DETERMINANTS OF CONTAINER DWELL TIME: THE CASE STUDY OF MOMBASA PORT

BY:

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DECLARATION

This research paper is my original work and has not been presented for a degree award in any other university.

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APPROVAL

This research paper has been submitted with our approval as university supervisors

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DEDICATION

I dedicate this research work to my Dad (Mr. E.Mola) and Mum (Mrs. Saida. B. Mkala), indeed you really inspired me to have a reason to study and consistently stood by me.

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I pray that, the Good Lord, who knows how to bless, will richly do so.

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Operation Definition of Terms

(1) **Container Dwell Time** is the duration of stay of containers in the port from the time of discharge from the ship up to the time of delivery to the owner in the case of import cargo and vis à vis for export. Simply it is the time taken between the arrival of cargo and their release from the ports custody.

(2)A **Twenty-foot Equivalent Unit (TEU)** represents a twenty-foot container. A forty-foot equivalent unit (FEU) represents a forty-foot container and is equivalent to two TEUs. Industry standard is to represent volume in TEUs.

(3) OTIs includes freight forwarders, customs brokers, and non-vessel operating common carriers (NVOCCs).

(4) **Throughput** is the number of moves per hours a quay cranes move containers.

(5) **Logistics** is the process of planning, implementing and controlling the flow of storage of raw materials, inventory, finished goods, services and related information from the point of origin to the point of consumption (Coyle et al., 1999).

ABBREVIATIONS

AHP	Analytical Hierarchy Process
C&F	Clearing and Forwarding
CDO	Central Documentation Office
CFS	Container Freight Stations
COC	Certificate of Conformity
CRM	Customs Reforms and Modernization
DEPT	Department
DO	Delivery Order
EAC	East Africa Community
EDI	Electronic Data Interface (EDI)
GOK	Government of Kenya
GOI	Government of India
ICD	Inland Container Depot
KAM	Kenya Association of Manufacturers
KEBS	Kenya Bureau of Standards
KIFWA	Kenya International Freight and Warehousing Association
KEPHIS	Kenya Plant Health Inspectorate Services
KPA	Kenya Ports Authority
KRA	Kenya Revenue Authority
KRC	Kenya Railways Corporation
KSAA	Kenya Ships Agents Association
Kshs	Kenya Shillings
KTA	Kenya Transporters Association
KMA	Kenya Maritime Authority
GOK	Government of Kenya
LPI	Logistics Performance Index
MOT	Ministry of Trade
MPRO	Mombasa Port Release Order
OLS	Ordinary Least Square
OTIs	Ocean Transportation Intermediaries
PC	Performance Contract
P&L	Profit and Loss
RMG	Rail Mounted Gantry Crane
SPSS	Statistical Package for Social Scientist
STS	Ship-to-Shore Gantry Crane
TEUs	Twenty Foot Equivalent Units
T/MENT	Transshipment
UNCTAD	United Nations Conference on Trade and Development
US	United States of America
Vol	Volume
WB	World Bank

ABSTRACT

The purpose of the research was to study container dwell time, which is a major determinant of Mombasa port efficiency. The research, evaluate the determinants of dwell time and identify both the problem areas, potential corrective actions and the impact of different clearing processes/stakeholders in the dwell time and whether they affect each other. It also examined and addressed which process present the most immediate obstacles to the excessive dwell time. Lastly it finds out the possible corrective actions and recommendations, which will lead to the realization of the best practice in the port. The sampling procedure used is systematic sampling technique. Primary data was collected by use of self-administered questionnaire. The data was then analyzed using descriptive technique, regression model and appropriate tests were conducted with the aid of STATA programme.

The results from Ordinary Least Square estimates revealed that, the independent variables show a positive relation with the dwell time. Most of the dwell time delays were during lodging to passing but the terminal stage (T_4) and terminal to gate release stage (T_5) had the most influence on dwell time. Here the main players who should improve their performance level are the clearing agents, KRA and especially transporters since they are responsible from terminal to gate release.

CHAPTER ONE

1.0 Introduction

Levinson (2006) defined import container dwell time as, the total period that a container stays in port, which is from the time it is discharged from the ship to the time it is delivered or the measure of the time elapsed from the time the container arrives in port to the time the container leave the port premises, after all permits and clearances have been obtained. It is usually measured in days/ hours.

1.1 Historical Background of the Mombasa Port

The port came into existence as a result of the dhow trade between East Africa, the Arabian Gulf, India and the far East which was carried out primarily by Arabs during the 12th Century at Mombasa Old Port, situated on the North side of Mombasa Island. It development of the port of Mombasa into a modern port started in 1896, when the first jetty was built at Kilindini on the Western side of the island. It formed a crucial starting point for the exploration and resource exploitation of the East Africa hinterland, and served to support the construction of the Kenya Uganda railway (www.kpa.co.ke/History of Mombasa Port)

The Kenya Port Authority (K.P.A) was established by an Act of Parliament (CAP 391 of the law **of Kenya**) in 1978. KPA was enlarged in 1986 when it merged with the autonomous state organization Kenya Cargo Handling Ltd. to form a single body responsible for all aspects of national port development and operations. KPA manages the port of Mombasa, which includes Kilindini harbor, Port Reitz, the Old Port, Port Tudor and all the tidal waters encircling Mombasa Island and other small ports at the Coast. The port of Mombasa is at the forefront of trade facilitation and ensures significance as the gateway to East and Central Africa.

The vision of KPA is to be ranked among the top twenty ports in the world in terms of reputation and performance by 2010. Its vision is to facilitate sea borne trade, in the most efficient manner. The core functions include the provision of marine services, cargo handling services, land-based services, dockage of ships and short-term warehousing.

1.2 Background of the study

Steenken and Stahlbock (2004) found out that, today over 60 per cent of world's deep sea general cargo is transported in containers, whereas some routes are even containerized up to 100 per cent. International containerization market analysis still shows high increasing rates for container freight transportation in the future. This leads to higher demands on seaport container terminals, container logistic and management. With ever increasing containerization, the number of seaport container terminals and the competition among them has become quite remarkable.

The port of Mombasa is an important and valuable national economic asset Which if well managed can generate substantial income to this country. It is the largest and busiest port on the East African Coast. The Port of Mombasa also has enormous potential for many shipping opportunities especially for trans-shipment and transit cargo.

The port of Mombasa not only serve the local market, but also has the opportunity to serve the land locked countries like Uganda, Burundi, Democratic Republic of Congo, Rwanda ,the southern and northern part of Tanzania, the southern part of Somalia among others, which pay for the service rendered. As for year 2009 as shown in the table below, about twenty two percent (22.3 %) of the total cargo handled at the port of Mombasa, is transit cargo for the land locked countries, and about three percent (3.3 %) is transshipment The remaining seventy four percent (74.4 %) is consumed locally. The average container dwell time for 2009 was 5.9 days against 13.1 days in 2007, reflecting an improvement of 55 per cent or 7.2 days (KPA, 2008 -2009). In general there has been an increasing trend of container traffic as shown in the table below.

Table 1: CONTAINER TRAFFIC 2002- 2009 TEUs

	2002	2003	2004	2005	2006	2007	2008	2009
TOTAL IMPORTS	143,359	173,539	203,918	207,796	229,465	282,836	297,388	307,847
TOTAL EXPORTS	134,700	157,209	200,434	201,587	218,554	266,860	283,890	301,453
TOTAL T/MENT	27,368	49,605	34,245	27,288	31,336	36,471	34,455	9,516
TOTAL	305,427	380,353	438,597	436,671	479,355	585,367	615,733	618,816

Source: KPA Bulletin of Statistic , 2002 -2009
T/MENT stands for Transshipment.

As we travel the vision 2030 journey, the Port of Mombasa is expected to play a key role in the envisaged transformation of Kenya to a prosperous middle income country. By improving the performance of a port system we would have improved the country's international market access. This will lead directly to increase in trade and result in higher income, thus better monitoring of seaport performance. In a fast changing world, it is very crucial in measuring its level of efficiency and thereby competitiveness (KPA, 2006).

World Bank (2010) established that, the port is already operating at maximum capacity with container imports at the port rising on average 10 percent each year since 2005. With growth in the East African economies predicted to reach 5 percent per annum or more over the next five years, this trend looks set to continue. And big engineering projects in the region will also add significantly to demand. Inefficiency of port operations and constraints on capacity are threatening the growth of Kenya and its neighbours. This has substantially reduced storage space within the stacking yard and occasioned serious operational inefficiency, congestions, low productivity at the container terminal, poor off take of containers, and high cost of doing business, incessant complaints from industry stakeholder. In case of perishable containerized goods, the prolonged dwell time may result in total loss in business. Raw materials and industrial products do not access the market in time. The prolonged dwell time may also lead to diversion of cargo to other competing ports, thereby ruining the reputation and image of KPA.

Dwell time study is then one of the key indicators of port performance according to UNCTAD (2002).

1.3 Problem statement

Currently, the Port of Mombasa, Kenya major seaport, has sporadic growth in containerization and is handling 615,733 TEUS container boxes as reported in KPA (2008). This is in excess of the designed terminal capacity of 250,000 TEUS per year, yet it is expected to handle growing imports and exports. The US Chamber of Commerce (2003) had predicted that container port volumes will at least double by 2020, with some individual ports seeing triple or quadruple growth. Recently the Mombasa port throughput grew by 2.8 percent from 15,096 million tons in 2007 to 16.41 tons in 2008. This was largely attributed to efficiency gains arising from the modernization of equipment and business process re-engineering. Similarly, KPA reported that container dwell time for the second quarter of 2009 to 2010 had reduced to 5.9 days against the 11.3 days in 2007 to 2008, reflecting an improvement of 47.8 percent which was attributed to enhanced efficiency in port operations. Adequate yard space was provided by KPA by appointing some Container Freight Stations (CFSs), who now receive cargo directly from the ships. They have also improved some administrative and operational measures (KPA, 2010).

Despite all these gains in efficiency, the Mombasa port volume is less than a quarter of Durban's port and only between 2 to 2.5 percent of the volumes which go through the busiest ports in the world. Singapore and Hong Kong (World Bank, 2010). Additionally, the container dwell time of 5.9 days still remains higher than the corporate performance target of 5.4 days, particularly for import container traffic.

This has serious implication for the realization and achievement of targets laid down in vision 2030. This is true because imports serve as a source of raw materials to fuel domestic production, while exports serve as a means of trading the excess domestically produced goods thus generating foreign income. If the port handling capacity is not improved, this could hinder trade and consequently the goals of vision 2030 (GOK, 2006).

The purpose of this study therefore, is to find out the main determinants of container dwell time by trying to understand how each sub process influence container dwell time. The study will try to find out exactly what time portion does each clearing process consume and make appropriate recommendations to improve the performance of the port of Mombasa, Kenya's gateway to the rest of the world.

1.4 Objectives of the study

The overall objective of the study is to examine the causes of the high dwell time and recommend specific actions to reduce it to a competitive figure of 5.5 days as per KPA Performance Contract.

In particular, the study seeks:

1) To find out the impact of different clearing process/stakeholders in the dwell time
2) To examine processes that present the most immediate obstacles to the excessive dwell time capacity growth.
3) To find out the possible corrective actions and recommendations, that will lead to the realization of the best practice in the port.

