing and Video Surveillance**: Preserving the port's perimeter as a guarded area with restricted access.

xvi. **Truck Gates And Inspection**: Preserving terminal access, including alternative access points, for drayage, supplies, and the workers.

xvii. **Office Buildings**: Ensuring that structures are resilient to a variety of anticipated natural disasters and that management and employees may do business continuously on-site.

xviii. **The National Inland Waterways Authority (NIWA)**: The Inland Waterways Department (IWD) of the Federal Ministry of Transport was renamed the National Inland Waterways Authority (NIWA) by an act of the National Assembly, CAP 47, Laws of the Federation of Nigeria, 2004 (Decree No. 13 of 1997). Its primary responsibility is to build and enhance Nigeria's navigable inland waterways. This government-affiliated law enforcement organization supports Nigerian port security.

5.0 Conclusion and Recommendations

Establishing an atmosphere free from criminal activity and without serving as a conduit for it is the aim of port security, allowing for the conduct of trade with a reassuring degree of certainty. Reducing the avenues for criminal exploitation of the maritime transportation industry, its suppliers, and its consumers should be the goal of a port security department. Deterrence, prevention, detection, and reduction of losses attributable to criminal activity should be the main priorities in designing a security program. Port security efforts must therefore be proactive as opposed to merely reactive. This calls for cooperation of information and investigation efforts with law enforcement organizations and the security divisions of the marine businesses that use a port's infrastructure. The actions discussed in this study's chapter four are beneficial for the environment and, if implemented properly in light of the changing demands of society and the economy, will help ensure that ports and maritime transportation are secure and productive. They will also fortify the bonds and collaborations that exist between ports and the communities they serve, which will boost a country's economic growth.

In conclusion, it should be noted that a country's ability to develop a functioning marine transport terminal that will be a great asset to its citizens while taking into account its limitations and potential is greatly aided by the effectiveness of its security measures. It also greatly enhances the urban landscape, encourages environmentally friendly architecture, and increases tourism within the country.

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