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FACTORS INFLUENCING CONTAINER TERMINALS EFFICIENCY: A CASE STUDY OF MOMBASA ENTRY PORT

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ABSTRACT: *Previous studies carryout revealed that many factors influence container terminal efficiency. This study revealed that factors such as inadequate quay/gantry crane equipment, reducing berth times and delays of container ships, dwell time, container cargo and truck turnaround time, custom clearance, limited storage capacity, poor multi-modal connections to hinterland and infrastructure directly influencing container terminal efficiency. The research document thoroughly explored these factors and discussed the extent to which they influence container terminal efficiency within the port industry. The primary objective of this study was to assess factors influencing Container Terminals Efficiency with a case study of the Mombasa Entry Port. The target population of the study was approximately 500 people which included Kenya Port Authority, Conventional Cargo Operations, and Container Terminal Operations. Questionnaire was the major instrument used to obtain primary data from the respondents; while the secondary data were obtained from existing empirical literature relevant to the study. The study employed an exploratory approach using a descriptive survey design. The questionnaire be designed using Likert scale type. A sample of 50 respondents was obtained through a stratified sampling technique of which 30 of the respondents participated in the survey. Data were analyzed using the Statistical Package for Social Sciences (SPSS) and Microsoft Excel 2013. The findings revealed 86.7% of the respondents believe that by improving the infrastructures at the port of Mombasa will minimize the congestion problems that sometime occur. Findings from the survey revealed that 83.3% of the respondents agree that the lack of Integrated IT system poses substantial delays in custom clearance procedures. The study also recommended that Kenya Port Authority (KPA) continuously invest in modern quay and gantry cranes to supplement the current ones in order to continuously enhance productivity of port operations and that the Government of Kenya invest in expanding the physical infrastructure such as adequate berthing facilities, wharves, yard capacity, quayside, railway, as well as hinterland connections expansion.*

KEYWORDS: *Container Terminals, Efficiency, Mombasa Entry*

INTRODUCTION

Background

Containerization of ship cargo was first introduced in 1956 (Levinson, 2006), aiming to cut down the costs of maritime transport by reducing cargo handling costs. Instead of loading/unloading each piece of transport item to or from a ship in a labor-intensive manner, containerization increases the efficiency and speed of transport by reducing the packing requirements and handling processes at all transfer points. That is between port, rail and road. At the end of 2005, the world container fleet was expected to have increased to 21.6 million TEUs (Twenty-foot equivalent units) (UNCTAD, 2006). Thus, countries without adequate unitized transport facilities will be disadvantage in their international trade (Castro, 1999).

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In order to achieve economies of scales, new ships are built with much greater capacity. To date, the largest container vessel can carry 11,000 TEUs. However, the deployment of larger ships demands huge investment in providing greater depth alongside the berth of the calling ports as well as more powerful quay cranes with long outreach and lift height. For efficient operation, ports also require a large storage yard and a better road and rail infrastructure. To satisfy the growing demand of container berths, ESCAP (2005) estimates that US27 billion is needed from 2002 to 2015 for 569 new container berth in the Asia and pacific region (ESCAP, 2005). With regards to the growing international sea traffic and changing technology in the maritime transport industry, seaports are coping with mounting pressures to upgrade and provide cutting-edge technology. They are also being forced to improved container terminals efficiency to provide comparative advantages that will attract more traffic. Some of the key challenging factors terminal operators are surmounting to is to secure traffic flows and prevent diversion to nearby ports including handling containers and cargos more rapidly, providing more adequate and performing equipment, reducing berth times and delays, enabling large storage capacity and ensuring multi-model connections to hinterland (Castro, 1999).

However, container terminals efficiency is often associated with productivity and performance; also additional factors that are associated with the more organizational side of production such as how efficiently ports use inputs to produce current output levels and whether the technologies adopted by container terminal operators are most efficient, that are critical to determining container terminals efficiency(Chin and Tongzon, 1998). Efficiency often means speed and reliability of container terminal services. In a survey conducted by UNCTAD (2011), 'on-time delivery' was cited to be a major concern by most shippers (UNCTAD, 2006). In fast-paced industries where products must be moved to the markets on time, terminal operators are vital nodes in logistics chain and as such must be in a position to guarantee shipping lines very reliable service levels. These include on-time berthing of vessels, guarantee turnaround time for vessels and guaranteed connection of containers. That is the total turnaround time it takes to wait for pilot to berth, terminal time, un-berthing and final departure from port area (Tongzon and Ganesalingam, 2009).

Terminal efficiency can be reflected in the freight rates charged by shipping companies, turnaround time of ships and cargo dwelling time. The larger a ship stays at berth, the higher is the cost that a ship will have to pay. This can be passed on to shippers in terms of higher freight charges and longer cargo dwelling time, thus reducing the attractiveness for them to hub at a port. Tongeon and Ganesalingam (2009) identified several indicators of terminal efficiency and categorized them into two broad groups, namely: operational efficiency measures and customer-oriented measures. The first set of measure deals with capital and labor productivity as well as asset utilization rates. The second set includes direct charges, ship's waiting time, minimization of delays in inland transport and reliability (Tongzon and Ganesalingam, 2009).

A Survey conducted by the East African Logistics Performance reveals significant improvement in port and corridor efficiency. Ongoing reforms and infrastructure improvements at the port of Mombasa have yielded significant results as cargo dwell time has dropped from an average 6.5 days in 2011 to 5 days in 2012. Despite these improvements, the efficiency at the port of Mombasa is still below the internationally acceptable standards of a maximum 3 days dwell time (East African Logistics Performance Survey, 2012). Compare to 2011, corridor efficiency has slightly improved resulting from concerted efforts by EAC governments to upgrade regional road infrastructure and eliminate non-tariff barriers. Despite

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these initiatives, truck turnaround times remain low as an average truck records less the 5,000KMs per month against an industry practice of 9,000 to 12,000KMs per months (East African Logistics Performance Survey, 2012). The efficiency of container terminal is still affected by the high regulatory burden of the road transport sector with numerous checkpoints (weight bridges, customs and police checks) along the transport corridor. This situation is compounded by congestion in urban areas along the transport corridor and less than adequate investment in the rail network to effectively complement the road transport system (East African Logistics Performance Survey, 2012).

The Port of Mombasa is the largest in East Africa and a vital gateway for imports and exports to Kenya and its neighboring countries. The imports and exports that pass through the Port of Mombasa are critical to Kenya's economic growth, and to the economic well-being of its neighbors as well. Liquid bulk items, mostly petroleum, oil and lubricants, are the single greatest import item by weight without these imports, Kenya's economy (and most other countries of the EAC) which depend on imports for all of its petroleum needs, would grind to a half. The next four largest items by weight, maize clinker, wheat, iron and steel are critical in meeting the country's food needs and in supporting its vibrant construction industry (KPA, 2010).

Conversely, Mombasa entry port has exceeded its design capacity, yet it is expected to handle growing imports and exports. The port is already operating at maximum capacity for both general and containerized cargo, and will suffer progressive declines in operational effectiveness unless both capacity and terminal efficiency issues are urgently addressed (KPA, 2010). In terms of capacity, container imports at the port have risen on average 10 percent each year since 2005 (KPA, 2010), despite relatively low GDP growth rates in 2007 to 2008. In term of efficiency, several key issues need to be addressed for both imports and exports that relate to movement of goods through the port, and inefficiencies caused by the management of trucks loading and unloading goods, collection of custom duties, inspection, etc.

The operational capacity for container cargo is particularly acute with the growing demand in containerized cargo; the Mombasa entry Port is facing serious capacity problems (KPA, 2010). Short-term immediate impact is an increased in vessel delays, port congestion surcharges, and slower throughput of the port (when congested) thus causing significant cargo delays and higher costs to importers.

Exporters also experience increased costs because of possible unscheduled delays at the port, disappointing customers who have based their own business decisions on fixed delivery schedules. The fact of the matter remains that, the capacity issues at the port of Mombasa could act as a brake on growing trade within the region (KPA, 2010).

Statement of the Problem

With growing international sea traffic and changing technology in the maritime transport industry, sea ports are coping with mounting pressures to upgrade and provide cutting-edge technology. They are also being forced to improve terminals efficiency to provide comparative advantages that will attract more traffic. Some challenging factors include: providing adequate and performing equipment, reducing berth times and delays, enabling large storage capacity and ensuring multi-modal connections to hinterland (UNCTAD, 2006); as well as improving infrastructure (Haralambides 2002).Terminal operations are affected not only by the larger

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number of vessel calls but also by the increased variability of call sizes. Vessels of over 15000 TEU are becoming increasingly common (Cullinane and Khanna 1999). This will concentrate container flows on a few megaports, in turn influencing berth and crane efficiency of the terminal and adding pressure on hinterland links, often with adverse effects on congestion and the environment (Yap and Lam 2013).

The Mombasa Entry Port has exceeded its design capacity, (KPA, 2010). It is already operating at maximum capacity for both general and containerized cargo, and will suffer progressive declines in operational effectiveness unless both capacity and terminal efficiency issues are adequately addressed (KPA, 2010).

Container imports at the port have risen on average 10 percent each year since 2005 (KPA, 2010). Some key problems associated to the inefficiency of the port are: dwell time issue, management of trucks loading and unloading goods, collection of custom duties, inspections, etc. (KPA, 2010). There are broadly several areas which influence container terminal efficiency: port's ability to service ships at the quayside (or at berth); yard capacity (to store goods before collection) and custom and clearance; infrastructure etc. These issues have therefore prompted the study to assess factors influencing container terminals efficiency: A case study of the Mombasa Entry Port.

Objectives

General objective

The main purpose of the study is to assess the factors influencing container terminals efficiency in the Maritime industry with case study of the Mombasa Entry Port, Republic of Kenya.

Specific objectives

i. To what extent does quay crane affect container terminal efficiency.
ii. To examine the role dwell time plays on container terminal efficiency.
iii. To critically examine the important of infrastructure on terminal efficiency.
iv. To establish the effect clearance procedures has on container terminal efficiency.

Research Questions

1. How does quay crane affect container terminal efficiency?
2. What role does dwell time play on the container terminal efficiency
3. How does infrastructure influence container terminals efficiency?
4. What is the effect of clearance procedures on container terminal efficiency?

Justification

This study is indeed significant because the Maritime Industry plays a major role toward the economic growth and development of a country. The Port of Mombasa has a strategic importance far beyond the borders of Kenya. As the largest port in East Africa, it is the main gateway for the import and export of goods not only for Kenya but also to countries of the East African Community (EAC) as well as Central Africa.

Moreover, the study seeks to benefit all stakeholders and players within the maritime industry especially container terminal operators and policy makers because the findings from the research will provide an in-depth knowledge on practical implications on factors influencing container terminal efficiency. The findings will also be a direction for future research and practical implications as well, especially to those who want to do similar research by assess factors influencing container terminal efficiency within the maritime industry.

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Finally, the research will be of great benefit to the Government of Kenya, it neighboring countries and other African countries who have similar problems with terminal inefficiencies; because when the findings and recommendations from the study are well utilized and taken into consideration by the appropriate authority and stakeholders, then the issues of container terminal inefficiencies can be adequately addressed thus enhancing the capacity and productivity of their ports which onward will boost economic growth and development.

Scope of the study

The scope of the study focuses on factors influencing container terminals efficiency with case study of the Mombasa Entry Port. It also looks at all persons involved in the operations of container terminal in the port of Mombasa, stakeholders who make use of the facility in port operation activities as well as freight forwarders/shippers, shipping agents and Kenya Port Authority (KPA). Furthermore, the target population included Kenya Port Authority, Conventional Cargo Operations, and Container Terminal Operations. The number of these officials when put together gave a total of approximately 500 people.

Limitations of the study

It is obvious that every study encounters challenges and difficulties; of which this study is no exception. Significant portion of the questionnaire was not filled in, this perhaps could be deduced that most of the respondents were not willingness to participate in the survey. As a result of this, the expected sample size was not met. Another challenge encountered was obtaining Research Authorization Letters. The process was very tedious because the researcher was mandated by the National Commission for Science, Technology and Innovation (NACOSTI), Republic of Kenya to obtain those letters before embarking on the research. Thus causing the researcher to travel severally to and fro from Nairobi to Mombasa which was very hectic especially so with the security system in the country, and the narrow road network between the two cities.

LITERATURE REVIEW

Introduction

This chapter reviews relevant literature both about the topic of the research with specific focus on relevant issues on container terminal efficiency. A number of existing papers and studies on container terminal efficiency were reviewed for this study. The frame of reference of this research project was guided by the problem and purpose. Hence, it was considered relevant in this research to review theory related to factors influencing container terminal efficiency. The review has shown that there are numerous theoretical perspectives and models on container terminal efficiency which have been developed for container terminal operations. For the purposes of this research project, the review was concentrate on just two aspects of the theories on container terminal efficiency: the Data Envelopment Analysis (DEA) and the DEA Window Analysis. Finally, the study looked at the hypothesized variables, conceptual framework, empirical review, critique of existing literature, summary and research gap.

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CONCEPTUAL/THEORETICAL FRAMEWORK

Data Envelopment Analysis (DEA)

The application of Data Envelopment Analysis (DEA) in seaport industry to measure port efficiency and performance was first proposed by Roll and Hayuth (1993). They think that seaports are complex service organizations and there is a long list of outputs and inputs characterizing the operations of seaports. Due to this complexity of factors affecting seaport efficiency, it is difficult to determine the efficiency and the extent to which a seaport's resources are fully exploited in achieving the goals.

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According to Roll and Hayuth (1993), DEA is considered as one of the most suitable tools for measuring seaport efficiency. They mentioned that DEA has some advantages compared with traditional approaches. For instance, it enables coinstantaneous analysis of multiple output and multiple inputs and enables the inclusion of environmental and other qualitative factors, which are highly important to evaluate performance; it can recognize the possibility of different but equally efficient combinations of outputs and inputs (in different propositions); and it does not require an explicit priori determination of relationships between outputs and inputs, or the setting of rigid importance weights for the various factors. However, they demonstrated the applicability of the DEA technique in seaport industry by constructing a hypothetical numerical example data with four outputs and three inputs where the performances of 20 ports are compared. They showed that DEA is a promising and easily adaptable method for obtaining the relative efficiency ratings of seaport and it is possible for a series of secondary research to provide a deeper insight into saeport performance and point out potentials for improvement (Roll and Hayuth, 1993).