1.5 Hypothesis of the study

The study makes the following hypothesis:

1. No relationship exists between lodging to passing processing time (t_1) and the container dwell time
2. No relationship exists between Central Documentation Office (CDO0) processing time (t_2) and the container dwell time
3. No relationship exists between revenue processing time (t_3) and the container dwell time.
4. No relationship exists between terminal processing time (t_4) and the container dwell time.

5. No relationship exists between terminal to gate release processing time (t_5) and the container dwell time.

1.6 Significance of the study

Despite the immense potential benefit the country stands to derive from the port, it continues to be held back by a myriad of challenges, albeit, not in the magnitude it experienced sometime ago. For instance, it is estimated that due to operational inefficiencies, it takes similar time and resources to clear one container at the port of Mombasa as compared to about 500 containers at the port of Singapore. Further more such inefficiencies are estimated to cost as much as 50 percent in additional expenses to importers, thus compromising efforts being taken to make our economy competitive (World Bank, 2005)

Jackson (2005) established that, there was need to improve port efficiency and marine transportation structures which have been identified for at least five years, no immediate large scale plan exists to address capacity shortfalls, primarily due to a lack of coordinated planning by the extensive and complex array of stakeholders. The ultimate supply chain consequences could be severe. Container dwell time delays consequently drive up shipping costs, trigger delivery delays due to congestion, and force shippers and consignees to retain higher inventory levels to address increased supply uncertainties. This problem then extends to domestic shippers and consignees as well.

For sometime now, there has been a rumbling debate within the port of Mombasa, as to who and which process is the main cause of longer container dwell time. The stakeholder and customers want to know who is responsible for what fraction of dwell time and how the port can improve its services to reduce the container dwell time. Adenekan (2008) found out that "The dwell time of containers is caused by many factors that directly or indirectly lead to the congestion at the port. These include the agents or importers, who spend many days to arrange customs clearance and use the port as a warehouse, thereby leaving the containers without being cleared at the port." This results in operational stagnation and low productivity at ports. Dwell time study in this case, is an important and timely contribution to this process. There are also few studies done on port efficiency and most of them are of other regions. Thus a study of our Kenyan port is important, citing container dwell time as the center of study. Until the time of this study, no formal record on how much time each work process takes to clear a container has been kept at the Mombasa Port. Dwell time information is only available yearly from KPA Statistical Bulletin and hence there is insufficient information with which to conclusively investigate the main problem of container clearance delays, that has lead to Mombasa port congestions and the dwell time does not match the international average target

Nathan (2008) noticed that, when port authority of terminal operators set to make a decision to improve its operation, the decisions are often made without a clear understanding of their effect on throughput and re-handling productivity. This is because practical methods that deal specifically with the effect of dwell time on productivity are limited in literature; hence the motivation for this work. The dwell time information which will be collected from stakeholders and the empirical tests will make it possible to investigate and understand the nature of the relationship between the dwell time and the container clearing processes. The study findings will be useful to the port Authority and its stakeholders, in finding out the main reasons why there is a long stay of containers. It will also guide to the possible solutions to avert the situation.

1.7 Limitations of the Study

The study is confined to Mombasa port and it will investigate the time it takes to clear a container at different processing stages. It will not be able to quantify the other factors which may cause delays like break down of machines which directly prolong the container dwell time, as there is no data on them.

The use of cross-sectional data for the study will not put into consideration congestions and seasonal variability over time. This is because of limitation of time. The data set will be collected in a period of two months. Time series data would have been ideal in this study but the data is not available.

The study will use a sample size of 100 containers due to limited funds and time. A large sample size would have been more representative.

1.8 Organization of the study

The rest of the paper is organized as follows; chapter gives the literature review upon which the analysis will be based. The literature will be from related work done within the transport industry and container port dwell time. Chapter three will be on methodology to be used in the study, description of data to be used and the description of the variables to be analyzed. Chapter four will focus on estimation of the variables and analysis of the results and chapter five will give the conclusion and policy recommendations based son the results.

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter presents a review of some of the studies on container ports and dwell time by critically examining the objectives, methodology applied and the findings. It aim to address topics and issues closely related to container dwell time. It is organized into theoretical literature, empirical literature and finally the literature overview.

2.1 Theoretical Literature

The new trend of development in ports emphasizes the greater integration and coordination of various components of the transport system and supply chain (Copacino, 1997). Contemporary ports are viewed as integration of complex activities. By improving their performance, ports can encourage the integration of economy into a global supply chains

Ainsworth (1992) argued that ports are logistics systems along the supply chain which has to respond to pull logistics; their action will contribute towards the reduction of inventory levels along the logistics pipeline, a fall in associated costs, and the fulfillment of tighter customers' requirements through high service levels within shorter lead times. As a link in a larger logistics chain, container terminals need to achieve a higher degree of integration with the supply chains they serve (De Souza et al., 2003).

Thus, at present, ports expand themselves as logistics platforms rather than being a mere link between maritime and inland transport (Bichou & Gray, 2004). This requires supply chain members to consider ports as a cluster of organisations in which different logistics and transport operators are involved in bringing value to the final consumers (Bichou & Gray, 2004).The aim is to make the supply chain function so that the right merchandise of the right quality is produced and distributed in the right quantities, to the right locations at the right time in a way that minimises system wide costs yet meet services level requirements. Ports play an important role in fulfilling this aim as most of these merchandise pass through them

Sanchez et al. (2003) argues that compounded operational interactions which take place among different service processes at port terminals also make container port operations one of the most difficult in the transport industry. Cullinane and Khanna (2000) argued that as such, modern container ports suffer under both internal and external pressure: they need to exhibit management competency in the pursuit of a suitable strategy and in the allocation of scarce resources.

As Goss puts it, "any improvement in the economic efficiency of a seaport will enhance economic welfare by increasing the producers' surplus for the originators of the goods being exported and consumers' surplus for the final consumers of the goods being imported" (Goss, 1990) Port efficiency can be one of the most important variables in generating large port outputs. Most shipper choose ports based on reputation on service efficiency, which consist of such factors as container dwell time, delays, reliability and urgency, documentation and tracing capabilities (Tongzon, 1995).

An efficient port raises the productivity to prime factors of the production (labor and capital). Improving the performance of a port system, improves a country's international market access and leads directly to increased trade and higher income; thus better monitoring of seaport performance, is very crucial in measuring its level of efficiency and thereby competitiveness (KPA, 2005). Port efficiency is derived from the port performance indicators. The most commonly used physical indicators in the seaport industry are ship turnaround time, waiting rate, berth occupancy rate, working time over time at berth, port throughput, container dwell time and many others.

Martinez et al (1991) said, "Cause for delay can be due to the poor performance of the administrative services, such as custom and sanitary inspections, or they could originate from poor coordination between ships and land modes of transport. [1]Bang (2000) identified the factors influencing container dwell time at the port as being the time it takes documents to be linked with customs, time for import licenses to be issued, time for documents to be processed by customs, time for customs to inspect the contents of containers, time for the consignee to be contacted, time for consignee to organize transport and time spent awaiting arrival of transport for the imports. For export he identified consolidation, marshalling and time awaiting document clearance.

Mark (2003) observed that, the shorter the dwell time, the higher the throughput density for a given terminal. Container dwell time is generally a function of the market place, little influenced

[1] Professor Bang H S (2000) "Understanding Container Terminal System." Chung Ang University Retrieved from www.kmi.re.kr/english/data/publication/k2000_full05.pdf

by ports. Terminals with large volumes of rail cargo tend to have shorter dwell times because rail cargo is typically moved off-site quickly. Local cargo at the Port may remain on the terminal site longer if shippers determine that the Port's container yard is a cheaper or more convenient storage location for their inventory than their own property thus they may delay to clear the import. This will lead to prolonging the port container dwell time.

According to Hall (2002), port has been taken as node in transport networks, through which regions can link up to the global economy. Campbell (1993) showed that due to enormous containerization, economic externalities generated by port activities are not restricted to the local area surrounding ports but sea ports are places formed and flowing under 'global' forces. He emphasized in his view that sea port are nodes to connect places in global networks.

Broschken (1988), claims that, strategic performance can be closely associated with organizational perceptions and inter-government relations. He also argues that, in times of transition what matter most for organizational effective is the design of microstructure of strategic planning, while the macrostructure of whole organization of port authorities may explain how the port is performing. He claims that by encouraging public agencies to achieve higher organizational effectiveness require us to view the issuer of port as one involving different level of administrative decision making.

Gulick (1998), in his opinion, view port performance cannot be explained by technological and market forces but by institutional relationship among agents seeking development.

2.1.1 Port Performance Measurement

Dyson (2001) argued that performance measurement plays an essential role in evaluating production because it can define not only the current state of the system but also its future. Performance measurement helps move the system in the desired direction through the effect exerted by the behavioural responses towards these performance measures that exist within the system. Mis specified performance measures, however, will cause unintended consequences with the system moving in the wrong direction.

Despite the importance of port performance measurement, however, it is surprising to note that there are almost no standard methods that are accepted as applicable to every port for the measurement of its performance (Cullinane, 2002). As reported by De Monie (1987), the measurement of port productivity has been greatly impeded by the following factors: the sheer number of parameters involved, the lack of up-to-date, factual and reliable data, collected in an accepted manner and available for dissemination, the absence of generally agreed and acceptable definitions, the profound influence of local factors on the data obtained and the divergent interpretation given by various interests to identical results.

Robinson (1999) reports, *inter alia*, four attempts in this regard. The first approach of measuring port productivity can be summarised as short and long-term categories. In the short term, there are four distinct areas that lend themselves to quantification: the stevedoring process, gate cycles, inter modal cycles and yard operations. The long-run concerns, on the other hand, are overall throughput, terminal throughput density, berth throughput density and container storage dwell time The second approach outlines six indicators of productivity: port accessibility, gross berth productivity, net berth productivity, gross gang productivity, net gang productivity and Net/net gang productivity. The third approach to measuring port productivity can be divided into three parts stevedoring productivity, waterfront reliability and stevedoring reliability. Finally, the fourth approach is based on the assumption that port production can be divided into categories of seaside, marshalling yard and landside.

Port managers are therefore often under great pressure to improve the performance of their ports. To improve performance, port managers need to evaluate constantly operations or processes related to providing, marketing, selling of services to the users. This entails rethinking of port development strategies as well as far reaching reforms in the legislative regulation, and managerial environment. Naturally therefore, the efficiency of ports has become a critical factor for a country's competitiveness and its trade prospects (Cullinane, 2002).

2.2 EMPIRICAL LITERATURE

Most investigations in literature are concerned with effectively allocating and scheduling key resources, such as berths, yard, quay cranes, yard cranes and container transport. In fact, the focus is currently not on optimizing the transport chain as a whole (Steenken et al.2004). The container terminal is here considered as a global system: instead of single optimization problems. (Gambardella et al,1998 and Henesey, 2006).

Levinson (2006) established that, dwell time is an important parameter that affects transit service quality. He found out that the smaller the value of the index, the higher the port efficiency .A high value for this indicator reveals cargo management problems. The best practices are generally obtained in the container market, where large ports exhibit value around 4.7 days. Chung (1993) also assessed port performance from the point of view of exporters/importers cargo dwell time. He said that, a high dwell time was generally an indication that all was not well with the port. He did not however identify areas where improvement may be sought. His study did not give the breakdown of the various procedures that had to be carried out before the cargo can be shipped or delivered to the owner.

Crainic (2003) dealt with the planning and management issues and models for long haul freight transport systems. Crainic and Kim (2007), illustrated several issues related to the containerized intermodal transport, as well as several applied mathematical modeling methodologies. Luo and Grigalunas (2003), developed a spatial economic, multimodal simulation model dealing with the containerized transport of cargo categories imported and exported through US container seaports.

Iannone (2000) identified the "inter-port model" as an extension of the conventional multimodal and multi-commodity transshipment problem. The main purpose of the network model is to highlight and measure the advantages that logistic agents can enjoy, in routing maritime containers through the inter ports. The model minimizes the sum of all container-related logistic costs throughout the entire port-hinterland distribution network, subject to balancing conditions at all nodes and capacity constraints over railway links. He presented an empirical application portraying the intermodal and logistic "first-tier" network in the Campania region, Southern Italy. The numerical prototype was programmed and solved using the GAMS (General Algebraic Modeling System) computer code. The results confirm the importance of the regional off-dock and inland logistic system for the distribution of international maritime containers flowing through the Campania seaport cluster. The future competitiveness of the regional seaports and their hinterland distribution system will depend on a further improved supply of inter-port services.

Cullinane *et al.* (2002) employed a single commodity, multimodal and multi-objective mathematical programming capacitated model to simulate, based on time and cost criteria, the optimization of the flows of full containers imported in China. Deidda *et al.* (2008) developed an integer programming model concerning the so-called "street-turn" or "triangulation" strategy of a shipping line. Kim *et al.* (1999) developed a multimodal mixed integer programming model to optimize the flows of full containers imported and exported in Korea. Kim *et al.* (2002) further developed a multimodal linear programming model, to optimize the flows of full containers imported and exported in Korea. Lee *et al.* (2006) developed a capacitated multi-commodity linear programming network model to analyze the containerized maritime flows between Asian ports and over the two-way USA Far East and Europe-Far East routes.

Kozan E (1997) discussed major factors for transfer efficiency of multimodal container terminals. A network model reflecting the logistic structure of a terminal and the progress of containers is shown. Its objective was to minimize the total throughput time, as the sum of handling and traveling times of containers. Murty et al (2003) described various interrelated complex decision problems occurring daily during operation at a container terminal. They worked on decision support tools and discussed mathematical models and algorithms.

Kasumu (1978) applied queuing network theory to analyze container handling operations at the container terminal. He tried to show the effect of the variations in handling times at each station, on port dwell time and the turn around times for ships and inland feeder vessels were demonstrated. He also identified the bottlenecks of each station and computed many useful performance measures accurately

Lee et al (2006) dealt wth yard storage allocation problem, in a transhipment hub with a great number of loading and unloading activities. The purpose is to minimise reshuffling and traffic congestion by efficiently shifting containers between the vessels and the storage area. A mixed integer programming model is proposed to determine the minimum number of yard cranes deployment. Two heuristics are developed and tested on generated instances. The first is a sequential method while the second is a column generation method.

Lee et al (2009) presented a mathematical model for the container pre-marshalling problem in order to minimise the number of container movements during pre-marshalling. The model formulated is an integer programming model consisting of a multi-commodity flow problem and a set of side constraints. A solution heuristic and a number of possible variations of the model are also discussed and computation results are provided

Cordeau, et al (2007) presented the service allocation problem, which is a tactical problem arising in yard management of container terminals. The purpose of the study is to minimise container re-handling inside the yard. The study was done on Gioia Tauro port which is located in Italy. The authors formulated a quadratic mathematical model for the problem. Two mixed integer linear programming formulations are presented. The result shows that for small size instances the heuristic always yields optimal solutions.

Nam et al (2001) investigate aspects of adoption of advanced technologies such as intelligent planning systems, operation systems and automated handling systems for container terminals. They set criteria for evaluation of different handling systems and apply them to examples in Korea. Results show that automation does not always guarantee out performance (e.g. higher productivity) – it depends on terminal characteristics such as labour costs.

Djankov et al (2008) found that each day cargo is delayed reduces a country's trade by 1 percent and distorts the ratio of trade in time-sensitive to time-insensitive goods by 6 percent. Growing literature suggests that transport costs; currently impose a higher effective rate of protection than tariffs.

GOI (2009) did a comparison of two major international ports - Rotterdam and Singapore. He had found out that. for containers the average dwell time at Rotterdam container terminal was 18.8 days for imports and 3.78 days for exports. But for Singapore container dwell time (both imports and exports) was 0.6 days The study identified the obstacles of achieving the international norms. Vast differences were observed in the availability of infrastructure, connectivity and electronic information exchange. Thus the evacuation of cargo in international port is very quick The study identified a number of factors responsible for high dwell time, contributing to the low efficiency of Indian ports. These included, infrastructure constraints, such as inadequate port capacity, poor road network, and limited cargo handling facilities, high downtime of equipment, low labour productivity and shortage of storage space. Also there was regulatory restriction on operation time, low IT application, including partial implementation due to too much manual documentation, archaic systems and procedures Other factors were limited time for payment and documentation, delay in mobilization of equipment, trucks and shortage of rail wagon.

Steenken (2004) viewed a container terminal as a production system that is represented as a network of complex substructures or platforms. He represented its operational aspects in a mathematical model for tactical planning. The problem was to allocate resources in each platform, in order to minimize the total delay on overall network and time horizon. He observed the overall aim of the port is to minimize container dwell time. He concluded by argueing that transport and crane activities have to be synchronized to avoid unnecessary crane waiting times or movements thus will help improve the container dwell time.

Steeken et al (2004) argued that, analytical models, especially queuing models, cannot be used to analyse terminal operations in the estimation of port performance indicators. They believe this because queuing models are valid only if the probability distribution of the arrival time of ships and their service time belong to the Erlang family of distribution functions. Ramani, (1996) also argued that analytical models themselves cannot be used wholly to model terminal operations, but they can be used to model certain aspects of terminal operation.

In 2004, KRA conducted Time Release Study. They studied the customs administration as a critical component in efficiency of international trade, as they process every consignment to ensure compliance with national & regular requirement as well as international trading rules. They identified that modern customs administrations have recognized that streamlining and simplifying clearance procedures is beneficial to their importers, their exporters and their national economies. To review their clearance procedures they studied the cargo dwell time. It helped them identify both the problem areas and potential corrective actions to increase their efficiency thus reducing their cargo dwell time. The study was carried out at sea ports, land border posts, an inland container depot and International airports. The findings of the Study were, the time taken to clear goods has to be improved to meet the highest international standards. The time taken in Kenya was 20 hours 18 minutes at land border posts, 10 days, 7 hours and 53 minutes at seaports and 5 days, 11 hours and 26 minutes at airports. Their principal recommendation was, there was need to introduce an electronic declaration system and bureaucratic procedures should be reviewed with a view to reduction or elimination as appropriate. The study however was more descriptive statistic by using mean and standard deviation to give their findings and conclusion. Also, the duration of study was too short (just a week) per section i.e. at airport, port and land borders.

Cheon (2007) examined the determinants of port output and efficiency. He adopted a combination of qualitative and quantitative methods, to examine the roles of port institutions and productivity. He found out that, port needed to structure themselves as large-scale logistic hubs that are substantially intergrated into global supply chains. He concluded that, the role of institutions were increasingly important in shaping port efficiency.

Kent et al (2004) argued that, port inefficiency as the most serious and least understood problems that impose cost on producers. These costs erode the intended benefits of trade preferences in major markets. It was observed, by improving port, it can lower total transaction costs and boost the competitiveness of a country's imports and exports. In the long run, it will create jobs, spur growth and improve the general welfare. The report analyzed the operation of a port challenged by congestion, Puerto limon (In Costa Rica), comparing it with port Cartagenia (In Colombia) known for its efficient operations.

As Ports form a vital link in the overall trading chain and, consequently, port efficiency is an important contributor to a nation's international competitiveness. UNCTAD (1987) emphasized the need to improve and measure port efficiency and concluded that available studies on port productivity have overall been unsatisfactory. The report goes on to say that any effort to analyze port efficiency is formidable due to the sheer number of parameters involved, as well as the lack of up-to-date and reliable data. At times, the inability to differentiate relevant factors contributing to port efficiency has resulted in unnecessary collection of significant amounts of data which were later found to be of limited use, thus resulting to wastage of port management resources (Tongzon, 1995).

2.3 Literature Overview

The new trend of container transportation, emphasises the greater integration and coordination of various components of the transport system and supply chain (Copacino, 1997). Port efficiency is derived from the port performance indicators and the commonly used are ship turnaround time, waiting rate, berth occupancy rate, container dwell time. Bang (2000) identified the factors influencing container dwell time at the port. Mark (2003) observed that, the shorter the dwell time, the higher the throughput density for a given terminal. Chung (1993) established that, a high dwell time was generally an indication that all was not well with the port.

There is no consensus on standard methods and terminology that are accepted as applicable to every port for measurement of port performance and production. Steeken, Vob, & Stahlbock, (2004) argued that analytical models, especially queuing models, cannot be used to analyse terminal operations in the estimation of port performance indicators. Poung (2000) did a dwell time model and it showed enough variation to allow him to use an ordinary least squares regression on his data. The model fitted 90 percent of the data. Aashtiani (2002) observed that, the calculation of dwell time was necessary in modeling transit assignment because an accurate estimation of dwell time will lead to more precise transit assignment results. The dwell time model output was shown to be statistically significant. Calculations were found to be valid when compared with observed data.

The literature review, show that there is a need to conduct the study because no academic study has been done for the port of Mombasa. This study would add value, as it will provide at least a dwell time model for Mombasa port, which can be used by the managers in making well informed decisions. Secondly, this study establishes the determinants of container dwell time and existing direction of relationship between container dwell time and its determinants.

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[*] Professor Bang H.S (2000) "Understanding Container Terminal System." Chung Ang University, Retrived from www.kmi.re.kr/english/data/publication/k2000_full05.pdf

CHAPTER THREE

3.0 METHODOLOGY

The section starts with the conceptual framework. It is then followed by the theoretical framework which tries to explain the economics behind dwell time theory and then model specification. Research design, data types and sources, target population, sampling frame, data collection and data analyses then end the chapter.

3.1 Conceptual Framework

This analysis especially focuses on container dwell time at port level as a unit of analysis rather than a container terminal level. Dwell time is a component measure of port efficiency and productivity. Dwell time has a multiplier effect on port profitability and the national economy at large. It is therefore interesting to empirically examine the structure of port authority, organizational relationship and managerial practices by port managers and other players, since they influence productivity and performance of port container production system.

Steenken (2004) argued that, container clearance involves a series of linked factors controlled by the different stakeholders. As a result, maximum capacity is controlled at different times by these potentially uncooperative stakeholders, so no gains will materialize until and unless all stakeholders jointly cooperate to increase port efficiency. Container dwell time is mainly affected by port operations, documentation, clearing agents compliance, diverse agencicies, government, port authorities, terminal operators and other service providers. Inefficiency at any or all of these points in the chain will increase container dwell time. (World Bank, 2001). So I will try to integrate different sorts of institutions and clearance procedure information into one single variable container dwell time.

Pong (2000) argued, in any mode of public transportation, dwell time is a key parameter of system performance, service reliability and quality. In deed, dwell time might represent a significant fraction of total trip time along a service transit line, thus affecting travel time and system capacity. Where dwell time variability lowers service reliability in terms of on-time performance and decrease service quality through longer waiting times and thus leads to overcrowding in the transport system.