Valentine and Gray (2002) compare the efficiency of 31 North America and European ports for the year 1998 forming outputs such as container a total throughput and the number of containers and inputs, such as the total length of berth and container berth length. According to these Authors the DEA method is useful to test the container seaport efficiency. Also, Barros (2003) analyzed technical and allocative efficiency of five Portuguese ports from 1999 to 2000 using cross-section data. The main objective was to investigate how port regulatory procedures affect the productivity of the port. He concluded that the incentive regulation for increasing productive efficiency was not achieving its aims and proposed a policy revision to enforce efficiency.

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For inputs he took the number of employees and the book value of assets and for outputs he took ships, movement of freight, gross tonnage, market share, break-bulk, containers, etc. The same author with Athenassiou (2004) studied the relative efficiency of Portugues and Greek ports using the DEA method. The results of the analysis indicated that there were inefficiency ports which could improve their performance.

Kaisar et al. (2006) analyzed the port productivity using the DEA method. They determined an efficient frontier or a set of the best practice seaports, which inefficient seaports may want to emulate and then concentrated on the sources and the extent of inefficiency of ports which could improve their operations. Assuming that the container port depends on the equipment and information technology and by the competition among ports, the main objective of their study was to minimize the use of inputs (the total quay length and the quay gantry cranes) and

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to maximize the output (container throughput). The annual panel data from 1998 to 2003 have been collected for each of the twenty-five ports.

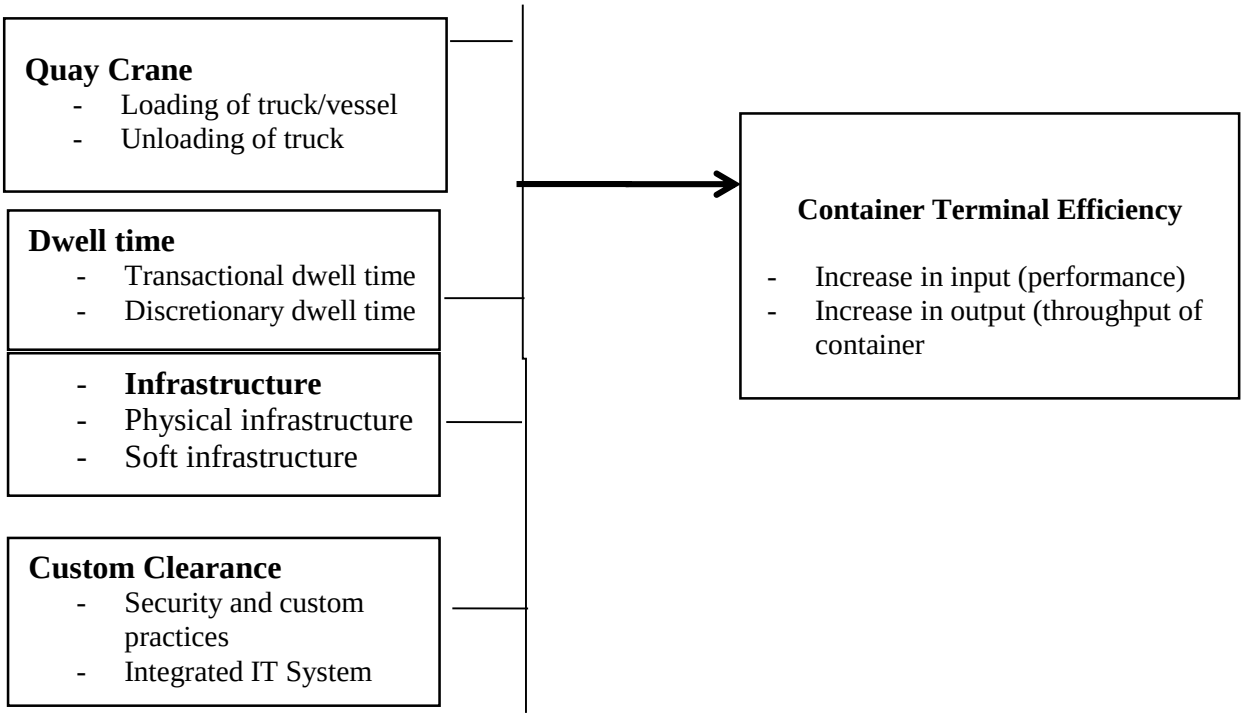
DEA Window Analysis

Cullinane et al. (2004) in their study evaluated the efficiency score of the world's major container sea-ports over time with the DEA window analysis using panel data and cross-section data. They compared the cross-section method and the panel data with the window analysis concluding that the cross-section method did not yield port performance in detail. Also, Min and Park (2005) used the DEA window analysis to evaluate the efficiency of 11 container terminals in a period of four years. The applied DEA window analysis enables observation of the changes in length, terminal efficiencies over time.

The data included the total quay length, the number of cranes, labor number; size of storage all belonging to inputs and cargo throughout as the output. Cullinane and Wang (2006) studied the efficiency of 69 container terminals with an annual throughput over 10,000 TEUs in Europe using cross-sectional DEA. They pointed to the existence of the significant inefficiency for the most of the terminals. It has been evidenced that the average efficiency of container terminals located in different regions differs, either to a large or to a small extent. The inputs were the terminal length, size of terminal area, equipment (expressed in numerical value), while container throughput was the output.

Conceptual Framework

The research was guided by a Conceptual Framework that is indicated by the independent and dependent variables.



Independent Variables **Dependent Variable**

Figure 2.1 Conceptual Framework

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Review of Variables

Quay crane

The quay crane operation is one of the important operations for the container terminal logistics, which carries out loading a container from a truck to a vessel or unloading a container from a vessel to a truck. Several major container terminal operations influence the efficiency of container terminal, which include the vessel berthing operation, the crane unloading/loading operation, the container delivery operation by trucks, the inspection operation, and the container storage operation. Of those operations, the crane operation is the key factor that determines the efficiency and effectiveness of a container terminal (Lee, Wang and Miao, 2000; Rodrigues, Xiao and Zhu, 2002; Kim and Park, 2004). When a container vessel is moored at berth, several cranes are arranged to load or unload containers for that vessel. Unloaded containers are transported by trucks and then go through other terminal operations. After finishing all unloading jobs, cranes will start load containers from land side on to the container vessel (Lee, Wang and Miao, 2000; Rodrigues, Xiao and Zhu, 2002; Kim and Park, 2004).

These interfaces are the quayside with loading and unloading of vessels, and the landside where containers are loaded and unloaded on and off trucks and trains. A container yard connects the quayside and landside, and provides space for container storage. Containers are stored either in stacks on the yard deck, or on truck chassis. Under a chassis storage system, each container is individually accessible providing fast transfer to landside movements. Yard cranes are utilized to access containers and reposition them within the stack. Because of increased demand and limited storage space in most modern seaports, nowadays stacking on the ground is the most commonly used storage approach (Steenken et al. 2004).
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When a vessel arrives in a seaport, it first has to moor for container loading and unloading. For this purpose, a number of berths are available at container terminals. Berths have very large construction costs, and therefore the number and length of berths at a container terminal is one of the most important strategic decisions that must be made at the strategic level. Berthing decisions initiate the work within a terminal by pushing and pulling containers into and from the yard storage areas. Obviously, the utilization of berths directly affects the overall utilization of the terminal, and therefore the operational level decision of allocating berth space to vessels is crucial. Most container berths in the large ports of the United States and Japan are leased by ship operators. Under such arrangements, ocean carriers are directly responsible for the containers. Such berthing systems are called dedicated berth systems, and terminals operating with dedicated berths are called dedicated terminals Vis & de Koster, 2003)

An alternative system, known as public berths, is used by many major hub ports like Hong Kong, Singapore, Rotterdam, and Hamburg. Public berth systems are used in multi-user terminals that process the vessels of different carriers, and generally have longer berths and higher berth utilization rates than dedicated terminals. When a vessel is moored at a berth, the unloading and loading of containers begins. Quay cranes are the standard equipment designed for this task. A quay crane is a special type of gantry crane having a large steel framework, which is positioned along the wharf (or quay) alongside a berthed vessel. Quay cranes are generally classified by their lifting capacity, and the size of the container ships they can load and unload. A Panamax crane can fully load and unload containers from a container vessel capable of passing through the Panama Canal (vessels 12-13 container rows wide). A Post-Panamax crane can fully load and unload containers from larger container vessels up to about 18 container rows wide. The largest modern container cranes are classified as Super-Post Panamax, and are used for vessels up to 22 container rows wide (Steenken et al. 2004).

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A modern container crane capable of lifting two 20-ft containers at one time generally has a lifting capacity of at least 40 tonnes. Some new cranes have now been built with 120 tonne load capacity enabling them to lift up to four twenty foot or two forty foot long containers. The speed of quay cranes during unloading and loading movements is also important. Modern quay cranes have hoisting speeds of 60-80 m/min when carrying a load. Trolley speeds can exceed 140 m/min. Given these parameters, it takes about 90 seconds to load or unload a single 40-ft container with an experienced crane operator. Post-Panamax cranes weigh approximately 800-900 tonnes while the newer generation Super-PostPanamax cranes can weigh 1600-2000 tonnes (Vis & de Koster, 2003; Stahlbock, and Voss, 2008).

Dwell Time

Container dwell time is one of the many performance indicators to assess the efficiency of terminal operation. As compared to standard indicators such as ship turnaround time or productivity indicators it is however not yet widely used for global benchmarking purposes. It is therefore challenging to define standard limits above which dwell time would be considered too long in any given seaport. Maritime industry sector experts tend to agree however on a 3 to 4 days representative mean value (Goardon, 2003). From a national perspective, the issue of dwell time has been specifically identified as a major hindrance to Kenya economic development for a long time (KPA, 2009).

The average current dwell time is 5 days depending on where the goods are destined – it does not compare favorably with international standards which are typically 1 – 3 days. On the other hand, gateways seaports are not only gateways, they are also a place of integration a number of players within the supply chain: port operators, public administration and authorities, brokers or intermediaries and shippers.
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Each of these players has a specific use of the seaport that conditions its perception of the long dwell time issue. For the terminal operations at the Mombasa Entry Port – there is a direct relationship between distribution of dwell times and terminal occupancy. It therefore needs to precisely evaluate a standard dwell time beyond which the efficiency of the terminal is negatively affected. This standard is the free time period defined "as the period during which a container can reside in the container yard without being assessed a demurrage fee" (Huynh, 2006).

According to UNCTAD (1995) it should correspond from a user perspective to the "sufficient time to allow efficient importers to clear their cargo" (UNCTAD, 1995), but in practice, the seaport authority and terminal operators define this free time according to capacity constraints, profit maximization, container traffic patterns or other consideration (for instance differentiation between transit and domestic goods), and they tend to reduce it for example when facing high congestion patterns. As for shippers (importers or exporters) dwell time in seaports can be assimilated to a temporary storage period which is justified either by the time necessary to complete cargo clearance formalities (transactional dwell time) or by a decision to leave cargo in the port for a definite number of days superior to that clearance delay (discretionary dwell time) . For containerized imports, cargo dwell time is defined as the time between vessel arrival and container exist from the port facilities – exceeds 20 days in average for most seaport in developing countries which makes them the most time-inefficient seaport in the world (UNCTAD, 2003).

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From a transport service perspective, container terminals are nothing more than intermodal nodes in global transport chains. Their basic function is then to transfer efficiently utilized cargo from a maritime transport mode (container ship) to a land transport mode (rail and truck) and vice-versa. The efficiency of this transfer operation is then assessed against performance objectives which are in general berth, yard and quay productivity objectives. If we focus specifically of time performance of entry ports for containerized imports we can however simply look at the agility at which containers are physically transferred from the containership to the land transport mode via the container yard. This total time for the physical transfers only plus the necessary idle time between operations is defined as operational dwell time (UNCTAD, 2003).

Infrastructure

The critical role that container infrastructure plays in favoring the economic development of a country or region is well established. Infrastructure is the necessary condition for efficient cargo handling operations and adequate infrastructure is needed to avoid congestion, foster trade development as well as securing deep-sea container connectivity for economies heavily dependent on international trade. Container infrastructure, however, needs to be complemented by efficient hinterland transport connections if the port is to fully exploit its potential as growth catalyst and supply chain node (Suykens and van de Voorde 1998). Unfortunately, it is not uncommon for development projects to focus exclusively on enhancing the infrastructural capabilities of the port, without adequate consideration of the hinterland connections.

The urgency of looking at port and terminal development in conjunction to their hinterland connectivity is exacerbated by the pressure on container terminals to increase their efficiency levels resulting from the rapid growth of containerized cargo traffic flows and their increased variability (Haralambides 2002).

As port capacity cannot be developed as rapidly as increases in demand (Haralambides 2002), any overcapacity is eventually exhausted and episodes of congestion ensue even in the most efficient terminals. This calls for a phased but continuous and well-coordinated effort in expanding container capacity at terminals. Terminal operations are affected not only by the larger number of vessel calls but also by the increased variability of call sizes. As Vessels of over 15000 TEU are becoming increasingly common, despite the fact that they may only be able to access a few large hubs (Cullinane and Khanna 1999). This will concentrate container flows on a few megaports, in turn impacting berth and crane productivity of the terminal and adding pressure on hinterland links, often with adverse effects on congestion and the environment (Yap and Lam 2013).

The expected increase in transshipment associated with larger vessel size, is likely to influence the terminals not only forcing them to handle higher volumes in the same period of time, but also to reduce the variability of their operations (i.e. increase reliability) in order to guarantee seamless flows of cargo among transshipment ports and/or transshipment port and feeder ports (Gilman 1999). The increases in productivity and reliability at terminals will require more tracking, greater container visibility and more emphasis on environmental and regulatory compliance particularly as terminals now occupy critical positions the supply chain (Notteboom 2008).

Generally, infrastructure is divided into physical and soft elements. Physical infrastructure includes not only the operational facilities such as the number of berths, the number of cranes,

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yards and tugs and the area of storage space, but also the intermodal transport such as roads and railways (Tongzon and Heng, 2005). Whereas, the soft infrastructure refers to the manpower employed. Maximum deployment of both types will assist in reducing vessel turnaround, thereby increasing the terminal capacity to accommodate more containers. Ships are continually increasing their carrying capacity and container made for large transport units in overseas container transport are under consideration. This scale enlargement requires new and capital-intensive transshipment facilities in gateway ports. Particularly, inter-modality is essential for the speedy transport of cargoes into and out of a gateway port. Without proper linkages, the efficiency of container terminal operation may decline due to congestion and delays (Tongzon and Heng, 2005).