The study will employ a Dwell time Model. This will be estimated using a linear estimation technique, the ordinary least square method (OLS), to measure how container dwell time (dependent variable) is influenced by container clearance procedures such as lodging to passing, revenue collection, and terminal to gate release procedures among others (independent variable). Statistical tests will be used to test for the statistical significance of the variables. Container clearing procedures will be categorised into five groups in terms of duration (hours) as follows:

3.1.1 Container Clearance Procedures Duration (Hours)

1. Lodgment to Passing of Entry Duration (Hours). The clearing agent makes a declaration on form C 63 and present to customs. The receiving clerk acknowledges receipt by stamping the entry with a receiving stamp showing the date and time it's lodged He also ensures all the necessary documents are attached for processing Data is captured in computer and is forwarded to the head of declaration office (HOD)

HOD then allocates an officer to process the entry. The processing officer checks the declaration and passes the entry, reject or refer to senior officers for action. It mainly involves the shipping agents, and KPA

2. Central Documentation Office (CDO) Duration (Hours). Here they counter check all the required documents are in order and matches with what is in their computer data. All passed entries are then to be dispatched to cash office. They also calculate the amount of duty payable.

3. Revenue Duration (Hours). On receiving the entries and comparing the taxes payable on the entry against the payments received in the bank. The entry is given to cashier to validate in the main computer in order to generate cash abstract to be used at the time the goods are being removed at the gates and central documentation office for confirmation of duty payment and authenticate that the entry was passed and taxes have been paid Then the customs clearance audit section checks and target for 100 percent verification.

4. Terminal Duration (Hours). There is also a documentation office. Here the entries are checked and compared against the cash abstract. If all the details agree, the release orders are dispatched to the port authority/ container freight operator to facilitate collection of their handling charges. The entry is then dispatched to the sheds/terminal where the goods are located for verification.

Verification process commences when the entry and release order is received from port or evidence of payment for the container freight station. Then either 100 percent verification or normal verification will be done and an examination account will be written on the reverse of the entry Participation of main stake holder processes through authorization, inspection of goods and documentation will be taken into account.

5. Terminal to Gate Release Duration (Hours). The clearing agent will process the gate pass with the port Authority/ transit shed operator. The container will be loaded on the truck and moved to the gate where Customs preventive officers record the truck details and release the container to the importer.

Dwell Time Duration (Hours). It includes measuring the time from arrival of good at port (Lodged at customs) until they are released at the port gate (KPA Gate Release).

Clearly dwell time is a function of some parameters that can be obtained by the process involved in that transport system. Kraft (1975) in his dwell time model he identified seven groups for these factors: human, modal, operating policies, mobility, climate and other system elements. Yet these factors are often constant in a given system or beyond the knowledge/ control of the operator. In consequence, given a particular port system, these factors will be included in a dwell time model by grouping the system specific factors into a constant term and including the unknown in an error term.

3.2 Theoretical Framework

Theoretical framework is essential to understanding the factors that may influence or are associated with an identified problem (**Khasakhala 1994**). Since ports are type of firm in search of optimizing their input and outputs for providing quality services to customers and maximizing their returns. So I will mainly examine how container dwell time is influenced by qualities and quantities of port stakeholders and container clearance procedures.

3.2.1 Port Productivity and efficiency

The concept of productivity is defined as the relation between input and output. At a firm level, productivity is often seen as one of the most vital factors that impact a firms competitiveness (Sink 1989). According to Porter (2002), "productivity depends on both quality and feature of products, and the efficiency with which they are produced." He further argues that the industry will lose out if it's productivity is not sufficiently higher than foreign rivals to offset any disadvantages in local wage rate.

Cheon (2007) argued that, performance is a more comprehensive but vague concept than efficiency. Performance refers to the degree of success in achieving intended goals and objective (Song et al 2008) In contrast efficiency is based more on concept of behaviours. That is, production and service activities themselves. Some of the port performance indicators are total throughput, port charges, average cost, total income and revenue growth, average turn-around-time and container dwell time.

Moreover, recently, port production has been organized in a more complex environment. As Marlow et al (2004) argues, traditional partial performance and efficiency indicators provide little information about the actual quality of services offered by ports. According to Marlow, in order to design a complete quality index of port performance, it should be considered that ports have become more agile, requiring integration of such logistics elements as supply chain and visibility of internal process of port management.

Farrell (1957) defined two different concepts of efficiency in production: technical efficiency and allocative efficiency. Technical efficiency is the conversion of physical inputs into outputs known as productive efficiency (Nicholson, 2004). In order to be technical efficient given current level of technology, there should be no wastage of inputs in producing a certain quantity of output Therefore the failure to produce the maximum amount of output from a set of input results in technical inefficiency. Allocative efficiency depends on whether the amount of inputs is chosen to minimize the cost of production when the firm is technically efficient.

3.2.2 Supply chain integration

The theoretical foundation for supply chain integration can be traced to the value chain model of Porter (1980). In this model, the author conceptualized the notion of linkages and in particular emphasized how the optimization of vertical linkages (with customers and suppliers) will improve supply chain integration and engender superior performance (Frohlich and Westbrook, 2001). The literature has emphasized the importance of integration across a supply chain, particularly with respect to performance.

It has been argued that partner (supplier/customer) integration into the firms' value/supply chains (to varying degrees) is critical if the firm is to add value to its product and service offerings

(Ragatz et al., 2002) and that such integration can lead to significant improvements in terms of cost reduction, delivery quality and shorter cycle time (Cousins and Menguc, 2006). The findings together with the inherent strategic nature of integration render the concept of overriding importance in supply chain management.

Vickery et al. (2003) in attempting to identify attributes of an integrative supply chain strategy focused on two main tenets, viz technologies that facilitate integration and integration practices. Both are regarded essential in achieving supply chain integration. Information technologies was found to be significant in facilitating supply chain integration which included computerized production systems, integrated information systems and integrated electronic data interchange.
Ragatz et al. (1997) identified the use of EDI as a key success factor for supplier integration whereas Burgess (1998), Stroeken (2002) and Tallon et al. (1997) found that information technologies integrate members of the supply chain. With respect to integration practices, these are defined by Vickery et al. (2003) as those practices that strengthen the linkages between the partners occupying different positions in the supply chain and could include aspects that are aimed at satisfaction of customers and suppliers through adding value to their respective operations (service, quality and cost). The literature has empirically identified linkages between integration and practices that add value to customers and supply chain partners including customer service (Stank et al., 2001), service quality (Stanley and Wisner, 2001), delivery, productivity, cost (Frohlich and Westbrook, 2001) and customer responsiveness (Narasimhan and Jayaram, 1998).

3.2.3 Dwell Time Model

Our model borrows from the earliest studies done toward understanding dwell time by Levinson (1983), where dwell time is determined by the number of process involved in an event. He used a simple regression approach to analyse and predict the dwell time. From his studies, research started to consider dwell time as a multi-variable model. Poung (2000) argued that, in any mode of transportation, dwell time was a key parameter of efficiency, service reliability and quality.

I first specify a simple model by assuming that the time $T_{clearing\ stage}$ required by each process to clear the container from port increases independently and linearly with respect to number of agents and process involved in doing it.

$$T_{clearing\ stage} = a + bH_i \quad \textbf{Equation 1}$$

Where $T_{clearing\ stage}$ = Time taken at $T_{clearing\ stage}$

H_i = Number of hours per i^{th} stage.

a = Constant.

b = Coefficient of estimated parameters.

i = can be 1, 2 ... n processes per stage.

Thus, the dwell time for a single container k can be taken as the sum of $T_{clearing\ stage}$ for all m process involved in the clearing of the container from port.

$$\min DT_k = (T_{clearing\ stage1}, T_{clearing\ stage2}, \ldots, T_{clearing\ stage\ m}) \quad \textbf{Equation 2}$$

Similarly, the total dwell time for n-container is the sum of the container dwell times

$$\min DT = (DT_1, DT_2, \ldots, DT_n) \quad \textbf{Equation 3}$$

Given the clearing stages and processes involved in clearing at the port, the container dwell time at the port, is reached when all the time taken by each clearing stage and process are evenly distributed over all the containers. So the proposed container dwell time in port according to Levinson (1983), can be expressed as

$$DT = a + bT \quad \textbf{Equation 4}$$

Where DT = Dwell Time Hours.

T = Sum of the Containers used by the study

a = Constant (presumed lost time attributed to the processes involved)

b = Coefficient of the estimated parameters (presumed time (Hours) attributed to the processing each container studied).

Previous works of Kraft (1975) and Lin et al (1991) suggested that the simple dwell time model like the one derived above, explained above 70 percent significant part of the dwell time duration, when applied to non- congestion situations. The above literature demonstrates that the dwell time model can be effectively be used to estimate the container dwell time at Mombasa Port

3.2.4 Model specification

Therefore, key factors for straight forward model specification would be simply be processes durations in hours for lodging to Passing, Central Documentation Office (CDO), Revenue, Terminal, Terminal to Gate Release, along with some measure of crowding level in port In the absence of real-time operations (example time interval between processes), this time is devoted to the five container clearing process as they are likely to the most significant factors at ceteris peribus. The first five variables are directly observable from the container clearing processes and can be collected with more or less resources The crowding level is harder to estimate and use because an accurate count of container would require on-terminal checks that are costly, while an approximate measure of crowding level might not lead to a satisfactory model.

Considering dwell time as a multi-variables model, the model in equation 4 can be expanded. It is assumed that the time a container at port requires clearing it from the port increases independently and linearly with respect to each clearing process time

Kraft (1975)) simple dwell time model was be adopted.

$DT = \beta_0 + \beta_1 T_1 + \beta_2 T_2 + \ldots + \beta_n T_n$ **Equation 5**

Where DT was dwell time (dependent variable) while T_1 $T_2 \ldots T_n$ were its independent determinants variables. β_0 was the autonomous variable while β_1 and β_2 were coefficient of the independent variables.

From the **container dwell time model** in this paper will be specified as follows.

$DT = fn(t_1, t_2, t_3, t_4, t_5)$ **Equation 6**

To give us

$DT = \beta_0 + \beta_1 T_1 + \beta_2 T_2 + \beta_3 T_3 + \beta_4 T_4 + \beta_5 T_5$ **Equation 7**

Where

DT = Dwell Time (Hours),

T_1 = Container at Lodging to Passing (mainly is shipping agents, and KPA) stage,

T_2 = Container at CDO (Central Documentation Office) stage,

T_3 = Container at Revenue (mainly involves KRA offices) stage.

T_4 = Container at Terminal stage ,

T_5 = Container at Terminal to Gate Release stage.

Where β_0 is constant (the down time) and Bi are the service time coefficient of the estimated parameters.

3.2.5 Model Justification

The Dwell Time model will be employed because it is an appropriate function when studying processes time, which follows each other in a constant sequence. It advantages are as follows:

- It is linear in its simple OLS form and thus easy to compute.
- It has been proved that it explains significant part of the dwell time.
- It gives instant access to main stakeholders' behaviour and shows how much they affect dwell time of containers in port.
- It can be used to measure the impact of change in policy by a stakeholder in the container dwell time.

3.2.6 Estimation Method and Econometric Tests

This study will employ the linear regression method to run the regression using the STATA programme.

The container dwell time function will be tested for, if the model is well specified and if there is heteroscedasticity, which are potential problems with cross sectional data. For testing of the model specification, a Ramsey reset test will be conducted.

Heteroscedasticity will also be tested. Heteroscedasticity occurs when the variances of all the observations are non constant (Green, 2000). A model that suffers from a heteroscedasticity problem will give consistent, but not efficient estimates. The Breusch Pagan test will be used to detect whether in the estimated models a heteroscedasticity problem is present. If present, it can be corrected by using a robust standard error for OLS estimations.

All the estimations and different tests will be run using STATA software packages.

3.3 Study Area

The port of Mombasa is the main Kenya seaport found on Mombasa Island in Coast Province. It exact location is Latitude 4°04'South and 39°41'East. Mombasa is headquarter of Coast province and serves as an industrial, commercial and service center for interior Kenya and land locked countries. It is linked with other towns and countries by rail and road networks. The port of Mombasa has a well-sheltered harbour with a designated capacity to handle approximately 20 million tones per year. It has 16 deep-water berths with a quay length of 3,044 meters, of which 3 are dedicated container berths. The port has a maximum dredged depth of 13.5 meters.

3.4 Research Design

The study covered imported containers destined to Kenya and its hinterlands. The type of commodity was not restricted.

The Study was be divided into two stages. The quantitative Study which assessed the dwell time in hours. The independent variable was the duration it takes in the processes of lodging to passing, CDO, revenue, terminal and terminal to gate release while the dependent variable was the container dwell time. In addition to the above, a desktop research was carried out, mainly to assist in familiarizing with port operations and services offered by ports and specifically Mombasa port. A qualitative Study was also be conducted. It involves Focus Group Discussions (FGD) and In depth interviews with stakeholders.

3.4.1 Source of Data

The study used both primary and secondary data. Primary data was collected by using interviews and structured questionnaire that were administered to stakeholders for qualitative study. For quantitative, clearance forms was attached with Cargo Dwell Time Data Collection Form that indicated how long each of the chosen clearing process takes. Secondary data was obtained from statistical reports, Gate Pass & Tiny Term module and other published reports

3.4.2 Coverage of the study

The study covered Mombasa port. The port has inland port like Nairobi and Kisumu. It was however impossible to visit the others due to financial and time constraints.

3.4.3 Target Population

Considering the volume of consignments and time constraints, it was not be possible to capture all the transactions selected during the period of study. This called for a sampling strategy that took into account the relative ease or difficulty in the mechanics of drawing a representative sample whilst ensuring validity and reliability of the data

3.4.4 Type of clients/Respondents

The study targeted the following port users: shipping lines, clearing agents, consignees/ importers, transporters and senior officials of various stakeholders and Government agencies

3.4.5 Sampling Frame

Three hundred stakeholders were interviewed on matter concerning dwell time delays. Systematic sampling was applied where, every fifth container import entry lodged, was selected for the survey which targeted 100 containers. Further screening of the quantitative data was done. This ensured the data of independent variable explained well the variations of Dwell time. The sample size was chosen based on time, resources, population, desired results and confidence level of data to be analyzed. At the terminal yard a random sampling method was used due to lack of a sampling frame as well as the fact that some stake holder like C&F Agents were not confined to a specified area.

3.4.6 Tools and Instruments for Data Collection

Considering that the study involved capturing of time data and the fact that port procedures are still manual, Container Dwell Time Data Collection Forms ***(See Appendix I)*** was attached to the selected entries, for the purpose of the survey, from the point of lodging until final release of goods from port gates. Container Dwell Time study Questionnaire ***(See Appendix II);*** was used for the purpose of collecting the relevant qualitative data. A clock and calculator was our main instruments of data collection.

3.4.7 Duration of the study

The study was done in two phases running concurrently. The first phase entailed a survey of documentation processing time, from lodgment of document with KPA to the exit gate, using the *Container Dwell Time Data Collection Form* **(see appendix I)**. While the second phase involved conducting interviews on a pre-designed questionnaire; *Container Dwell Time Study* Questionnaire **(see appendix II)**. The two phases took a total of 6 weeks.

CHAPTER FOUR

4.0 Results And Discussions

In this chapter the results of the study are presented and discussed. It starts with the qualitative analysis and gives the cause of the problems and suggested solutions to them. The second section will be quantitative analysis on dwell time determinants. So we will regress dwell time as the dependent variable on other five variables. Lastly we will test the hypothesis and evaluate if we reject or accept them on the basis of the results of the study.

4.1 QUALITATIVE ANALYSIS

The figure 1 shows the breakdown of the composition of the survey respondents who were interviewed and whose views this report is based. The format used was a multiple response questionnaire as the stakeholders have operations in different areas.

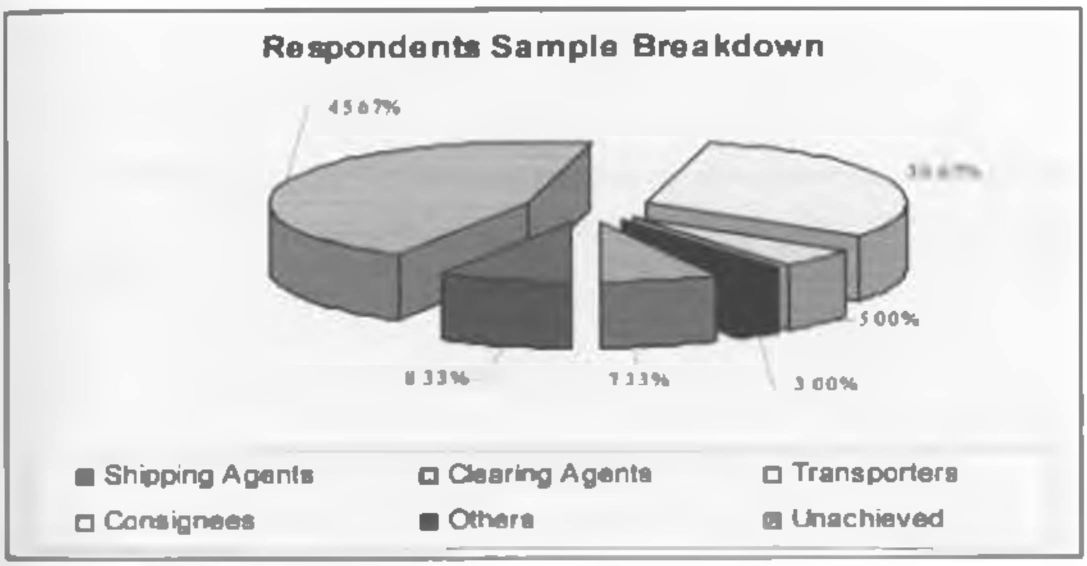

Figure 1. The breakdown of the composition of the survey respondents

The sample size of clearing agents (45.67%) and transporters (30.67%) were representative of the desired target. The consignees (5%) and shipping agents (8.33%) were inadequate. However, since the clearing agents play the middle level role their well representation covered for the consignees.

The achieved base target was 92.67 % of the overall target (278 out of 300 respondents), which is representative enough to allow for further analysis of the finding. (See Appendix VII).

Length of Operations

Majority of the respondents (77.34 percent) issued with questionnaires have been in business operations for more than 5 years. This implies that the information given would be valuable. (See Appendix VIII)

Length of Transaction with KPA

The length of operation of the respondent in KPA usage was 64.75 % of the respondents have used the services for over 5 year and only 27.34 % were less than 5 years. The 27.34 % included the1.08% that had been in operation with KPA for 6 to 11 months and 26.26 % had operated with KPA between 1 and 5 years. 7.91% did not indicate their length of operation with KPA. (See Appendix IX).

Container Cargo Delays

Respondents were asked if they experience any delays in clearing their containers from port, of which 96.4% acknowledged. The firms agreed that there was delays included shipping line of whom 69.9% agreed, clearing agents 99.3% agreed, 100% of consignees said yes, 98.8% of transporters and the other agents at least 66.7% also agreed there was delay in the container clearing processes (See Appendix X)

Main findings by client categories

The respondents were asked to rate the overall performance of the stakeholders on 5 point scale, where 1 was very poor, 2 poor, 3 fair, 4 good and 5 excellent Out of 300 respondents interviewed, the ranking were as shown in table 2

Table 2: Overall Performance Ranking scale

	Frequency	Percent	Cumulative
Very Poor	151	9.2	9.2
Poor	462	28.2	37.4
Fair	566	34.5	71.9
Good	337	20.5	92.4
Excellent	124	7.6	100
Total	1640	100	

Source: Own Analysis of Appendix XI

Above result displayed that, the performance of most stake holders in the cargo clearance procedure was below their expectation. 71.9 percent were performing below good while having 37.4 percent of them below fair. This is very serious and thus the stake holders should either change or improve their way of offering the service so as to be able to improve dwell time to reach the performance contract

Table 3: Analysis of Shipping Lines/ Agents Problems and Proposed Recommendation Matrix

Problem	% of Frequencies	Policy Recommendation
Delivery Order delays	43%	• Shorten procedures • Increase staff levels • Quick dispatch to port • Simplify payments
Problem with Maersk	13%	• Investigations of management relations at Maersk
Uploading of SIMBA Manifest Number	11%	• Manifest to be provided in advance (7days before arrival)
Sorting out demurrage	10%	• Improve process • Issue advance invoices
Systems breakdowns or slow	9%	• Improvement on speed • Get more machines

Source: Own Analysis

Table 4: Analysis of Clearing Agents related Problems and Proposed Recommendation Matrix

Problem	% of Frequencies	Policy Recommendation
Delayed Charging of Storage/rent	13%	• Immediate and quick securing of relevant charges
Poor Customer Relations	9%	• Practice good public relations • Improved communication to clients • Staff training in Customer Care and work performance

Slow Document processing	36%	• Improve documentation procedure • Faster documentation process • Train staff on relevant skills • Customs to speed up document clearance • Increase facilities necessary for processing documents • Approval of documents

Source: Own Analysis

Table 5: Analysis of Transporters related Problems and Proposed Recommendations Matrix

Problem	% of Frequencies	Policy Recommendation
Vehicles delay at the gate due to lengthy port pass procedures	37%	• Gate loading Port pass procedures should be reduces • KPA should remove alteration fees • Increase the delivery time • Install stand-by generators to reduce delays
Unworthy vehicles being allowed to do business at the port	42%	• Shut out unworthy vehicles • Inspection of all vehicles/truck on a regular basis • KPA security & Traffic police should work in harmony as they both do the same job
Police harassment at weigh bridges and long queue at weigh bridge	21%	• All cargo should be escorted • Close weigh bridges

Source: Own Analysis of Appendix XI

Most complaints related to transporters were;

- Vehicles delay at the gate due to lengthy port pass procedures 42 %; and,
- Un-roadworthy vehicles being allowed to do business at the port 37 %.