Custom Clearance

The impact on operations of custom clearance procedures at ports and in transportation is well established (Clark, Dollar and Micco 2004, Haralambides and Londoño-Kent 2004), and one of the main advantages of dry port is the possibility of concentrating custom inspections outside of the seaport terminals (Roso 2008, Roso, Woxenius and Lumsden 2009*b*). One of the first definitions of dry ports, Inland Clearance Depot, (UNECE 1998) specifically accounted for the provision of customs clearance services. These facilities are defined as inland intermodal terminals dedicated to the handling and storage of goods under custom transit. The typology of operations performed in dry ports differ globally but typically include good clearance for temporary storage for onward transit, export, warehousing or import.

The provision of custom clearance and quarantine services imposes high security procedures for accessing the dry port, similarly to seaports, and depending on the country may include high fencing, cameras and guards (Roso and Lumsden 2010).

The port of Mombasa is vital to Kenya's domestic economics. Maritime trade accounts for more than 70% of the port of Mombasa's total cargo volume, and that volume is growing at around 12% per year (KPA, 2009). The imports and exports play a fundamental role in facilitating Kenya's integration to international trade. However both importers and exporters face high costs for sea transport and substantial inefficiencies in port clearance procedures. UNCTAD (2003) reports that the average freight rate for imports for example is 47% higher than in most developing countries and twice the rate in developed countries, estimated at 5.21% (UNCTAD, 2003). From a political economy perspective however, entry ports are also the place where the customs clearance procedures are completed to allow goods to enter definitively or temporarily into the country. For country like Kenya it is a critical function as duties and taxes collected at the Mombasa Entry Port are very essential contributor to the state revenues (KPA, 2009). The efficiency of customs at the Port of Mombasa is then closely monitored with a focus mostly on revenue collection performance. However, there is a growing awareness of the significance of customs clearance time efficiency to facilitate international trade. In theory, the time to perform import clearance formalities starts much before containership arrival and is not therefore strictly related to cargo dwell time. But in fact the bulk of formalities are still performed after ship arrival in most developing countries ports despite trade facilitation initiatives of which Mombasa port is no exception (UNCTAD, 2003). Customs clearance and cargo dwell time are therefore closely related. Customs take (sometimes rightly) a large share of the blame for long delays, but they are not alone (UNCTAD, 2003).

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For some operations, customs clearance is efficiently managed by shipper and clearing and forwarding agents, and transactional dwell time is not a major contributor to total dwell time. For other however the time lost in the clearance process because of missing documents, errors in the declaration or simply lack of anticipation is so important that it explains an important proportion of long delays. Moreover, customs administration are just one player among others players who manage official formalities. Nevertheless, in terms of dwell time, customs processes still usually "mark" the beginning and the end of most of the processes (UNCTAD, 2003). Security and custom regulation can impose substantial delays in the operation of the terminal and it is therefore essential that coordination with the agencies responsible for these activities is negotiated and security practices are embedded in terminal management. Literature now exists in the area on security for container logistics (Acciaro and Serra, 2013), but major issues remain with reference to the impact of scanning procedures (Bakshi, Flynn and Gans, 2011) ISPS code (Yang, 2010, Yeo, Pak and Yang, 2013).

Empirical Review

Some scholars (Tongzon, 1995; de Langen, 2003) have researched factors influencing cargo flow. Other studies (TongzonetHeng, 2005; de Langen, 2007; Wiegmans et al, 2007; Chang et al, 2008; Tongzon, 2002; 2009) have focused factors influencing the choice of ports. These studies are interdependent since the cargo flow depends on the port choice of port users. Using these findings is particularly interesting in order to understand which variables can be included in the model. Additionally, advantages such as the location of the port and the distance to the consumer markets play an important role in the volume of port throughput. However, more factors of ports determine the terminal throughput volumes.

Also, Tongzon (1995) determines that cargo flow is dependent on the following factors: the first factor is the geographical location of a port. If the port is located on an easily accessible location by different modalities, more cargo is likely to flow to that specific port. The second factor is the frequency of ship calls. The higher the frequency of ship calls, the higher the port throughput. The third factor is the terminal efficiency. This indicator can be measured by looking at the container mix, the crane efficiency, the size of the vessels and cargo exchange (economies of scale), average number of container handled per hour. Again, Tongzon states that port charges could also be included as variable in the model. However their contribution to the total costs is relatively small (Tongzon, 1995)

Conversely, some scholars (TongzonetHeng, 2005; de Langen, 2007; Wiegmans et al, 2007; Chang et al, 2008; Tongzon, 2002; 2009) have identified factors influencing the choice of port users. The studies determine choice factors of different port users. These studies are relevant for this research since the choice of the port users determine the cargo flows to the ports. The most discussed factors from these studies are, besides the location, the physical and technical infrastructure, the port efficiency, the hinterland connections, the port charges and the available (logistic) services. The physical and technical infrastructure includes port physical characteristics such as the depth of the water, the type of cranes in the port and the meters of quay. These variables indicate the limits of the capacity of the port and so the possible port throughput (Tongzon et Heng, 2005; de Langen, 2007; Wiegmans et al, 2007; Chang et al, 2008; Tongzon, 2002; 2009). On the other hand, port competition has had an impact on the port choice factors. Containerization has led to standardization in the maritime industry, implying that ports cannot rely on specialization to maintain their market share and to generate revenues as much as they used to do (OECD, 2008). By containerization, ports in the same region became closer substitutes for the port users.

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Furthermore, port competition has moved from competition between ports to between transport chains (de Langen et al, 2010). Hinterland connections are of vital importance for a port, because container ports are nowadays a link in a logistics chain (de Langen et al, 2010). Nevertheless, this implies that the quality of the hinterland connections and the diversity of the modalities available determine the level of container terminal throughput. Additionally, the costs of hinterland have become relatively important. However, OECD (2008) states that the cost per kilogram per km on the hinterland is 5 to 30 times as high (this depends on the hinterland transport mode) as the shipping cost by sea. Also port charges have an influence on the competitive position of the port; they include taxes, administration costs and shipping tariffs. Port users prefer the port with the best price/quality ratio. However port charges are not the most important choice influencer since this indicator is mentioned lower in the list compared to the other factors in several studies. Also, Tongzon (1995) states that port charges form an extremely low proportion of the overall costs of international trade. To make a link between port competition and the psychical and technical infrastructure: when these infrastructures are strongly congested, their quality decrease and this weakens the ports competitive position.

Critique of the existing literature relevant to the study

In this critique of existing literature, the researcher had discussed two major theories: Data Envelopment Analysis (DEA) proposed by Roll and Hayuth, (1993) and the DEA Window Analysis by Cullinane et al. (2004). The researcher agrees with these authors that both DEA and DEA Window Analysis are appropriate with evaluating the efficiency of container terminal.

The theme of this well researched and powerfully argued volume is that seaports service organizations are very complex and as such there are long list of outputs and inputs characterizing the operations of ports. Firstly, Roll and Hayuth (1993) argue that due to the complexity of factors influencing port efficiency, it is difficult to determine the efficiency and the extent to which a port's resources are fully exploited in achieving the goals (Roll and Hayuth, 1993). The authors further argue that DEA is considered as one of the most suitable tools for measuring port efficiency. They argue that DEA is considered as one of the most suitable tools for measuring port efficiency. However, Roll and Hayuth (1993) expand on this idea by mentioning that DEA has some advantages compared with traditional approach. Their argument was backed by giving example where DEA enables coinstantaneous analysis of multiple output and inputs which also enable the inclusion of environmental and other qualitative factors that are highly important to evaluated efficiency. Additionally, the applicability of DEA technique in port industry was constructed using hypothetical numerical example data with four outputs and three inputs where the efficiency of 20 ports was compared. The result from their test shows that DEA can easily be adopted for obtaining the relative efficiency ratings of port and terminal.

Their contention is supported by a case study conducted by Valentine and Gray (2002) which compare the efficiency of 31 North America and European ports for the year 1998 forming outputs such as container a total throughput and the number of container and inputs, such as the total length of berth and container berth length. Their argument was also in agreement with Roll and Hayuth (1993) that DEA method is useful to test the efficiency of container terminal.

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Furthermore, Barros and Athenassiou (2004) supporting the contention of Roll and Hayuth (1993) studied the relatively efficiency of Portuguese and Greek ports using the DEA method. The results of the analysis indicate that there were inefficiency ports which could improve their performance. On the other hand, Kaisar et al. (2006) analyzed the port productivity using DEA method. According to the authors, DEA is also best for evaluating the efficiency of container terminal.

Secondly, Cullinane et al. (2004) evaluated the efficiency score of the world's major container seaports over time with DEA Window Analysis using panel data and cross-section data. Moreover, Cullinane et al. (2004) contention was further supported by Min and Park (2005) when they used the DEA Window Analysis to evaluate the efficiency of 11 container terminals in a period of four years. They found out that the DEA Window Analysis enable observation of the changes in length, terminal efficiencies over time. In additional to the contention of Cullinane et al. (2004), a case study on 69 container terminals with an annual throughput over 10,000 TEUs in Europe using cross-sectional DEA was conducted by Cullinane and Wang (2006). The results from their study point to the existence of the significant inefficiency of container terminals located in different regions differ, either to a large or to a small extent. In their analysis, the inputs were the terminal length, size of terminal area, equipment (expressed in numerical value), while container throughput was the output.

Research Gaps

In view of the various studies reviewed, there are some new efforts present in the literature, which relate to niche issues stemming from the current political, economic, technological and business developments at a global level. The first group of works stems from the current development in port security aspect. The works of Bichou (2011) and Guan and Yang (2010) are among the most recent works dealing with container terminal security aspects and the possible bottlenecks created. The second type of problems, relate to supply chain aspects and the role of ports and container terminals in the design of modern supply chains. The works of Ribinson (2002), Panayides (2006) and Parola and Sciomachen (2005) are among the first who tackled the problem at a port level. The aim of these works is to identify the current trends in modern supply chains and find ways of integrating port operations at the best level possible. More focused on container terminals due to the increasing role of container cargo in global trade are the work of Fan, Wilson, and Tolliver (2009), Panayides and Son (2008), Van Der Horst and De Langen (2008), Notteboom and Rodrigue (2008) and Rodrigue and Notteboom (2009). In these works, the reader can find interesting aspects of containerized global supply chains with comparisons not only of different terminals but of trade routes and cargoes as well.

Summary

This paper has assessed factors influencing container terminal efficiency. The review of the study has been concentrated on theories and empirical studies that have made an effort towards establishing factors influencing container terminal efficiency. Some of these factors discussed were: turnaround time of ships and cargo dwell time, capacity and infrastructure, quay crane, custom clearance, etc. Also, the review has shown that there are numerous theoretical perspectives and models on container terminal efficiency which have been developed for container terminal industry. For the purposes of the research project, the review has concentrated on two aspects of the theories on container terminal efficiency: the Data Envelopment Analysis (DEA) first proposed by Roll and Hayuth (1993); while several researchers (Cullinane et al., 2004; Min and Park, 2005; Cullinane and Wang, 2006) have

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conducted studies using the DEA Window Analysis method to measure the efficiency of container terminal.

On the other hand, the empirical review has presented some scholars (Tongzon, 1995; de Langen, 2003) who have researched on factors influencing cargo flow. Other studies (TongzonetHeng, 2005; de Langen, 2007; Wiegmans et al, 2007; Chang et al, 2008; Tongzon, 2002; 2009) have focused on factors influencing the choice of ports.

RESEARCH METHODOLOGY

Research Design

The study employed an exploratory approach using a descriptive survey design to assess factors influencing container Terminals efficiency; a case study of the Mombasa Entry Port. A descriptive research design presents and reports the way things are (Mugenda and Mugenda, 2003). Also, descriptive research design is used when data are collected to describe persons, organizations, settings or phenomena (Creswell, 2003). Kothari (2008) mentions that descriptive design has enough provision for protection against bias and ensure reliability.

The study adopted a quantitative survey as a major method. Quantitative surveys are designed to fit a questionnaire schedule. This is most commonly used technique in research (Veal, 2006).

Target Population

Sekaran (2010) refers to population as the entire group of people or things of interest that the researcher aims to assess. Population as defined by Mugenda and Mugenda (2003) is an entire group of individual or objects having common observable characteristic. The study therefore took all person involved in the operations of container terminal in the port of Mombasa as well as stakeholders who make use of the facility in port operations.

The target population included Kenya Port Authority, Conventional Cargo Operations, and Container Terminal Operations. The number of these people when put together is approximately 500. Therefore the study targeted 500 people.

Table 3.1: Summary of Target Population

Stratum	Target Population	Percentage
Kenya Port Authority	**100**	20
Conventional Cargo Operations	**200**	40
Container Terminal Operations	**200**	40
Total	**500**	**100**

Sampling Frame

The sampling frame describes the list of all population units from which the sample was selected (Cooper & Schindler, 2003). It is a physical representation of the target population and comprises all the units that are potential members of a sample (Kothari, 2008). Kerlinger (1986) states that a sample size of 10% of the target population is large enough. Therefore, a proportionate sample size of appropriately 50 respondent which is 10% of the population was selected using a stratified sampling technique from the identified sample as shown in Table 3.1.

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Table 3.2: Sampling Frame

Department-Section/Unit	Target Population	Frequency	Percentage
Kenya Port Authority	**100**	**10**	10%
Conventional Cargo Operations	**200**	**20**	10%
Container Terminal Operations	**200**	**20**	10%
Total	**500**	**50**	**100%**

Sampling and Sample size

Keller (2009) indicates that a sample is a set drawn from the entire population. A stratified sampling technique was employed to stratify three (3) units at the Port of Mombasa: Kenya Port Authority (KPA) with 100; Conventional Cargo Operations with 200 and Container terminal Operations with 200. As Kothari (2004) expresses, a sample size between 10% and 20% is considered adequate for in-depth studies. Therefore, the sample size for this study was 10%.

Instruments

The main instrument employed for data collection in this research was questionnaire. A 1 – 3, 1 – 4 and 5-point Likert scale questionnaire was administered to the respondents.

Data Collection Methods

The data collection process was done through a systematic sequence of events. The process began by first seeking permission from the Principal Human Resources Development Officer of Kenya Port Authority in order to avoid any possible stop that might have arisen from lack of permission to conduct the research. 30 This was followed by sample selection based on the strata as explained in the sampling technique above. However, the researcher made a self-introduction and requested for consent of the respondents in taking part in the exercise. Subsequently, questionnaires were them administered to the respondents. On the other hand, the secondary data were collected from existing literature relating to the study topic.

Reliability and validity

"It is important that all surveys are tested before the actual survey is conducted. This is done to ensure that the questionnaire is cleared to respondents and can be completed in the way the researcher wishes" (John Adams et al., 2007). Pilot testing is an activity that helps the study in determining whether there are errors, limitations, or other weaknesses within the design and allow the researcher to make necessary adjustments and corrections before embarking on the survey. A pilot study was undertaken on approximately 10 freight forwarder and shipping lines agents since they are directly involved with container operations to test the reliability and validity of the questionnaire.