Table 6: Analysis of Kenya Railways related Problems and Proposed Recommendations Matrix

Problem	% of Frequencies	Policy Recommendation
Unavailability of rolling stocks	62%	• Increase number of wagons • Privatization • Acquire new wagons • Improve train turn
Lack of locomotives	8%	• Provide adequate locomotive engines
Low carrying capacity of wagons	5%	• Increase number of wagons
High number of sick/old wagons	5%	• Upgrade wagons

Source: Own Analysis

Table 7: Analysis of KPA Revenue Office related Problems and Proposed Recommendation Matrix

Problem	% of Frequencies	Policy Recommendation
Lengthy documentation procedure	31	• Eliminate unnecessary processes • Simplify documentation procedures and reduce paperwork. • Improve on document dispatch to respective sections • Add more staff • Manifest should be captured in time • Reduce number of departments handling similar documents • Create a Revenue One Stop Center
IT Systems/Power Failure	16	• Have standby power generators • Improve computer systems
Delay in Billing and Invoicing	11	• Speed up the billing and invoicing process • Improve supervision

Source: Own Analysis

Table 8: Analysis of KPA Operations related Problems and Proposed Recommendation Matrix

Problem	% of Frequencies	Policy Recommendation
Unavailability and consistence breakdown of machines	41%	• Purchase more reliable machines and service them regularly
Poor planning of operations	18%	• Good planning on efficient operation • Have a good traffic control network • Improve on the loading section and containers meant for loading be given first priority • Open more gates apart from gate 18 and 20 • Avail more parking space • Increase the KPA gang to cater to clients
Lengthy documentation procedures	16%	• Improve services • Avoid duplication of documentation procedures • Documentation should be less bureaucratic • Speed up dispatch of documentation • All clients should be ledger account holders

Source. Own Analysis

Table 9: Analysis of KRA related Problems and Proposed Recommendation Matrix

Problem	Frequency	% of Frequencies	Policy Recommendation
The SIMBA System	91	35%	• Improve authorization of payments • Reduce processing time • Ensure system reliability • Fair decision making • Increase trained personnel conversant with valuation procedures • Avoid duplication of duties • Add more machines and personnel • Adhoc duty increases to be avoided • Provide alternative when need arises • Address entry rejections by speeding up the re-applying • Customs Release Order Issuance to be speeded up • Remove time lapses between bank and KRA • Increase allocation of competent officers to verification section.
Break down of computers	50	19%	• Provide Server in KRA – MSA • Address system breakdowns • Find alternative power supply.
KRA Personnel	42	16%	• Enhance public relations • Training the personnel's • Enhance coordination & efficient Communication • Increasing staff • Staff motivation especially CDO • Increase working hours

Verification and Scanning process	32	32%	• Should only scan first and do verify 100% if there is a problem • Reduce 100% verification • Valuation of documents to be done at port area • Should operate on weekends • Remove scanning for brand new goods • Improve on results report • Security delays to be avoided

Source Own Analysis

Table 10: Analysis of KEPHIS related Problems and Proposed Recommendation Matrix

Problem	% of Frequencies	Policy Recommendation
Unreasonable requirements	33%	• Adjust requirements
Slow release of documents	33%	• Speed processing
Plenty of attachment documents	17%	• Require few documents to release cargo
Cargo sample quantity is too high	17%	• Request reasonable sample

Source: Own Analysis

Table 11: Analysis of Port Health related Problems and Proposed Recommendation Matrix

Problem	% of Frequencies	Policy Recommendation
Unavailable staff	27%	• Have a disciplined staff
Theft of samples	13%	• Should be transparent and accountable
Sampling process time is too long	20%	• Do it faster by using random sampling technique.
Poor service	13%	• Improve service delivery
Double cargo verification	13%	• Harmonize verification procedures with other stakeholders
Corruption	7%	• Install CCTV and have a reporting system/team to investigate the corrupt officers

Source: Own Analysis

Table 12: Analysis of KEBS related Problems and Proposed Recommendation Matrix

Problem	% of Frequencies	Policy Recommendation
KEBS Requirements and regulations	39%	• Notice on new implementations should be adequate - COC (certificate of conformity) • Review requirements – PVOC rules • Reduce documentation • Make regulations public • Spares & materials shouldn't be subjected to COC • Using copy rather than original COC • Review where consignments are to be inspected
Procedures	16%	• Too much sampling • Have reasonable criteria • Quick remittance of results • Reduce long documentation procedures
Personnel	32%	• Increased staff • Better communication • Improve reporting time • Better PR • Extend working hours • Skilled staff in labs - CDS
Inspection	8%	• KRA and KEBS should harmonize their releases and targets

Source: Own Analysis

Table 13: Analysis of Banks related Problems and Proposed Recommendation Matrix

Problem	Frequency	% of Frequencies	Policy Recommendation
Working hours do not conform with those of KPA	7	12%	• Should work for extra hours including weekends • Night shift working schedule should be introduced
Few cashiers at the tellers	9	16%	• Increase cashiers and form SIMBA system
Long queues at the banks especially National Bank of Kenya	27	26%	• Introduce more branches • Employ more staff • Install more counters • Allow other banks like Kenya Commercial Bank, Barclays and Standard to collect money on behalf of KRA
SIMBA system breakdown	15	26%	• Improve the web-link with KRA • System should be fast in transmission

Source: Own Analysis

Table 14: Analysis of Port Police related Problems and Proposed Recommendation Matrix

Problem	Frequency	% of Frequencies	Policy Recommendation
Harassment to clients	19	37%	• Deploy competent personnel • Discipline errant officers
Corruption	12	23%	• Stop Corruption
Unnecessary interference in cargo clearance processes	7	13%	
Increased delay in verification	4	8%	• Removal of police in the verification process • Work jointly with relevant parties

Source: Own Analysis

Table 15: Analysis of Security Officers Procedures and Proposed Recommendation Matrix

Problem	% of Frequencies	Policy Recommendation
Security staff	47	• Un cooperative • Abolish Corruption • Reduce harassment of divers • Better PR • Shouldn't remove truck port pass without alerting
Procedures	19	• Reduce bureaucracy • Faster documentation at exit gates • Extend exit gate time • Provide parking space • Cut out unnecessary steps of documentation
Trucks Checking	12	• Minimize checks • Speed up release of vehicles • Remove False accusations
Slow issue of temporary passes	9	• Review issuance of temporary pass • Reduce congestion of trucks • Increase manning levels

Source: Own Analysis

Expected Ideal Dwell Time

Table 16 shows that the majority, 94.6 %, expects a dwell time of between 1 and 5 days. On the other hand only 4.9 % of the respondents expect a dwell time of 6 days or more. Evidently the respondents desire a shorter dwell time. (See Appendix XII)

Table 16: Show Summary Expected ideal dwell time

DAYS	1	2	3	4	5	6	7	8	9	10	Above 10
Percentage	31.2	29.00	21.10	7.9	5.4	0.00	1.60	1.00	0.0	1.30	1.00

Trend line

On average, the recorded total dwell time is 10.24 days (245.75 hours). The respondents expect dwell time of 1 to 5 days which is far below the actual scenario of 10.24 days. This implies that KRA, Clearing Agents, Shipping Agents/lines, and Importers require doubling their effort to reduce the dwell time to desired level.

The 5.9 days is utilized in landing to billing (Revenue) phase, which is directly under KRA control and accounts for 57.61% of total dwell time The processes involved include submission of manifests to KRA and KPA by Shipping Agents, issuance of Delivery Order by Shipping Agents, lodgment of entries with KRA by Clearing Agents, processing of entries by KRA and lodgment of MPROs to Customs CDO by Clearing Agents.

The billing to delivery phase is where KPA is a key player. It takes an average 2.75 days or 26.82% of the total dwell time is attributed to the following processes after billing at KPA revenue office, availing containers for verification by KPA, verification and release of containers by KRA and other government agencies, booking, loading of containers and gate pass issuance by KPA and issuance of gate memos at exit points by KRA and Police. Around 15.57 % of the time for average dwell time seem to be wasted outside the 5 identified clearing processes.

During the study of the document flow during the container clearing process, it was revealed that the stages consuming the most container dwell time were Landing to lodgment processes (44.34 percent) followed by Terminal processes (21.05 percent) and Terminal to Gate Release process taking the least (5.77 percent) The study also revealed that Revenue office takes on average 20 hours and not 3 hours as per the KPA Revenue Office target

4.2 Empirical Analysis

The study focused on 5 main processes, namely: lodging to passing process, Central Documentation Office (CDO) process, revenue process, terminal process and terminal to gate release process of the container port of Mombasa. The study sampled randomly 100 containers. Sampling procedures employed, ensured adequate representation of containers were captured before data cleaning. After the data cleaning process, 87 container data point remained for analysis as shown in appendix III. The cleaning process involved dropping outliers and observations with missing data.

Table 17: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
T1	87	108.9655	115.4952	24	984
T2	87	12.61908	21.11288	.13	96.37
T3	87	19.99437	14.97248	.97	89.67
T4	87	51.74138	28.04732	.27	125.63
T5	87	14.17402	24.91952	.08	118.08
DT	86	245.7492	82.37351	108.75	539.17

Source: Statistical computations based on statistics in appendix (III).

The above table 17 gives us the general description of the individual 5 variables. The average dwell time per entry is 245.75 hours (10 days, 5 hours and 45 minutes) with its minimum being 108.75 hours and maximum was 539.17 hours.

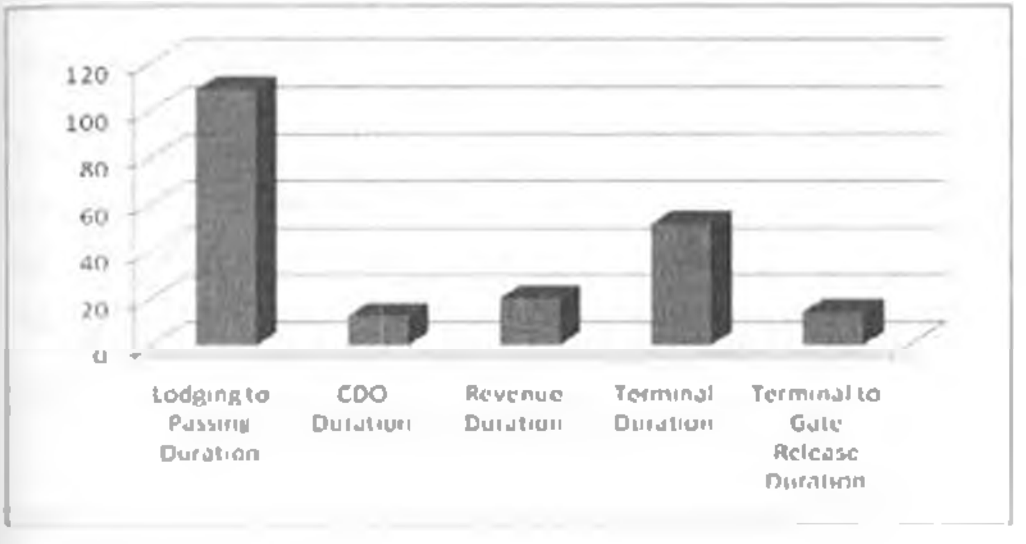

Figure 2: Showing the mean of the clearing procedures

On the part of independent variable we observed that lodging to passing used the highest duration which was 108.97 hours (4 days, 13hours). It dominates the dwell time and contributes to 44.34 % of the dwell time. Indicating there should be done a lot of improvement on this part if we are to reduce dwell time to a competitive figure of 5.4 days as per Kenya Ports Authority Performance Contract. This dwell time differ with that of figure showed in bulletin of statistic because the one of bulletin of statistics include all container imports even those of abnormal occurrences which should be omitted from the calculations. Terminal process duration was second with 51.74138 hours (2 days, 3 hours and 45 min). Third and fourth was revenue and terminal to gate release process each taking 20 hours and 14.17 hours respectively. CDO process consumed the least duration of the dwell time, as it used only 12.62 hours. This was due to the improvement of technology at the port.

4.2.1 REGRESSION ANALYSIS

From the regression of the data (See Appendix V), the econometric model was found to be

$$\mathbf{DT = 32.8552 + 0.9862T_1 + 0.8978T_2 + 1.1719T_3 + 1.2349T_4 + 1.1743T_5}$$
$$\mathbf{(2.43) \quad (16.01) \quad (4.75) \quad (4.19) \quad (7.11) \quad (6.37)}$$

32.8552 is the Y intercept term. It means that when the independent variables are equal to zero, then dwell time (DT) will be 32.8552 hours. It's the point at which the regression line cuts the vertical Y axis. It is presumed to be the down time that is reflect the lost time before the actual container clearing process start in our case.