Data Processing and Analysis

Data for this study was quantitative in nature. Quantitative analysis was done for the numerical data obtained from the field. This was done using descriptive statistics with the help of Statistical Package for Social Sciences (SPSS) and Microsoft Excel 2013. The responses in the questionnaire was coded into common themes to facilitate analysis. Data was presented in

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descriptive form supported by tables, frequency distributions and percentages. The researcher used likert scale as parameter to measure the variables.

RESEARCH FINDINGS AND DISCUSSIONS

Introduction

The chapter represents the empirical findings and results of the research. The data presented includes response rate, background information of the respondents and the presentation of research findings against each individual specific objective. Descriptive statistics was also employed in analyzing the findings.

Response Rate

From the data collected, out of 60 questionnaires administered, 30 were filled and returned which represents 50% response rate. Such a response rate is considered adequate according to Mugenda and Mugenda (2003) who mentioned that a 50% response rate is adequate, 60% good and above, while 70% is rated very good. This also collaborates with Bailey (2000) assertion that a response rate of 50% is adequate, while a response rate greater than 70% is very good. This infers that the response rate in this case of 50% was an adequate representation of the entire targeted population.

Data Presentation and Findings

Background Information

The study sought to establish the background information of the respondents by using the following parameters: gender, age, level of education, type of organization, name of department section/unit, position held by the respondents, and number of years respondents have been working with the department.

Gender Distribution

Table 4.1: Gender of the Respondents

Gender	Frequency	Percentage
Male	22	73.3%
Female	8	26.7%
Total	**30**	**100**

The descriptive statistics of the study indicates that 22 (73.3%) of the respondents were male, while the remaining 8 (26.7%) were female as shown in Table 4.1. This implies that male respondents participated more in answering the questionnaires.

Age of the Respondents

Table 4.2: Age of the Respondents

Age	Frequency	Percentage
Less than 24 years	0	0%
25 – 29 years	0	0%
30 – 45 years	21	70%
46 – 50^{+} years	9	30%
Total	**30**	**100**

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The finding shows that 70% of the respondents are aged between 30 – 45 years, 30% of the respondents are aged between 46 – 50^{+} years. This implies that majority of the respondents are aged between 30 – 45 years.

Level of Education

Table 4.3: Level of Education

Level of Education	Frequency	Percentage
Diploma	19	63.3%
First degree	0	0%
Post Graduate degree	3	10%
Certificate	5	16.6%
"O" Level	2	6.7%
CPA	1	3.3
Total	**30**	**100**

From the descriptive statistics shown in table 4.3, 19 (63.3%) of the respondents were reported to be diploma holders, 3 (10%) of them were holders of Post Graduate degree, 5 (16.7%) of the respondents were holders of certificate, 2 (6.7%) were reported to be holders of "O" Level, while the remaining 1 (3.3%) respondent had CPA.

Type of Organization

Table 4.4: Type of Organization

Organization Type	Frequency	Percentage
Container Terminal Operations	22	73.3%
Conventional Cargo Operations	3	10%
KPA	5	16%
Total	**30**	**100**

The finding reveals that 73.3% of the respondents came from container terminal operations department, 3 (10%) of the respondents are from Conventional Cargo Operations, while 5 (16.7%) of them came from Kenya Port Authority (KPA). This implies that majority of the responses came from the Container Terminal Operations department.

Name of Department section/unit

Table 4.5: Department Section/unit

Section/Unit	Frequency	Percentage
Conventional Cargo Operation	9	30%
Monitoring and Control	1	3.3%
Heavy Lift	1	3.3%
Railtainer Services	1	3.3%
Container Terminal Operations	11	36.7%
Administration	2	6.7%
Planning Office	2	6.7%
Manifest	1	3.3%
Claim and refund	1	3.3%
Shore	1	3.3%
Total	**30**	**100**

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Table 4.5 shows that 30% of the respondents came from the Conventional Cargo Operations department/section, 3.3% of the respondent came from monitoring and Control section, 3.3% of the respondent works in Heavy Lift section, 3.3% of the respondent works in Railtainer Services section, 36.7% of the respondents came from Container Terminal Operation department/section, 6.7% of the respondent came from Administration, 6.7% of the respondents came from Planning Office section, 3.3% of the respondent work in Manifest section, 3.3% of the respondent work in Claim and Refund section, while 3.3% of the respondent works in Shore section.

What is your position/status in the organization?

Table 4.6: Respondent Position

Position	Frequency	Percentage
Senior Manager	2	6.7%
Middle Manager	5	16.7%
Junior Manager	18	60%
Operator	0	0%
Clerical	3	10%
Docker	1	3.3%
Unionisable	1	3.3%
Total	**30**	**100**

The finding from Table 4.6 depicts that 6.7% of the respondents hold the position of Senior Manager, 16.7% of the respondents hold the position of Middle Manager, 60% of the respondents hold the position/status of Junior Manager, 10% of the respondents are clerical workers, 3.3% of the respondent holds the position of Docker, 3.3% of the respondent holds the position of Unionisable, while operator position accounts for 0%. This shows that majority of the respondents hold the position/status of Junior Manager.

How many years have you worked in this organization?

Table 4.7: Number of Years you have worked in the organization

Year	Frequency	Percentage
Over 10 years	22	73.3%
6 – 9 years	8	26.7%
3 – 5 years	0	0%
Less than 2 years	0	0%
Total	**30**	**100**

The finding from Table 4.7 shows that 73.3% of the respondents have worked in their respective department/section for over 10 years, 26.7% of the respondents have worked between the periods of 6 – 9 years. While none of the respondents worked between a period of 3 – 5 years and less the 2 years respectively. This shows that majority of the respondents have worked with their respective departments/sections at the Port of Mombasa for over 10 years.

Container Terminal Efficiency

To what extend do you agree or disagree with the following statement.
Container Terminal Efficiency can be measured by the level of increase in inputs and throughput.

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The study sought to find out the extent of agreement or disagreement as to whether container terminal efficiency can be measured by the level of increase in inputs and throughput at the Mombasa Entry Port. As Figure 4.1 indicates, 6.7% of the respondents strongly disagree, 3.3% of the respondent disagree, 3.3% of the respondent was uncertain, 50% of the respondents agree while 36.7% of the respondent strongly agree. The finding shows that increasing the level of inputs and throughput in container terminal determines its efficiency.
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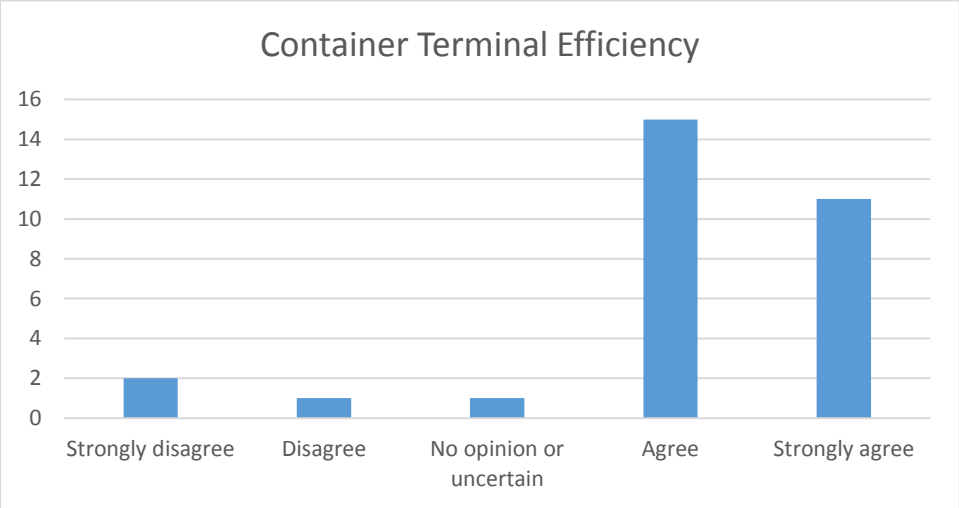

Figure 4.1: Container Terminal Efficiency

How do you assess the throughput of container cargo at the Port of Mombasa Currently?
The study sought to assess the current throughput of container cargo at the Port of Mombasa. It reveals that 40% of the respondents assess the throughput to be moderate, 53.3% assess it to be high, 6.7% of the respondents assess it to be very high, while very low and low options account for 0%. This implies that the throughput of container cargo at the Port of Mombasa currently is encouraging, due to its high throughput.

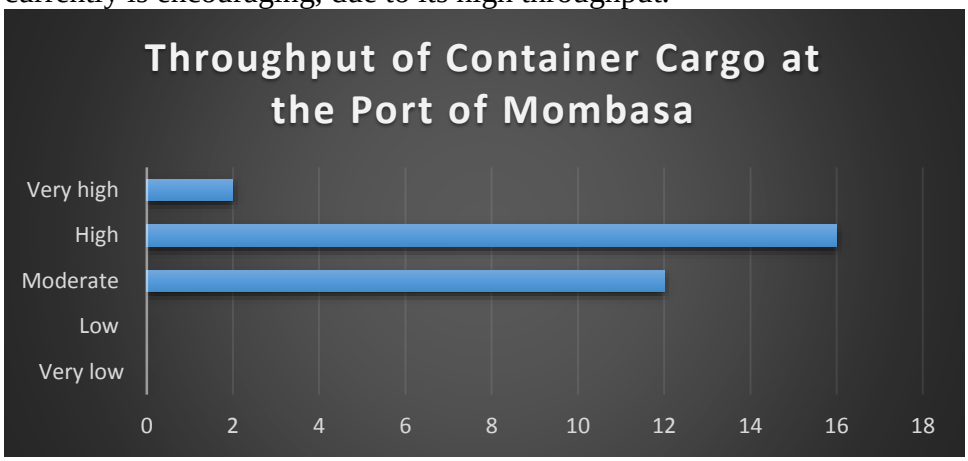

Figure 4.2: Throughput of Container Cargo at the Port of Mombasa

Do you think by expanding the current terminal will increase the volume of container inputs and throughputs respectively?

The study sought to ascertain as to whether expanding the current terminal will increase the volume of container inputs and throughputs respectively at the Port of Mombasa. Of the 30

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respondents, 30% of the respondents indicate maybe, meaning they are not too certain, 70% of the respondents overwhelmingly say yes, while 0% accounts for no. This infers that despite the current level of improvement at the port, it is imperative for incremental expansion to increase more container traffic.

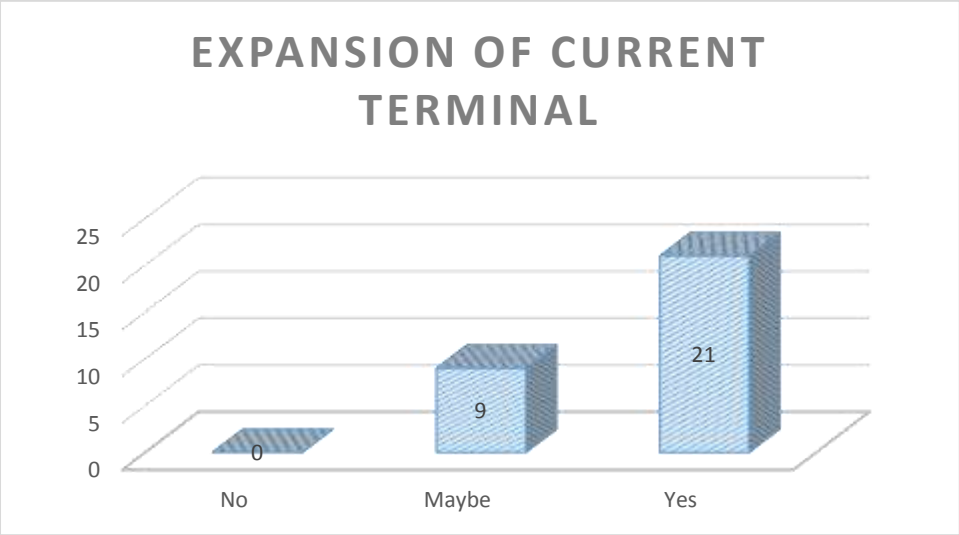

Figure 4.3 Expansion of Current Terminal

How do you grade the current performance of container terminal at the port of Mombasa?

The study aimed to grade the current container terminal performance at the port of Mombasa. Out of the 30 respondents, 3.3% of the respondent grades the current performance very poor, 0% accounts for poor, 46.7% of the respondents grades the performance on the average, 36.7% of the respondents grade the performance goo, while 3.3% of the respondent grades the performance to be excellent. This concludes that the current performance of container terminal at the Port of Mombasa is on the average.

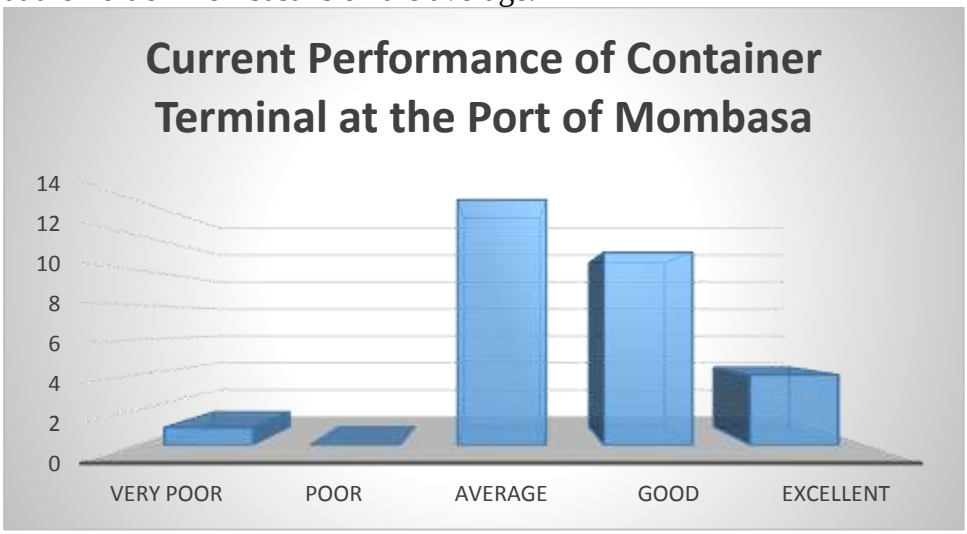

Figure 4.4: Current Performance of Container Terminal at the Port of Mombasa

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Quay Crane

How do you rank the performance of Quay Crane in terms of loading and unloading of vessels/trucks at the port of Mombasa?

A 5-point Likert Scale was used to rank the performance of Quay Crane in terms of loading and unloading of vessels/trucks at the port of Mombasa. The finding shows that 43.3% of the respondents rank the performance of Quay Crane on average, 50% of the respondents rank it good, 6.7% of the respondents rank the performance to be excellent, while very poor and poor were left unanswered. Therefore, the findings concludes that the performance of the Quay Crane in terms of loading and unloading of vessels/trucks at the port of Mombasa is good.

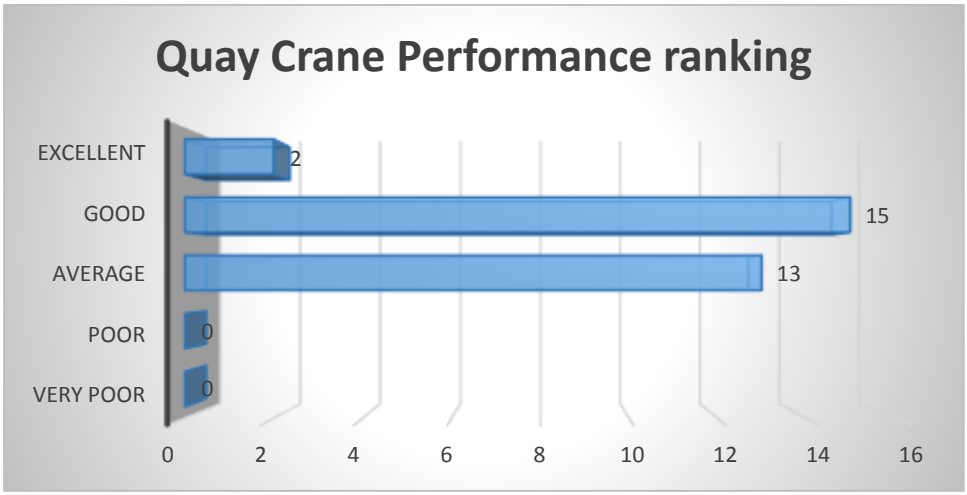

Figure 4.5 Quay Crane Performance Ranking

How do you grade the operational effectiveness of the current quay crane at the terminal?

The study sought to grade the operational effectiveness of the current Quay Crane at the terminal. Finding reveals that 3.3% of the respondents grades the operational effectiveness ineffective, 53.3% of the respondents grade it on average, 36.7% of the respondents grade the operational effectiveness very effective. This implies that the operational effectiveness of the current quay crane at the terminal is on average.

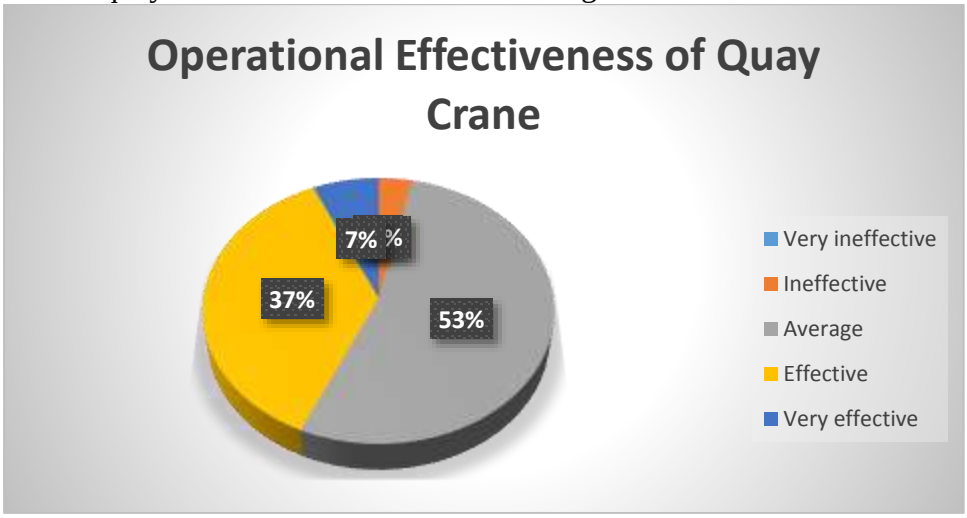

Figure 4.6: Operational Effectiveness of Quay Crane

On average, how could you measure yard crane operational efficiency?

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A 5-point Likert Scale was used to measure yard crane operational efficiency. Of the 30 respondents, 6.7% of the respondents' measure yard crane operational efficiency very good, 36.7% of the respondents measure it good, 56.7% say satisfactory, while poor and very poor were left unanswered.

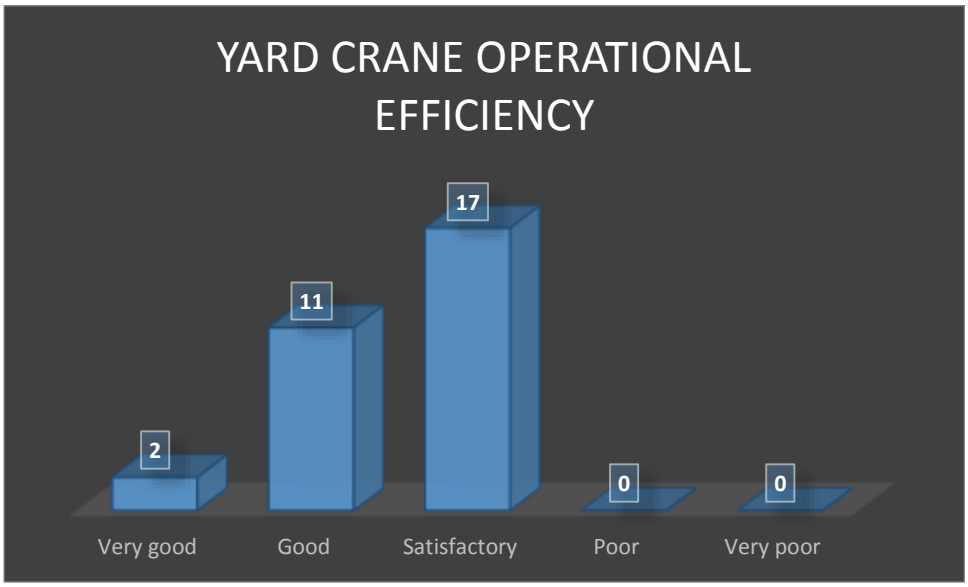

Figure 4.7: Yard Crane Operational Efficiency

4.6 Dwell Time

Table 4.8: Dwell time as an indicator to assess container terminal efficiency

Option	Frequency	Percentage
Strongly disagree	0	0%
Disagree	0	0%
No opinion or uncertain	0	0%
Agree	12	40%
Strongly agree	16	60%
Total	**30**	**100**

The study sought to find out the extent of agreement or disagreement as to whether dwell time is an indicator to assess container terminal efficiency at the Port of Mombasa. As Table 4.8 depicts, 40% of the respondents agree, 60% of the respondent strongly agree, while strongly disagree, disagree and uncertain were unanswered. The finding shows that dwell time is used as an indicator to assess the efficiency of container terminal.

Table 4.9 Turnaround time of trucks at the Port of Mombasa

Option	Frequency	Percentage
Very much below average	0	0%
Below average	18	60%
Above average	11	36.7%
Very much above average	1	3.3%
Total	**30**	**100**

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The study sought to find out the average position of turnaround time of trucks at the Port of Mombasa. Table 4.8.1 shows that, of the 30 respondents, 60% of the respondents place the turnaround time of trucks below average, 36.7% of the respondent place it above average, 3.3% of the respondent indicates very much above average, while very much below average was unanswered. This infers that the turnaround time of trucks at the Port of Mombasa is below average.

Table 4.10 Container ships Port of Call

Option	Frequency	Percentage
Hardly ever	0	0%
Occasionally	0	0%
Sometimes	1	3.3%
Frequently	19	63.3%
Almost always	10	33.3%
Total	**30**	**100**

A 5-point Likert Scale was used to establish the frequency of calls for container ships at the Port of Mombasa. The finding shows that 3.3% of the respondent says sometimes, 63.3% of the respondents say frequently, 33.3% of the respondents say almost always, while hardly ever and occasionally were unanswered. This infers that many container ships are called at the port of Mombasa frequently, due to its strategic location and being the major harbors for East Africa.

Table 4.11 Transactional dwell time at the port of Mombasa

Option	Frequency	Percentage
Very slow	0	0%
Slow	1	3.3%
Average	20	66.7%
Fast	9	30%
Very fast	0	0%
Total	**30**	**100**

The study sought to assess transactional dwell time at the Port of Mombasa. Of the 30 respondents, 3.3% of the respondent assess the transactional dwell time to be slow, 66.7% of the respondents assess it on average, 30% of the respondents assess the transactional dwell to be very fast, while very slow and very fast were unanswered. The finding therefore reveals that transactional dwell time which is the total time taken to complete clearance processes is on average.

Table 4.12: Discretionary dwell time at the port of Mombasa

Option	Frequency	Percentage
Very low	0	0%
Low	2	6.7%
Moderate	24	80%
High	4	13.3%
Very high	0	0%
Total	**30**	**100**

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The study sought to rate the current discretionary dwell time at the Port of Mombasa. Of the 30 respondents, 6.7% of the respondent rate the current discretionary dwell time to be low, 80% of the respondents rate it to be moderate, 13.3% of the respondents rate the current discretionary dwell time high, while very low and very high were unanswered. The finding therefore infers that the current discretionary dwell time which is the decision based on allowing cargo to stay longer time in the port is moderate.

Infrastructure

How do you assess the significance of both physical and soft infrastructure in terminal operation?

The study sought to assess the significance of both physical and soft infrastructure in terminal operations. So far, the finding reveals that 40% of the respondents assess both physical and soft infrastructure in terminal operations to be important, 60% of the respondents assess it to be very important, while the not important and somewhat important were unanswered. This implies that both physical and soft infrastructure play a major role in terminal operation.

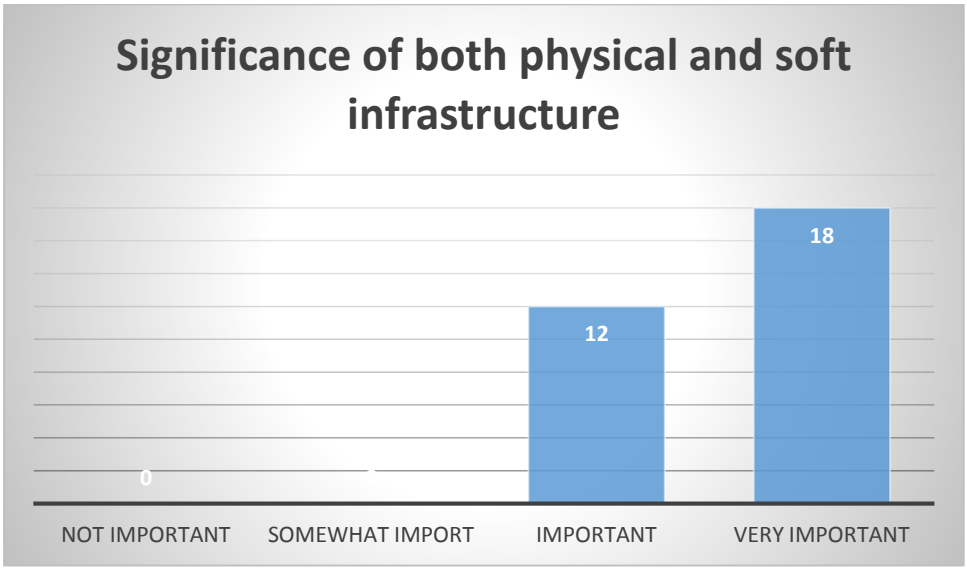

Figure 4.8: Significance of both Physical and Soft Infrastructure

How do you assess the congestion of container operations at the port of Mombasa?

A 5-point Likert Scale was used to assess the congestion of container operations at the port of Mombasa. Finding reveals that of the 30 respondents, 3.3% of the respondents assess the congestion problem of container operations to be very bad, 63.3% of the respondents assess it on average, 20% of the respondents assess it as being good, 13.3% of the respondents assess it to be very good, while none of the respondent mention it to be bad. This infers that the congestion problem of container operations at the port of Mombasa is on the average.

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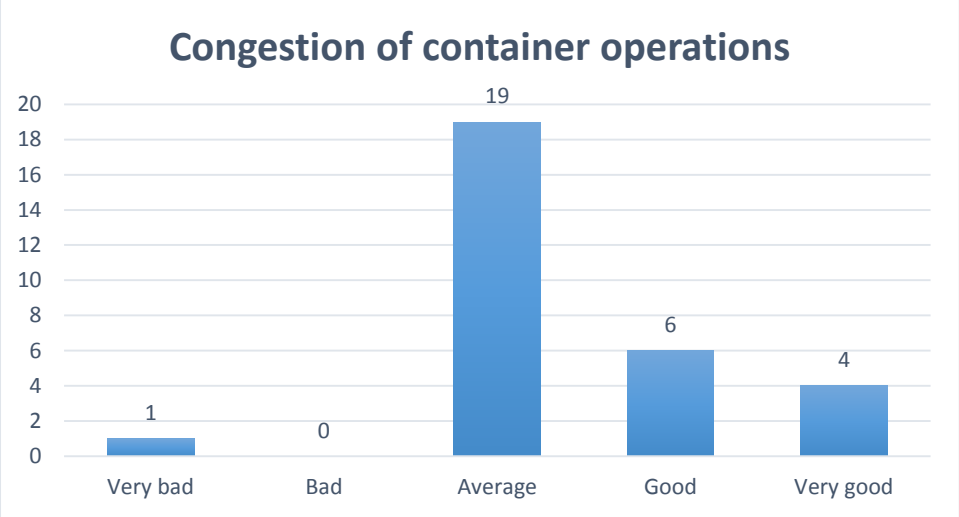

Figure 4.9: Congestion of Container Operations

How would you describe the nature of congestion at the port currently?

The study aimed to describe the current nature of congestion occurrence at the port. The finding shows that 36.7% of the respondents describe the current nature of congestion occurring occasionally, 60% of the respondents describe it occurring sometimes, 3.3% of the respondent describe it occurring frequently, while hardly ever and almost always were unanswered. Therefore, this suggests that the current nature of congestion at the Port of Mombasa occurs sometimes.