T_1 was a container at lodging to passing stage measured in hours spent, it has a positive coefficient of 0.9862. An increase in lodging to passing process by one hour makes dwell time to increase by 0.9862 hours. This increase in dwell time is significant at 1%. Therefore we reject the hypothesis lodging and passing process do not influence dwell time.

T_2 was a container at central documentation office (CDO) stage measured in hours spent, it has a positive coefficient of 0.8978. If a clearance process of container takes one additional hour in the CDO stage dwell time will increase by 0.9862 hours. This increase in dwell time is significant at 1%. Therefore we reject the hypothesis CDO does not influence dwell time.

T_3 was the container at revenue stage measured also in hours spent, it has a positive coefficient of 1.1719. If a clearance process at the revenue stage takes one additional hour, dwell time will increase by 1.1719 hours. This increase in dwell time is significant at 1%. Therefore we reject the hypothesis revenue stage processes do not influence dwell time.

T_4 was time taken by a container in the terminal stage measured in hours spent, it has a positive coefficient of 1.2349. If terminal stage takes one additional hour, dwell time will increase by 1.2349 hours. This increase in dwell time is significant at 1%. Therefore we reject the hypothesis revenue stage processes do not influence dwell time because computed t statistic of 7.11 has a p value of 0.000.

T_5 was time taken by a container from the terminal stage to gate release, measured in hours. It has a positive coefficient of 1.1743. If terminal stage to gate release takes one additional hour, dwell time will increase by 1.1743 hours. This increase in dwell time is significant at 1%.

Therefore we reject the hypothesis of terminal to gate release stage process do not influence dwell time because computed t statistic of 6.37 has a p value of 0.000.

The test of goodness of fit using the adjusted R-squared is observed to be 0.7997(80%).This implies that, around 80% of the variation in dwell time is explained or predicted by independent (predictors) variables. The rest of 20% cannot be explained by the variable in the equation and is taken care by the error term. The conclusion is that the regression model at issue has a good fit. Also we note that, all the five process have the positive expected sign.

In the diagnostic test as shown in Appendix VI, the F- statistic, the parameters are jointly statistically significant at 1 percent. According to Breusch-Pagan test which is used to test heteroskedasticity and has null hypothesis of constant variance. From the analysis, we fail to reject null hypothesis, and therefore we conclude that there is no heteroskedasticity in the model. Ramsey reset test which is a specification error test, was done to test whether the model was properly specified. It is based on a null hypothesis that, the model has no omitted variables. Based on our results on the F- statistic, we fail to reject the null hypothesis and we therefore conclude that, the model was properly specified.

Chapter Five

5.0 Conclusion And Recommendations

The chapter begins with drawing conclusions from the empirical findings in chapter four. Then it is followed by policy recommendations, limitation of the study and lastly suggested areas of further research.

5.1 Summary

The study was on container dwell time a case study of the port of Mombasa. It examined the determinants of container dwell time. The study was motivated by the sporadic growth of containerization at the port of Mombasa which takes longer duration to clear. Even though there has been efficiency gains arising from the modernization of equipments and business process procedures, the Mombasa port dwell time was still higher than that of its performance contract target. Its port volume was less than a quarter of Durban's port and only 2 to 2.5 percent of the volume of port of Singapore and Hong Kong. The objectives of the study were to examine the causes of high dwell time and recommend specific actions to reduce it to competitive figure.The study used primary data collected on 87 containers and 278 respondents using questionnaires at the port of Mombasa. All the stakeholders who were interviewed were directly involved in the container clearance processes at the port of Mombasa. The main stakeholders interviewed included shipping agents, clearing agents, consignees and transporters.

5.2 Conclusion

Majority of the respondents issued with questionnaires have been in business operations at port for more than 5 years. Respondents unanimously agree they experience delays in the clearing of containers. The overall performance ranking of the stakeholders showed that majority were performing below their expectations with majority performing below good. The study further investigated each individual stakeholder problems that lead to a prolonged dwell time.

The port production system was fully demonstrated in this research. The study ends up accepting that a production system may have different components which are part of the whole system, though they exist in independence.

The hypotheses were adopted to investigate the determinants of container dwell time using OLS dwell time model. In the study, it was found out that there was no relation between the independent variables. The parameters were found to be jointly statistically significant at 1 percent level of significance. All the independent variables showed positive correlations with the dwell time, implying that, an increase in any determinant of the independent variable will lead to increase in dwell time. It was further observed that, most of the dwell time delays were during lodging to passing. Here the main players who should improve their performance level in this process are the clearing agent, shipping line and KRA

Major findings from empirical model supported our alternative hypotheses; all stages in container clearing process influence dwell time. With terminal stage having most influence on dwell time. The major conclusion is that, all the stakeholders should coordinate and work together to attain an efficient port. Lastly recommendation for further studies will be done.

5.3 Policy recommendations

The container clearance involves a series of linked factors controlled by different stakeholders, and no gain can materialize unless all stakeholders jointly cooperate to improve the port both a locative and technically efficiency. The integration practices will strengthen the linkages between the stakeholders, who occupy different positions at the port. The policy recommendations for each stake holder were as follows.

Shipping Lines/ Agents mainly experienced the problem of delivery order delays, systems breakdowns and slow sorting out of demurrage. It is recommended that, they should shorten the procedures involved in processing their delivery orders, do a quick dispatch of the delivery orders to the port and make the process of payment to them simplified. It is also recommended to do investigations of Maersk management which is a major shipping agent. The manifest should be provided in advance (7days before arrival) accompanied with advance invoices to enable the initial process of container clearance commence thus will help save time wasted in the container clearance procedures.

The main firm for the clearance of containers is the clearing agents. The problems associated with them include delayed payment of Storage charges at the port, with poor customer relations and slow document processing. Remedies recommend includes immediate and quick securing of relevant charges on behalf of the clients, have staff training in customer care and work performance and improving staff speed in processing the documents by recommending a reward to the employees in order to improve on their performance.

It was observed that transporters experienced dwell time delay due to vehicles delay at the gate as a result of lengthy port pass procedures, unworthy vehicles being allowed to do business at the port that causes jam, police harassment at weigh-bridges and also long queues at Weigh Bridge. I recommend that, the procedure of acquiring the port pass should be simplified, shortened and remove alteration fees incase there is an error in the document. Installation of stand by generators at the gates is highly recommended, so that the clearing of truck procedure should not stall incase of power failures. The port should not allow un road worthy vehicles in their premises thus will force the transporter to maintain their vehicles to accepted standards.

Analysis done on Kenya Railways established that, the major reasons why it was experiencing delays was because of unavailability of rolling stocks, lack of locomotives, low carrying capacity of wagons and most of the wagons were too old thus their efficiency were low. The appropriate policy recommendations will be to re privatize the organization if the current management cannot improve on their performance. The firm needs therefore to upgrade and procure more new equipments and wagons for it to run at its best optimal level.

Delays caused by KPA were due to lengthy documentation procedures, IT systems and power failure, delays in billing and invoicing, unavailability and consistence breakdown of machines and poor planning of operations. The study recommended measures to speed up the billing and invoicing process by simplifying the procedures involved in documentation and supervising the staff to ensure that they are not causing deliberate delays. For machines, they need more reliable machines which are serviced regularly. Good planning on operations is required at the port that will also ensure good traffic control network. The clients should also be encouraged, to have up to date ledger accounts for payments to both KPA and KRA

KRA had the problems with its Simba system software and its computers which keep on failing to operate effectively. Some of the KRA processes like verification and scanning were also its major causes of experiencing delays due to uncooperative of their personnel. The appropriate policy recommendations needed to solve these problems include ensuring system reliability by having KRA operating for 24 hours efficiently with alternative backups of both the machines and power incase of failures. The machines in use need to be upgraded, I recommend for more new machines, well trained and motivated personnel. All its processes need to be streamlined to avoid duplication of duties.

KEPHIS. Port health, KEBS, bank and port police were also analyzed. They had almost similar problems like slow processing of its respective document and poor services mainly due to inadequate motivated and poorly trained staff. To improve their efficiency, they will require speed up their processing procedures by streamlining their work procedures within their respective organization and also harmonize with other stakeholders. I also recommend them to have less documentation, to be transparent and accountable, increase their staffing level that should be well trained and motivated and also extend their working hours. The port police were found to be causing delays and were accused of harassing clients, interfering with container clearance processes unnecessarily and of being corrupt. The remedy for this is for the port to ensure that, all the incentives that encourage corruption, complacency and lack of integrity should be removed. The police should work jointly with other relevant parties like KPA gate staff, KRA staff at the verification point to avoid duplication of duties thus save time. The study propose that, all the organizations should have competent personnel with good public relations.

5.4 Limitations

The study utilized cross sectional data due to lack of time series data. Major limitation was funds which were limited thus I was unable to visit all the required port operators offices and stations. The length of the study was short, it took only six weeks to observe the average dwell time. A longer period could have been better to give more accurate figures. The study did not examine related activities of Inland Container Depots (ICDC's) due to time and financial constraints. Also it was difficult in obtaining relevant data and information from some of the key institution representative due to lack of corporation. Lastly, eenvironmental factors like rain and flood were not captured because of lack of appropriate tools, equipments and skills to capture the data.

Areas of Further Research

This study could be extended over other ports over time, because it was based only on the port of Mombasa for the period of the study. More studies can also be conducted on dwell time to capture the time for breakdown of machines and congestion at the port. This will be possible by prolonging the time of the study. The study recommends further researchs, to find out the reason for extended or abnormal delays of containers in the port and get the remedies to control them. Also the trends of container dwell time as per seasons can be researched and even further classify the trend in terms of local containers and transit container dwell time. Labour efficiency can also be analysed on how it affects the container dwell time at the port. Lastly a similar research can also be carried out transit containers.

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APPENDICES

Appendix 1:

(Form A) s/no:……………………

CONTAINER DWELL TIME DATA COLLECTION FORM

CONTAINER NUMBER	
SIZE	
MPRO NO	
ORIGIN	
DESTINATION	

	DATE	TIME	REMARK
CUSTOM ENTRY LODGED			
DISPATCHING TO KPA REVENUE OFFICE			
RECEIVED AT KPA REVENUE OFFICE			
DISPATCHING TO CDO			
RECEIVED AT CDO			
DISPATCH TO TERMINAL			
RECEIVE AT KPA TERMINAL			
END OF ISPECTION			
RELEASE BY CUSTOMS AT TERMINAL			
KPA GATE RELEASE			

Gate Pass number: ____________________ **Gate number:** ____________________

NOTE: THIS FORM MUST BE RETAINED AT THE GATE

Appendix II: *S/No.................*

CONTAINER DWELL TIME STAKE HOLDERS QUESTIONNAIRE

1.0 Contact

1.1 Company Name

1.2 Contact Person

1.3 Nature of Business e.g (Shipping Line/Clearing Agent/Importer/Transporter/Others)

1.4 Year of establishment Business interaction with KPA

1.5 Address

Box:
Tel:
E –mail:

2.0 Business Volume

2.1 Average container volume per month/year (TEUs)

Imports:		***Exports:***	

3.0 Container Delays

3.1 Do you encounter any delays in processing your documents and cargo clearance?

YES ☐ **NO** ☐

3.2 If yes, where do you encounter delays?

Performance Key:

Very poor	Poor	Fair	Good	Excellent
1	2	3	4	5

Organization	How long (Hrs/Days)	Cause of the Delays	Rank	Recommendation
Shipping Lines				
Clearing Agents				

Organization		How long (Hrs/Days)	Cause of the Delays	Rank	Recommendation
KRA					
KPA	Revenue				
	Operation				
Kenya Railways					
KEBS					
KEPHIS					
Port Health					
Transporters (Road)					
Banks					
Police					
Others (Please specify)					

3.3 Any other bottlenecks encountered ....

	Days
3.4 On average how long does it take you to clear container from the port?	
3.5 What should be the ideal container dwell time for the port of Mombasa?	