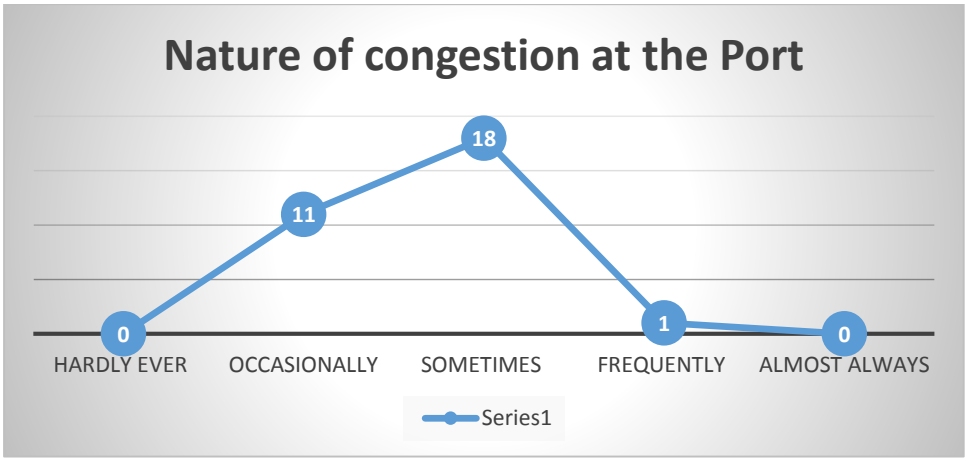

Figure 4.10: Nature of congestion at the Port of Mombasa

Generally, do you think by improving the Infrastructures will help minimize the congestion problem at the port of Mombasa?

The study sought to get the view of respondents as to whether improving the infrastructure at the port will help minimize the congestion problem at the Port of Mombasa. The finding reveals that 13.3% of the respondents say maybe, meaning they were uncertain to that, 86.7% of the respondents overwhelmingly say yes, while none of the respondent indicate no. This concludes that the congestion problem sometimes at the port can be minimized if only both infrastructures are improved.

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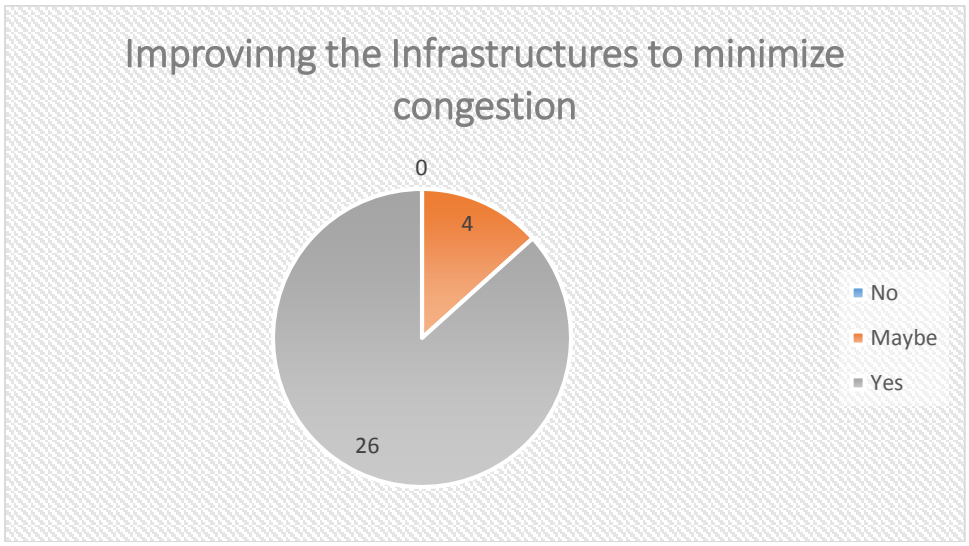

Figure 4.11: Improving the Infrastructures to minimize congestion

How do you assess the competency of terminal operators at the Port of Mombasa?

The study sought to assess the competency of terminal operators at the port of Mombasa. Finding reveals that out of 30 respondents, 80% of the respondents assess terminal operators to be competent, 20% of the respondents assess terminal operators to be highly competent, while not competent, some competent and uncertain were unanswered. This infers that terminal operators are well trained and competent.

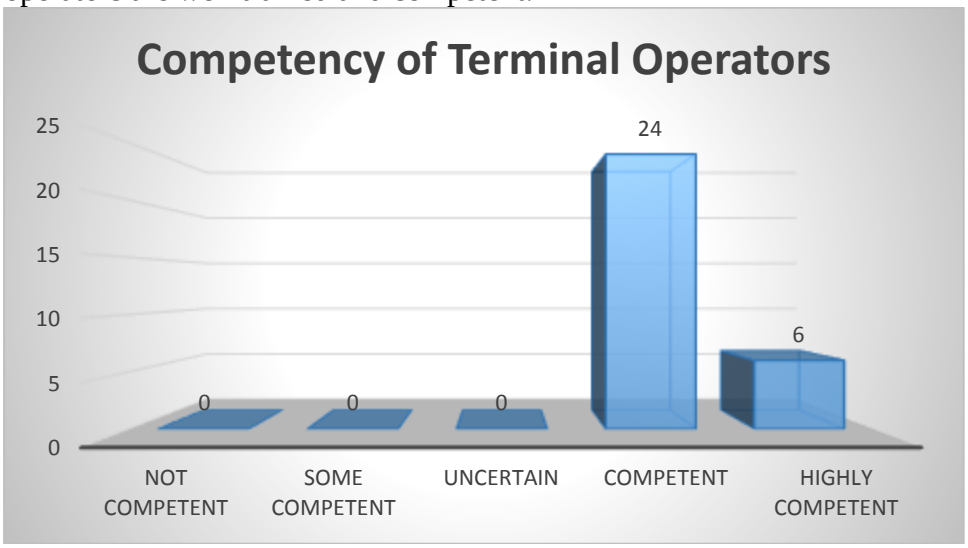

Figure 4.12: Competency of terminal Operators

Custom Clearance

What is the average number of days used in clearing containers at the port currently?

The study sought to find out the current average number of days used in clearing containers at the port. Finding reveals that 20% of the respondents say within 24 hours, 20% of the respondents say 1 – 3 working days, 60% of the respondents say on average is 4 – 6 working days, while 7 – 9 and 10 – 12 working days were unanswered. This shows that the average number of days used in clearing containers at the port of Mombasa is 4 – 6 working days; which is still below an internationally acceptable standards of maximum 3 days dwell time.

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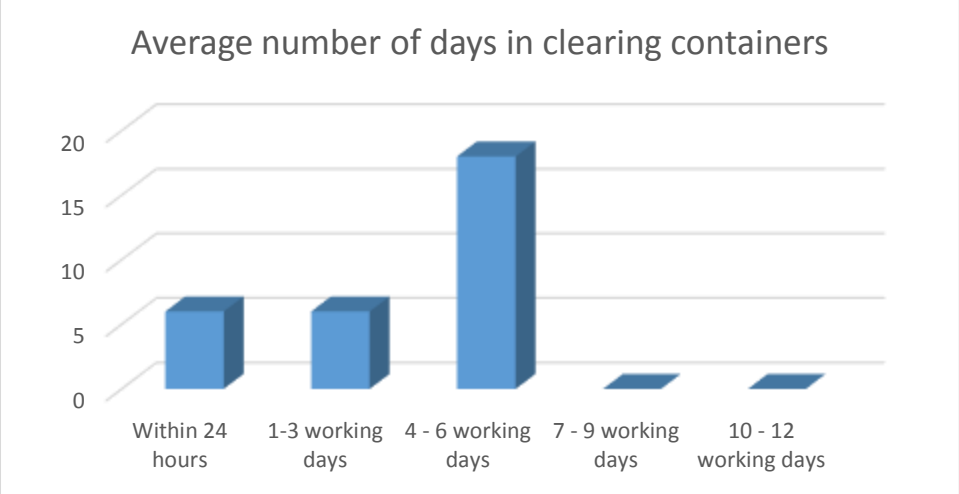

Figure 4.13: Average number of days in Clearing Containers

How do you measure the effectiveness of custom clearance services at the port?

The study sought to measure the effectiveness of custom clearance services at the port. Finding shows that, 10% of the respondents measure the effectiveness of custom clearance service ineffective, 56.7% of the respondents measure it on average, 30% of the respondents measure it effective, while none of the respondent measure it very ineffective. This implies that the effectiveness of custom clearance services at the port of Mombasa is on average.

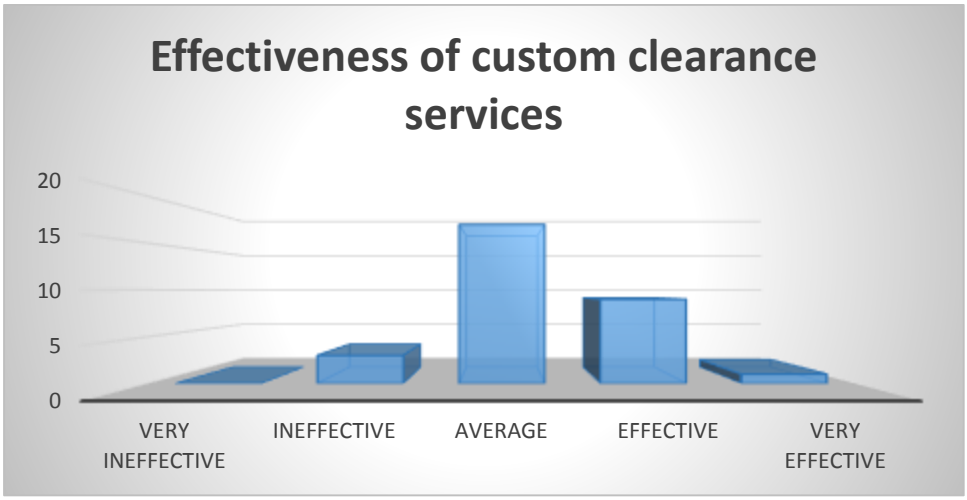

Figure 4.14: Effectiveness of Custom Clearance Services

Do you agree or disagree that security and custom practices are indicators for measuring container terminal efficiency?

The study aimed to determine the extent of agreement and disagreement as to whether security and custom practices are indicators for measuring container terminal efficiency. 6.7% of the respondents disagree, 3.3% of the respondent was uncertain, 66.7% of the respondents agree, 23.3% of the respondents strongly agree, while none accounts for strongly disagree. This finding concludes that both security and custom practices are indicators for measuring container terminal efficiency.

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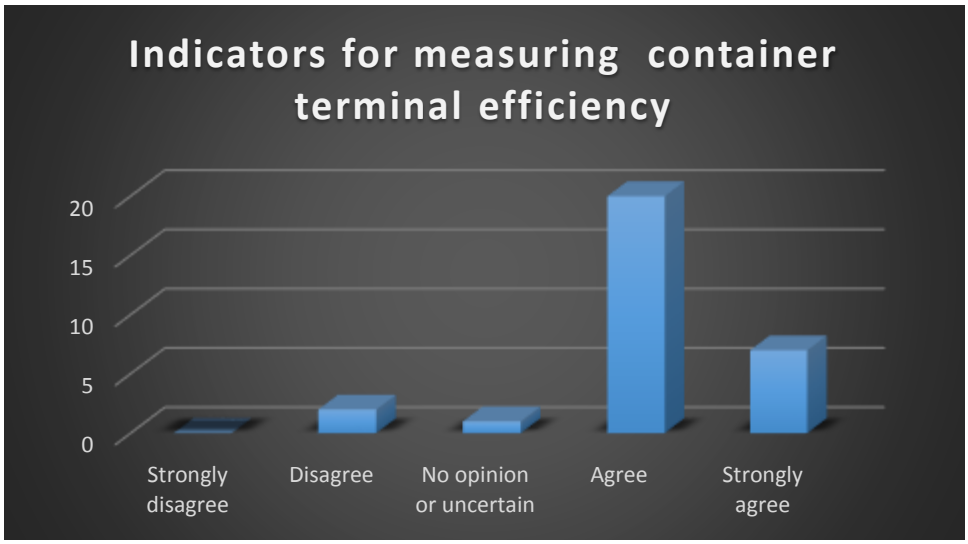

Figure 4.15: Indicators for measuring container terminal efficiency

Do you think that the lack of Integrated IT system poses substantial delays I custom clearance procedures?

The study sought to ascertain the opinion of respondents whether the lack of Integrated IT System poses substantial delays in custom clearance procedures. Finding shows that 3.3% of the respondents say no, 13.3% of the respondents say yes. This infers that the lack of Integrated IT System poses substantial delays in custom clearance procedures.
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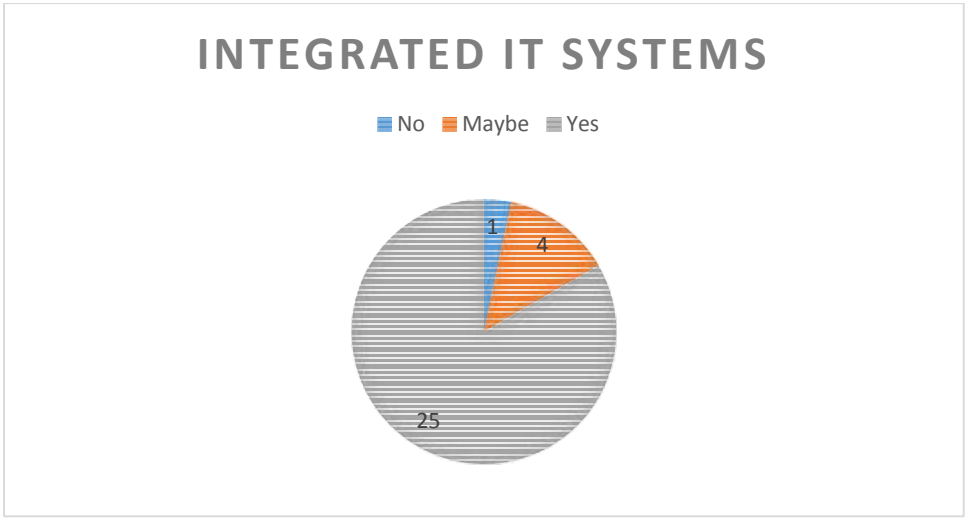

Figure 4.16: Integrated IT Systems

DISCUSSION OF FINDINGS

How does quay crane affect container terminal efficiency?

Quay Crane affect container terminal efficiency through three major factors: performance in terms of loading and unloading of vessels/trucks, operational effectiveness and operational efficiency. Majority of the respondents representing 50% rank the performance of quay crane at the port of Mombasa as being good. 53.3% of the respondents grade the operational effectiveness of the current quay crane at the terminal on average. Also the finding shows that

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56.7% of the respondents measure the operational efficiency of the yard crane to be satisfactory.

What role does dwell time play on container terminal efficiency?

Dwell time plays major role in determining container terminal efficiency. 60% of the respondents strongly agree that dwell time is an indicator to assess the efficiency of container terminal. As it relates to the turnaround time of trucks at the port, 60% of the respondent place it below average. With respect to the frequency of ships calling at the port, 63.3% of the respondents indicate frequently. This is due to it being the largest port in East Africa and it strategic location which serves other East African countries. 66.7% of the respondents assess transactional dwell time at the port to be on average. This is the total time taken to complete clearance processes. On the other hand, 80% of the respondents rate discretionary dwell time to be moderate. This is the decision based on allowing cargo to stay longer time in the port

How does infrastructure influence container terminals efficiency?

Infrastructure for the purposes of this study refers to both physical (hard Infrastructure) and soft (Management of Port operations) which inversely influence container terminals. 60% of the respondents assess infrastructure to be very important. 63.3% of the respondents assess the congestion of container operations at the port to be on average, due to limited yard capacity to store container before collection. 60% of the respondents indicate that congestion sometimes take place in the port. This reflects the limited space available to hold containers and trucks respectively. As a result of the congestion problems, major of the respondents accounting for 86.7% indicate that infrastructure needs to be improved in order minimize the congestion problems that sometimes occur at the port.

What is the effect of clearance procedures on container terminal efficiency?

Findings from the study reveals that 60% of the respondents indicate that the average number of days used in clearing containers at the port currently is between 4 – 6 working days. This is still below an internationally acceptable standards of a maximum 3 days dwell time. Findings shows that 56.7% of the respondents measure the effectiveness of custom clearance services at the port to be on average. As it relates to security and custom practices being an indicators for measuring container terminal efficiency, 66.7% of the respondents agree. While majority of the respondents accounting for 83.3% agree that the lack of Integrated IT system poses substantial delays in custom clearance procedures.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

The objective of the study was to assess factors Influencing Container Terminals Efficiency; a case study of the Mombasa Entry Port. Previous studies have revealed that container terminal efficiency is influenced by many factors which include but not limited to: quay crane, dwell time, infrastructure, custom practices and security measures, truck turnaround time, etc. The study thoroughly assessed these factors and discussed the extent to which they influence container terminal efficiency within the maritime industry. The study also looked at two major theories: Data Envelopment Analysis (DEA) and DEA Window Analysis as well other empirical studies relating to the topic. The study targeted population included freight forwarders/shippers, shipping lines/agents, Kenya Port Authority (KPA) as well as container terminal operators. Questionnaire was used as a major instrument to obtain primary data. The

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questionnaire was designed using Likert scale ranging from 1-3, 1-4 and 1-5 respectively. A sample size of 50 respondents was used for the research of which 30 of the respondents participated in the survey. The data were analyzed using Statistical Package for Social Sciences (SPSS) and Microsoft Excel 2013.
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However, the findings revealed that container terminal efficiency is measured by the level of increase in inputs and throughput. The results indicated that the volume of container handled at the port of Mombasa is high and was revealed that expansion of the current terminal will certainly increase the volume of container inputs and throughput to meet international standards. The findings also revealed that the performance of container terminal at the Port of Mombasa is on average.

Additionally, findings indicated that quay crane performance in terms of loading and unloading of vessels/trucks at the Port of Mombasa is good. Also, findings indicated that the operational effectiveness of the current quay crane at the terminal is on the average. On the other hand, the findings revealed that yard crane operational efficiency is satisfactory.
Moreover, findings indicated that dwell time is an indicators to assess container terminal efficiency. Also, the results indicated that the turnaround time of trucks at the Port of Mombasa is below average. The results further indicated that ships are frequently called at the port. This is due to it being the largest port in East Africa and it strategic location which serves other East African countries. The findings indicated that transactional dwell time at the port of Mombasa is on average. This is the total time taken to complete clearance processes. The findings also revealed that the issue with discretionary dwell time at the port is moderate. This is the decision based on allowing cargo to stay longer time in the port.

As it relates to the significance of both physical and soft infrastructure in terminal operation, findings revealed that it is very important. The results indicated that the congestion problem of container operations at the port is on average. While findings revealed that the nature of congestion occurred sometimes. In reference to improving the infrastructure at the port in order to decongest container traffic, findings revealed that it is imperative.
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Also, findings indicated that terminal operators at the port of Mombasa are competent and well trained. Furthermore, findings revealed that the average number of days used in clearing containers at the port currently is between 4 – 6 working days, which is still below an internationally acceptable standards of a maximum 3 days dwell time. Findings revealed that the effectiveness of custom clearance services at the port is on average. It was also revealed that security and custom practices are indicators for measuring container terminal efficiency. Finally, findings indicated that the lack of Integrated IT System poses substantial delays in custom clearance procedures. Which is also attributed to container terminals efficiency.

CONCLUSION

This study aims to assess factors influencing container terminals efficiency. A case study of the Mombasa Entry Port. The study tries to answer the following questions:

1. How does quay crane affect container terminal efficiency?
2. What role does dwell time play on container terminal efficiency?
3. How does infrastructure influence container terminals efficiency?
4. What is the effect of clearance procedures on container terminal efficiency?

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To accomplish the research objectives, a 1- 3, 1 -4 and 5-point Likert Scale questionnaire survey was conducted from the 29th of October – the 7th of November 2014, using quantitative survey. The questionnaire was printed out in hard copy. The hard copy questionnaire was created using Microsoft Word 2013. As the survey was about container terminal efficiency, the respondents were all employees who were knowledgeable about container operations at the port of Mombasa.

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The data was analyzed using SPSS and Microsoft Excel 2013 respectively. All the research questions of the study were answered in chapter 4. From the survey conducted, findings revealed that container terminal efficiency is measured by the level of increase inputs and throughput. For the research question "**How does quay crane affect container terminal efficiency?"** The study found out that quay crane affect container terminal efficiency through three major factors: performance in term of loading and unloading of vessels/trucks; it operational effectiveness as well as it operational efficiency.

For the third research question "**How does infrastructure influence container terminals efficiency?"** The study found out that infrastructure both physical (hard infrastructure) and soft (Management of port operations) inversely influence container terminal efficiency. The following factors were associated with infrastructure: limited yard capacity to store container before collection, congestion problem due to over capacity. This can be overcome if the improvement of infrastructure is considered. From the last research question **"What is the effect of clearance procedure on container terminal efficiency?"** The study found out that the delays in clearance procedures relating to the average number of days to clear container has effect on container terminal efficiency. With respect to Mombasa port, it is 4 – 6 working days as revealed by the findings, which is still below an internationally acceptable standards to maximum 3 days dwell time. The study found out that the effectiveness of custom clearance services has effect on container terminal efficiency. Also, the study found out that the lack of integrated IT System poses delays in custom clearance procedures which inversely effect container terminal efficiency.

From the above findings, the study concludes that the lack of adequate and performing quay crane equipment, container cargo dwell time, vessels/trucks turnaround time, infrastructure both physical and soft, customer clearance procedure, security, and lack of integrated IT system in custom clearance procedure influence container terminal efficiency.

Therefore, the findings from this study have practical applications to maritime logistics in the global supply chain due to its evolving nature.

RECOMMENDATIONS

After the analysis of the research findings of all the collected data, the researcher is pleased to advance the following recommendations:

Quay cranes served as an essential elements of the transshipment of containers in the container terminals. It is therefore recommended that Kenya Port Authority (KPA), a state corporation clothed with the responsibility to "maintain, operate, improve and regulate the Port of Mombasa considers continuous investments in modern quay cranes as well as gantry cranes to supplement the current ones in order to continuously enhance productivity, increase container inputs and throughput respectively. This is indeed imperative due to the huge volume

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of container imports and exports the port handles as well as being the major harbor for its neighbor countries within East African and other part of the World. This in itself will make the Port of Mombasa survive the global competition in Maritime Logistics which will subsequently boost economic growth for Kenya as a Nation.

Based on the findings from the survey, the Government of Kenya needs huge investments in expanding the physical infrastructure such as adequate berthing facilities, wharves, yard capacity, quayside, railway, as well as expanding the hinterland road network. These physical infrastructure are the main determinants of port productivity, agility and efficiency. Not only that, but also invest in the soft infrastructure especially the ICT infrastructure. The ICT infrastructure needs to be re-engineered and handle by IT specialists who will then integrate various internal systems as well as external systems to which KPA does business with. When both internal and external systems are integrated, it will streamline the port operations, business processes and reduce some of those barriers like long cargo dwell time, delays in custom and clearance processes, long waiting time of vessels at deep seas, etc. These barriers cause the Kenya Government to lose millions of shillings every year. Kenya as a nation depends heavily on international trade due to its strategic location, by investing more in the infrastructures especially the hinterland connections to its regional borders will accelerate trade growth and significance increase in revenue growth will be realized thus making the Port of Mombasa competitive.

Finally, it is recommended based on the findings that the Management of Kenya Port Authority invest more on training and development of staff and employees. This will also minimize some of the human errors and duplications of business processes that normally occur on the job site. It was revealed from the survey that majority of the respondents are diploma holders and are in higher positions with their respective department/sections and have worked with KPA for over 10 years. The level of education when compare with the position occupied had some implications when it comes to performance and output.

AREAS FOR FURTHER RESEARCH

Further research should be undertaken on the following areas: Container Cargo Handling Safety Policy Implementation in Maritime Logistics and the Role Global Supply Chain plays in Container Terminals Security. These areas have been identified for future research so as to contribute to the academic debate in Maritime Logistics in Global Supply Chain.

REFERENCES

Acciaro, M. and Serra, P. (2013). “Maritime Supply Chain Security: A Critical Review”, in *IFSPA 2013, Trade Supply Chain Activities and Transport: Contemporary Logistics and Maritime Issues*, pp. 636

Alreck, P and R. B. Settle (1985). The Survey Research Handbook. Homewood, Illinois: Irwin

A. Lim, B. Rodrigues., F. Xiao, and Y. Zhu, (2002). “Crane scheduling using Tabu search”, *Proceedings of the 14th IEEE International Conferenceon Tools with Artificial Intelligence*.

Bailey, R., Qi Chen, Ellen E, and Abbie S., (1998). Competitive advantage, Journal of Accounting and Economics 37, 1670201.

Bakshi, N., Flynn, S.E. and Gans, N. (2011). “Estimating the operational impact of container inspections at international ports”, *Management Science*, vol. 57, no. 1, pp. 1-20.

ISSN 2054-0930 (Print), ISSN 2054-0949 (Online)

Barros, C. (2003). "Incentive Regulation and Efficiency of Portuguese Port Authorities", *Maritime Economics & Logistics*, 5 (1), 55-69

Barros, C. and Athanassiou, M. (2004). Efficiency in European Seaports with DEA: Evidence from Greece and Portugal. Maritime Economics & Logistics, 6, 122-140

Bichou, K. (2011). "Assessing the impact of procedural security on container port efficiency", *Maritime Economics and Logistics*, vol. 13, no. 1, pp. 1-28.

Castro, C.F.d. (1999). Containerization, Logistic Cost and Facilitation (less documented aspects of an old theme). In Regional transport and transit facilitation workshop. Bangkok.

Chang, Y-T., Lee, S-Y., Tongzon, J. (2008). Port selection factors by shipping lines: Different perspectives between trunk liners and feeder service providers, *Marine Policy*, Vol. 32, p. 877 885.

Chin, A., Tongzon, J., (1998). Maintaining Singapore as a major shipping and air transport hub. In: Toh, T. (Ed.), Competitiveness of the Singapore Economy. *Singapore University Press, Singapore*, pp. 83–114.

Clark, X., Dollar, D. and Micco, A. (2004). "Port Efficiency, Maritime Transport Costs, and Bilateral Trade", *Journal of Development Economics*, vol. 75 2, pp. 417-50.

Creswell, J.W. (2003). Research design: Qualitative, Quantitative, and mixed methods

Cooper, D.R and Schindler, P.S. (2003*). Business research methods*. Irwin: McGraw-Hill.

Cullinane, K. and Khanna, M. (1999), "Economies of Scale in Large Container Ships", *Journal of Transport Economics and Policy*, vol. 33 2, pp. 185-207.

Cullinane, K., Wang, T-F. (2006). *The Efficiency of European container ports: across-sectional Data envelopment analysis*, International Journal of Logistics: Research and Applications, Vol.9, No.1, pp 19-31.

Cullinane, K. P. B., Song, D. W. and Gray, R. (2002). A Stochastic Frontier Model of the Efficiency of Major Container Terminals in Asia: Accessing the Influence of Administrative and Ownership Structures. *Transportation Research Part A*, 36, pp. 743-762.

D. H. Lee, H. Q. Wang, and L. Miao (2000). "Quay crane scheduling with non-interference constraints in port container terminals", *Transportation Research E*, 44, pp. 124-135.

East Africa Logistics Performance Survey (2012).

ESCAP. (2005). Regional shipping and port development strategies (container traffic forecast): Economic and Social Commission for Asia and the Pacific, United Nations.

Fraenkel, J. R. and N. E. Wallen (2002), How to Design and Evaluate Research in Education, 4th ed. – Boston

Gilman, S. (1999). "The size economies and network efficiency of large containerships", *Maritime Economics and Logistics*, vol. 1, no. 1, pp. 39-59.

Guan, Y., & Yang, K.H. (2010). Analysis of berth allocation and inspection operations in a container terminal. Maritime Economics and Logistics, 12, 347-369.

Haralambides, H. E. (2002). Competition, excess capacity, and the pricing of port infrastructure. *International Journal of Maritime Economics, 4(4)*, 323-347.

Haralambides, H. E., Cariou, P., and Benacchio, M. (2002). Costs, Benefits and Pricing of Dedicated Container Terminals.*International Journal of MaritimeEconomics*, 4, pp. 21-34.

Haralambides, H.E. and Londoño-Kent, M.P. (2004). "Supply Chain Bottlenecks: Border

ISSN 2054-0930 (Print), ISSN 2054-0949 (Online)

Crossing Inefficiencies between Mexico and the United States", *International Journal ofTransport Economics,* vol. 31 2, pp. 183-95.

Huynh, N. (2009). "Reducing truck turn times at marine terminals with appointment scheduling",*Transportation Research Record: Journal of the Transportation ResearchBoard*, vol. 2100, no. 1, pp. 47-57.

John Adams, Haftz T.A. Khan, Robert Raeside and David White (2007). Research Methods for Graduate Business and Social Science Students, New Delhi, pp.136.