4.0 Your recommendation to reduce cargo dwell time ....

Appendix III: CONTAINER DWELL TIME DATA

	T_1	T_2	T_3	T_4	T_5	DT
1	48	4	45	45.9	1.23	203.75
2	24	49.5	21.58	2.4	100.85	233.08
3	144	1.5	20.17	3.43	118.08	372.43
4	48	5	21.63	73.98	1.58	184.9
5	72	1.25	25.22	93.78	1.8	227.72
6	48	4	19.47	95.97	4.37	207.5
7	216	0.4	2.63	24.27	0.93	280.7
8	120	1.55	3.33	25.17	1.25	185.42
9	192	2.03	44.92	53.82	1.15	329.42
10	240	0.78	20.37	29.28	0.72	402
11	144	26	4.3	40.23	1.18	250.25
12	96	0.67	24.17	15.4	3.47	228.87
13	48	24	23	95.38	2	204.02
14	192	0.57	18.5	0.27	73.98	321
15	96	17.83	5	42.5	7.58	186.33
16	96	4	18.75	119.67	4.32	351.15
17	96	4	42.47	96.62	3.92	351.17
18	48	4	42.93	96.72	0.77	252.12
19	360	0.92	18.37	1.22	2.03	422
20	144	3.75	20.75	23.8	2.3	230.35
21	48	2.28	19.25	29.2	25.88	160
22	144	17.67	2	50.17	27.25	257.42
23	48	2.87	20.37	50.52	1.37	207.88
24	24	3.67	43.45	77.63	19.32	250
25	96	3.38	20.5	50.77	1.47	232.23
26	144	1.35	3.67	45.65	1.6	232.75
27	48	5	25.87	45.65	1.45	208.6
28	168	0.83	21.83	48.5	1.65	257.65
29	48	2.12	59.42	87.28	1.72	210.25
30	192	45.28	3.33	75.33	17.55	370.13
31	24	1.82	20.58	30.27	46.97	231.67
32	72	4.1	19.08	44.43	3.85	228.53
33	96	1.18	16.83	47.37	0.82	178
34	96	1.58	4.47	17.27	29.3	182.98
35	48	23.55	16.83	44.78	3	156.78
36	24	88.82	6.08	66	2.87	204.78

37	24	1.47	22.03	23.8	2.2	108.75
38	24	19.95	4.67	65.25	0.08	178.83
39	96	17.47	5.42	43.08	0.8	179.97
40	96	17.75	2	71.25	1.3	204.55
41	24	29.95	19.08	47.33	5.78	209.37
42	72	54.08	17.5	72.92	2.48	254.23
43	24	1.85	20.58	49.35	0.9	228.68
44	96	1.25	21.75	46.68	4.12	185.55
45	120	2.73	19.75	3	50.42	208.58
46	96	18.08	5	21.83	24.1	206.35
47	120	4.95	19.75	3.02	97.57	279.83
48	48	19	24.75	3.32	1.8	160.28
49	96	1.7	3.58	69.92	1.72	209.13
50	96	4.05	18.67	51.33	2.58	210.17
51	264	2.42	45.22	125.63	19.57	539.17
52	120	3.43	17.92	77.92	1.7	377.45
53	48	1.82	51.47	94.5	1.72	233.47
54	984	23.18	18.28	29.88	18.77	1,091.40
55	24	1.08	40.17	55.75	17.5	226.17
56	48	0.32	19.58	27.67	1.13	114.05
57	24	96.37	19.08	68.65	2.63	227.53
58	48	2.37	5.25	16.5	75.08	204.5
59	72	19.12	5.42	65.4	1.88	299.37
60	120	0.38	2.63	90.92	1.78	251.7
61	24	1.75	5.5	65.25	1.12	131.08
62	120	4.5	18.28	47.5	26.22	252.47
63	72	6.12	41.62	47.53	2.43	204.72
64	96	17.25	6.38	66.43	4.03	206.55
65	216	77	42.17	49.25	4.53	447.53
66	96	0.77	18.25	71.83	2.97	206.55
67	72	1.9	28.33	42.88	21.63	201.37
68	96	4	19.58	47	2.75	207
69	72	0.13	3.08	21.25	2.17	110.42
70	96	2.3	20.92	50.98	2.72	207.45
71	216	1.08	21.67	21.83	75.25	352.08
72	96	4.17	19	49.25	1.88	182.88
73	72	6	89.67	99.58	25.72	327.13
74	48	1.92	18.08	50.22	2.78	136.75
75	48	2.38	4.47	45.65	22.73	156.8
76	288	1.48	24.17	47	1.92	400.08

77	168	2.03	20.92	52.53	26.6	328.88
78	96	2.18	20.92	52.97	1.18	207.9
79	120	1.78	19.75	27.77	43.18	418.12
80	24	79.52	40.5	53.22	1.43	280.4
81	144	18.65	4.47	46.83	18.35	249.6
82	48	3.53	20.5	50.08	1.58	136.92
83	96	2.33	3.83	22.5	74.17	209.58
84	144	90.5	23.92	76.62	0.82	400.85
85	72	22.65	0.97	112.32	3.02	300.58
86	72	17.32	5.92	88.97	3.22	276.9
87	192	18.6	20.97	48.73	1.55	299.33

Appendix IV: Summarised Statistics

```
sum  T1 T2 T3 T4 T5 DT

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
          T1 |        87    108.9655    115.4952         24        984
          T2 |        87    12.61908    21.41288        .13      96.37
          T3 |        87    19.99437    14.97248        .97      89.67
          T4 |        87    51.74138    28.04732        .27     125.63
          T5 |        87    14.17402    24.91952        .08     118.08
-------------+--------------------------------------------------------
          DT |        86    245.7492    82.37351     108.75     539.17
```

_Source: Statistical computations based on statistics in appendix (III).

Appendix V: Regression Statistics

```
. regress DT T1 T2 T3 T4 T5

      Source |       SS       df       MS              Number of obs =      86
-------------+------------------------------           F(  5,    80) =   68.85
       Model |  468003.136     5  93600.6272           Prob > F      =  0.0000
    Residual |  108755.382    80  1359.44228           R-squared     =  0.8114
-------------+------------------------------           Adj R-squared =  0.7997
       Total |  576758.518    85  6785.39433           Root MSE      =  36.871

------------------------------------------------------------------------------
          DT |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          T1 |   .9862035   .0615875    16.01   0.000     .8636404    1.108767
          T2 |   .8977908   .1889028     4.75   0.000     .5218622    1.273719
          T3 |   1.171892   .2793813     4.19   0.000     .6159055    1.727879
          T4 |    1.23494   .1737696     7.11   0.000     .8891272    1.580752
          T5 |    1.17426   .1842607     6.37   0.000     .8075703    1.540949
        cons |   32.85516   13.53015     2.43   0.017     5.929315    59.78101
```

Source: Statistical computations based on statistics in appendix (III).

Appendix VI: Diagnostic Statistic Test

	Breusch-Pagan Test	Ramsey RESET test
F-Statistic	0.01	0.25
P- Value	0.9061	0.8633

Appendix VII: Respondents Sample Breakdown:

Targeted	**Respondents**	**% sampled**
Shipping Agents	25	8.99
Clearing Agents	137	49.28
Transporters	92	33.09
Consignees	15	5.4
Others	9	3.24
Total Achieved (Base)	**278**	**92.67**
Targeted	**300**	

Appendix VIII: Length of operation

Duration	**Respondents**	**% sampled**
Base	**278**	
6 -11 months	2	0.72
1-5 yrs	61	21.94
6-10 yrs	81	29.14
11-20 yrs	71	25.54
Over 20 yrs	38	13.67
Not indicated	25	8.99

Appendix IX: Length of Transaction with KPA

	Mombasa	Percentage
Base	278	
6 -11 months	3	1.08
1-5 yrs	73	26.26
6-10 yrs	75	26.98
11-20 yrs	73	26.26
Over 20 yrs	32	11.51
Not indicated	22	7.91

Appendix X: Container Cargo Delay

	Mombasa Respondents:			
Base	278		Percentage	
	Yes	No	Yes %	No %
Shipping line	16	7	5.76	2.52
C/Agents	150	1	53.96	0.36
Consignees/Importers	15	-	5.4	0
Transporters	85	1	30.58	0.36
Others	2	1	0.72	0.36
TOTAL	268	10	96.4	3.6

Appendix XI: Service Delivery Ranking

	Excellent	%	Good	%	Fair	%	Poor	%	V. Poor	%	Respondents
Shipping Lines	2	1.11%	23	12.78%	70	38.89%	59	32.78%	26	14.44%	180
Clearing	3	4.76	14	22.22	21	33.33	22	34.92	3	4.76%	63

Agents		%		%		%		%			
Kenya Revenue Authority	2	0.78%	30	11.72%	113	44.14%	99	38.67%	12	4.69%	256
KPA Revenue	7	3.35%	43	20.57%	79	37.80%	63	30.14%	17	8.13%	209
KPA Operations	1	0.43%	26	11.26%	90	38.96%	87	37.66%	27	11.69%	231
Kenya Railways			6	7.32%	12	14.63%	32	39.02%	32	39.02%	82
Kenya Bureau of Standards	23	21.70%	34	32.08%	30	28.30%	13	12.26%	6	5.66%	106
KEPHIS	19	28.36%	34	50.75%	12	17.91%	2	2.99%	0	0.00%	67
Port Health	18	20.93%	33	38.37%	25	29.07%	6	6.98%	4	4.65%	86
Transporters	10	10.53%	26	27.37%	33	34.74%	20	21.05%	6	6.32%	95
Banks	23	21.30%	34	31.48%	31	28.70%	19	17.59%	1	0.93%	108
Police	14	12.17%	30	26.09%	40	34.78%	25	21.74%	6	5.22%	115
Others*	2	4.76%	4	9.52%	10	23.81%	15	35.71%	11	26.19%	42
TOTAL	124	7.56%	337	20.55%	566	34.51%	462	28.17%	151	9.21%	1640

* Includes KPA Security and Maersk where the former accounted for 38 out of the 40 respondents

Appendix XII: Expected ideal Dwell time (Days)

DAYS	1	2	3	4	5	6	7	8	9	10	Above 10
Shipping Lines	5	3	4								2
Clearing Agents	45	60	53	19	8			1		2	
Transporters	41	19	2	3	5		1	1		2	1
Others[4]	1		2	1	3						
Consignees	7	10	6	2	2		3	1			
TOTAL	99	92	67	5	17	0	5	3	0	4	3
Percentage	31.2%	29.0%	21.1%	7.9%	5.4%	0.0%	1.6%	1.0%	0.0%	1.3%	1.0%