Kaisar, I.E., Pathomsiri, S., Haghani, A. (2006). *Efficiency Measurement of US Ports Using Data Envelopment Analysis*, National Urban Freight Conference, Long Beach California.

Kerlinger, F. (1986). *Foundations of behavior research* (3rd ed.). New York: Holt, Rinehart, and Winston.

Keller, G. (2009). *Mangerial Statistics Abbreviated*, 8th ed. South Western: Cengage Learning. 2-4,159, 513, 355.

Kenya Ports Authority Annual Review and Bulletin of Statistics, (2012).

Kenya Ports Authority, Annual Review and Bulletin of Statistics, (2009).

KPA, Container Dwell Time Study for the Port of Mombasa, March (2010).

K. H. Kim, and Y. M. Park, (2004). "A crane scheduling method for port containers", *European Journal of Operation Research*, 156, pp 752-768.

Kothari, C. (2004). *Research methodology,methods & techniques* (2nd ed.).New Delhi: Wishwa Prakashan.

Langen, de, P.W. (2003), Forecasting Container Throughput: A Method and Implications for Port Planning, *Journal of International Logistics and Trade*, Vol. 1(1), pp. 29-39.

Langen, de P.W., Nijdam, M., Horst, van der, M. (2007). New indicators to measure port performance, *Journal of Maritime Research*, Vol. 5(1), p. 23-26.

Langen, de, P.W., Nijdam, M.H., van der Lugt, L.M. (2010). *Port Economics, Policy and Management*.Erasmus University Rotterdam.

Lee, D.-H., Wang, H. Q., & Miao, L. (2008). Quay crane scheduling with non-interference constraints. *Transportation Research Part E: Logistics and Transportation Review, Volume 44* (Issue 1), 124-135.

Levinson, M. (2006). *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger*. Princeton University Press.

Maloni, M., Paul, J.A. and Gligor, D.M. (2013). "Slow steaming impacts on ocean carriers and shippers", *Maritime Economics and Logistics*, 15, 151-171.

Min, H., Park, B.I (2005).: *Evaluating the inter-temporal efficiency trends of international container terminals using data envelopment analysis*, Int. J. Integrated Supply Management, Vol. 1, No. 3, pp 258-277

Notteboom, T., Konings, R., (2004). "Network dynamics in container transport", *Belgian journal of geography - BELGEO*, Volume 5, Number 4, 461-478.20.

Notteboom, T. (2008). "*The Relationship between Seaports and the Inter-modal Hinterland in light of Global Supply Chain: European Challenges"* Discussion paper no. 2008-10.Joint Transport Research Centre, OECD / International Transport Forum, Paris.

Mugenda,A .and Mugenda, O (.2003). *Research methods*; *quantitative and qualitative approaches*. Africa Center for Technology (ACTS), Nairobi Kenya

OECD (2008). *International Transport Forum*, Discussion Paper.

ISSN 2054-0930 (Print), ISSN 2054-0949 (Online)

http://www.internationaltransportforum.org/jtrc/discussionpapers/DP200819.pdf

Roll, Y. and Nayuth, Y. (1993). "Port Performance Comparison Applying Data Envelopment Analysis (DEA)", *Maritime Policy and Management*, 20 (2), 153-161.

Roso, V., Woxenius, J. and Lumsden, K. (2009). "The dry port concept: connecting container seaports with the hinterland", *Journal of Transport Geography*, vol. 17, no. 5, pp. 338-345.

Roso, V. 2008, "Factors influencing implementation of a dry port", *International Journal of Physical Distribution and Logistics Management*, vol. 38, no. 10, pp. 782-798.

Roso, V. and Lumsden, K. (2010). "A review of dry ports", *Maritime Economics and Logistics*, vol. 12, no. 2, pp. 196-213.

Stahlbock, R. and Voß, S. (2008). "Operations research at container terminals: a literature update", *Or Spectrum*, vol. 30, no. 1, pp. 1-52.

Sekaran, U. (2010). *Research Methods for business* :A skill Building Approach (5th Edition .) USA: John wiley & Sons Publisher

Steenken, D., Voß, S., Stahlbock, R., (2004). "Container terminal operation and operations research – a classification and literature review", *OR Spectrum*, Springer-Verlag GmbH, Volume 26, Number 1.

Suykens, F. (1996). Influence of Port Tariffs on Maritime TransportÓ. VI International Congress of Maritime Traffic and Port Handling. Vigo (Spain).

Suykens, F. and van de Voorde, E. (1998). "A quarter a century of port management in Europe: objectives and tools", *Maritime Policy and Management*, vol. 25, no. 3, pp. 251-261.

Tongzon, J. (1995). Determinants of Port Performance and Efficiency, *Transportation Research Part A*, Vol. 29, p. 245–252.

Tongzon, J. (2002). *Port Choice Determinants in a Competitive Environment*, IAME Conference, Panama.

Tongzon, J., Chang, Y., and Lee, S. (2009). How supply chain oriented is the port sector? *International Journal of Production Economics*, 122, 21–34.

Tongzon, J., Heng, W. (2005). Port privatization, efficiency and competitiveness: Some empirical*evidence from container ports (terminals). Transportation Research Part A*, Vol. 39, p. 405–424.

Tongzon, J., Chang, Y. and Lee, S. (2009). "How supply chain oriented is the port sector?" *International Journal of Production Economics*, vol. 122, no. 1, pp. 21-34.

UNCTAD. (2006). Review of maritime transport, 2005: United Nations.

UNECE (1998). *UN/LOCODE - Code for ports and other locations, Regulation 16*, UN, Geneva.

United Nations Conference on Trade and Development (2006). *Review of Maritime Transport*. New York and Geneva: Author.

United Nations Conference on Trade and Development (2011). *Review of Maritime Transport*. New York and Geneva: Author.

UNCTAD, (2003). Review of Maritime Transport.

UNCTAD, (2009). *Review of Maritime Transport*, Report by the UNCTAD Secretariat, accessible online at www.unctad.org

Valentine, V.F., Gray, R. (2001). *The measurement of port efficiency using data envelopment analysis*, in Proceedings of the 9th World Conference on Transport Research, Seoul.

Valentine, V.F. And Gray, R. (2002). An Organizational Approach to Port Efficiency. IAME Panama.

Van De Voorde, E. and Vanelslander T. (2008). Market Power and Vertical and Horizontal

ISSN 2054-0930 (Print), ISSN 2054-0949 (Online)

Integration in the Maritime Shipping and Port Industry.*OECD WorkingPapers*. http://puck.sourceoecd.org/vl=4200552/cl=11/nw=1/rpsv/cgi-bin/wppdf?file=5ksq6288rbd8.pdf

Vis, I. and R. Koster. (2003). Transshipment of containers at a container terminal: An overview. European Journal of Operational Research, 147:1-16

Vogt, W. Paul (1999). *Dictionary of statistics and methodology*. Sage: Thousand Oaks, California.

Wiegmans, B.W., van der Hoest, A. and Notteboom, T. E. (2008). "Port and terminal selection by deep-sea container operators" *Maritime Policy and Management*, vol. 35, no. 6, pp. 517-534.

Wiegmans, B.W., Van der Hoest, A., Notteboom, T.E. (2008). Port and terminal selection by deep-sea container operators, *Maritime Policy and Managements: The flagship journal of international shipping and portresearch*, Vol. 35(6), p. 517-534.

Wiegmans, B.W., Rietveld, P., Pels, E. and van Woudenberg, S. (2004). "Container Terminals andUtilisation of Facilities", *International Journal of Transport Economics*, vol. 31 3, pp. 313-39.

Wiegmans, B. (2003). Performance conditions for container terminals. *Maritime Economics & Logistics*, 6, 276–277.

Wiegmans, B.W., van der Hoest, A. and Notteboom, T. E. (2008). "Port and terminal selection by deep-sea container operators" *Maritime Policy and Management*, vol. 35, no.6, pp. 517-534.

Yang, Y. (2010). "Impact of the container security initiative on Taiwan's shipping industry", *Maritime Policy and Management*, vol. 37, no. 7, pp. 699-722

Yap, W.Y. and Lam, J.S.L. (2013). "80 million-twenty-foot-equivalent-unit container port? Sustainability issues in port and coastal development", *Ocean and Coastal Management*, vol. 71, no. 0, pp. 13-25.

Yeo, G., Pak, J. and Yang, Z. (2013). "Analysis of dynamic effects on seaports adopting port security policy", *Transportation Research Part A: Policy and Practice*, vol. 49, pp. 285-301.

APPENDICES

Appendix A: Introductory Letter to Respondents

Re: Data Collection
Dear Respondent,

I am a student pursuing Master of Science (MSc) degree in Procurement and Logistics at the Jomo Kenyatta University of Agriculture and Technology (JKUAT). Currently, I am undertaking a research study on **"FACTORS INFLUENCING CONTAINER TERMINALS EFFICIENCY; A CASE STUDY OF MOMBASA ENTRY PORT**, in partial fulfillment of the requirements for the award of the degree of Master of Science in Procurement and Logistics.

You have been selected to participate in the survey and the researcher would highly appreciate if you assist him by responding to all questions as completely, correctly and honestly as possible. It is solely for academic purposes. Your opinions, responses and views are very important to this study and will be completely confidential. No respondent will be identified.

Thank you very much for your participation, cooperation and understanding.

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Sincerely,

Samuel Monday Nyema
RESEARCHER

Appendix B: Questionnaire

SECTION A: BACKGROUND INFORMATION OF R OF RESPONDENTS

1. Sex of Respondent: (A) Male [ ] (B) Female [ ]
2. Age of Respondent: (A) Less than 24 years [ ]
   (B) 25 – 29 years [ ]
   (C) 30 – 45 year [ ]
   (D) 46 – 50^{+} years [ ]
3. Level of Education acquired: (A) Diploma [ ]
   (B) First Degree [ ]
   (C) Post Graduate Degree [ ]
   (D) Other (Specify)_____
4. Type of organization: (A) Container Terminal Operations [ ]
   (B) Conventional Cargo Operations [ ]
   (C) Other (Specify) _____
5. Name of Section/Department/Unit: _____
6. What is your position/status in the organization?
   (A) Senior Manager [ ]
   (B) Middle Manager [ ]
   (C) Junior Manager [ ]
   (D) Operator [ ]
   (E) Other (Specify)_____
7. How many years have you worked in this organization?

(A) Over 10 years [ ]
(B) 6 – 9 years [ ]
(C) 3 – 5 years [ ]
(D) Less than 2 years [ ]

SECTION B: CONTAINER TERMINAL EFFICIENCY

8. To what extend do you agree or disagree with the following statement.
   Container Terminal Efficiency can be measured by the level of increase in inputs and throughput.
   1 = strongly disagree { } 2 = Disagree { } 3= No opinion or uncertain { }
   4 = Agree { } 5 = strongly agree { }
9. How do you assess the throughput of container cargo at the Port of Mombasa currently?
   1 = Very low { } 2 = Low { } 3 = Moderate { } 4 = High { }
   5 = Very high{ }
10. Do you think by expanding the current terminal will increase the volume of container inputs and throughputs respectively.
    1 = No { } 2= Maybe { } 3 = Yes { }
11. How do you grade the current performance of container terminal at the port of Mombasa.

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1 = Very poor { } 2 = Poor { } 3 = Average { } 4 = Good { } 5 = Excellent { }

SECTION C: QUAY CRANE

12. How do you rank the performance of Quay Crane in terms of loading and unloading of vessels/trucks at the port of Mombasa?
    1 = Very poor { } 2 = Poor { } 3 = Average { } 4 =Good { } 5 = Excellent { }
13. How do you grade the operational effectiveness of the current quay crane at the terminal?

    1 = Very ineffective { } 2 = Ineffective { } 3 = Average { } 4 = Effective { } 5 = Very effective { }
14. On average, how could you measure yard crane operational efficiency
    5 = Very good { } 4 = Good { } 3 = Satisfactory { } 2= Poor { } 1 = Very poor { }

SECTION D: DWELL TIME

15. Do you agree or disagree that dwell time is an indicator to assess container terminal efficiency.
    1 = Strongly disagree { } 2 = Disagree { } 3= No opinion or uncertain { } 4= Agree { }
    5 = Strongly agree { }
16. What position would you place the turnaround time of trucks at the port of Mombasa
    1 = Very much below average { } 2 = Below average { } 3 = Above average { }
    4 = Very much above average { }
17. How often do container ships call at the port monthly.
    1 = Hardly ever { } 2 = occasionally { } 3 = sometimes { } 4 = frequently { }
    5 = Almost always { }

18. How do you assess transactional dwell time at the port of Mombasa
    1 = Very slow { } 2 = Slow { } 3 = Average { } 4 = Fast { } 5 = Very fast { }
19. How would you rate discretionary dwell time at the port currently?
    1 = Very low { } 2 = Low { } 3 = Moderate { } 4= High { } 5 = Very high { }

SECTION E: INFRASTRUCTURE

20. How do you assess the significance of both physical and soft infrastructure in terminal operation
    1 = Not important { } 2 = somewhat important { } 3 = important { }
    4= very important { }
21. How do you assess the congestion of container operation at the port of Mombasa
    1 = Very bad { } 2 = Bad { } 3= Average { } 4 = Good { }
    5= Very good { }
22. How would you describe the nature of congestion at the port currently?
    1 = Hardly ever { } 2= Occasionally { } 3 =Sometimes { } 4= Frequently { }
    5 =Almost always { }
23. Generally, do you think by improving the infrastructure will help minimize the congestion problem at the port
    1 = No { } 2 = Maybe { } 3= Yes { }
24. How do you assess the competency of terminal operators at the Port of Mombasa
    1 = Not competent { } 2= Some competent { } 3= Uncertain { } 4= Competent { }
    5 = Highly competent{ }

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SECTION F: CUSTOM CLEARANCE

25. What is the average number of days used in clearing containers at the port currently?
(A) Within 24 hours { }
(B) 1-3 working days { }
(C) 4 – 6 working days { }
(D) 7 – 9 working days { }
(E) 10 – 12 working days { }
26. How do you measure the effectiveness of custom clearance services at the port
1 = Very ineffective { } 2 = Ineffective { } 3 = Average { } 4 = Effective { }
5 = Very effective { }
27. Do you agree or disagree that security and custom practices are indicators for measuring container terminal efficiency
1 = Strongly disagree { }2 = Disagree { } 3= No opinion or uncertain { } 4 = Agree { }
5 = Strongly agree { }
28. Do you think that the lack of Integrated IT System poses substantial delays in custom clearance procedures.
1 = No { } 2 = Maybe { } 3 = Yes { }

END OF QUESTIONNAIRE
Thanks for your time and participation!

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