

**FACTORS AFFECTING EFFICIENCY OF CONTAINER FREIGHT
STATIONS: A CASE OF MOMBASA PORT, MOMBASA COUNTY,
KENYA**

BY

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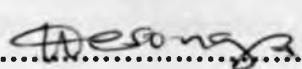
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**A RESEARCH PROJECT REPORT SUBMITTED IN PARTIAL
FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE
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DECLARATION

This research project report is my original work and has not been submitted for a degree in any other university.

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This research project report has been submitted for examination with my approval as the University supervisor

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DEDICATION

This study is dedicated to my loving wife Betty , my dear sons Jaydon & Gordon, my parents Mr&Mrs Johnstone Aderi and all my friends and colleagues who have lent undying support and inspiration.

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First I would like to appreciate my supervisor Dr. Moses Otieno for the invaluable input and tireless assistance and support he accorded. He worked tirelessly to guide and support me throughout my research and subsequently this report. I would like to thank the University of Nairobi staff for the support they accorded me, in particular Caroh, Purity and Musembi. I would like to thank my PPM colleagues especially Vincent Obuya, Mephah Caroh whose team work and tenacious spirit kept every member of the cohort going. Lastly to all my dear friends like Anthony Namboka and Anthony Mulaku thanks a lot for your patience and prayers.

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ABBREVIATIONS AND ACRONYMS

- KPA** - Kenya Ports Authority.
- CFS** - Container Freight Station.
- KRA** - Kenya Revenue Authority.
- UNCTAD** - United Nations Conference on Trade and Development.
- TEU** - A 20 Foot Container.
- ICD** - Inland Container Depot.
- CaMIS** - Cargo Management Information System.
- ILO** -International Labour Organization.

ABSTRACT

Container Freight Stations (CFS) are sea port facilities which have been touted as important interventions that can mitigate congestion at Mombasa Port. It is therefore germane that CFS must be efficient in the performance of their functions. The aim of this study was to investigate the factors affecting the efficiency of CFS affiliated to Mombasa Port. Specifically, the study aimed at determining whether the type of infrastructure present (such as roads, port, rail, and communication network), the systems used by the CFS to receive and release containers and the machinery/equipment employed by the CFS could influence their efficiency. The study used a descriptive survey design to collect the pertinent data. The target population consisted of all the 17 managers or responsible officers of the CFS at Mombasa Port. Since the target population was small, the study adopted a census method, in which the entire population was used in the study. Primary data was collected using structured questionnaires while secondary data was collected through the analysis of documents. Quantitative data summarised using descriptive statistics while inferential statistics used to answer the research questions under study. An Ordinal Linear Regression (OLR) model was used to analyse the relationships between the independent variables (type of infrastructure present, systems used by the CFS to receive and release containers and machinery/equipment employed by the CFS) and the dependent variable (efficiency of CFS). This study is significant because there is scant literature on this subject of CFS efficiency, and studies carried out so far on CFS efficiency have overall been constrained partly by the lack of up-to-date and reliable data (UNCTAD, 1987). Second, as nations are becoming more “global” and their industries more exposed to the pressures of international competition, there is a growing realization that services supplied to their industries must be provided on an internationally competitive basis. Thus, there is a push amongst port authorities to improve their port efficiency due to increasing competition between ports and growing pressure from shippers for lower port and shipping charges. Needless to say, CFS form a vital link in the overall trading chain and consequently, their level of efficiency and performance determines to a large extent a nation’s international competitiveness. However, in order to achieve and maintain a competitive edge in the international markets, a nation needs to understand the underlying factors of CFS efficiency, and continually assess its performance relative to the rest of the world so that appropriate business strategies can be devised. It is hoped that the findings from the study will be useful to the CFS and Kenya Ports Authority in designing optimal systems that can provide the most efficient services to their customers in order to increase performance and competition.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Increased global trade and geographical dispersion of production has resulted in a phenomenal expansion in the volume of maritime freight transport over recent decades. For instance, in 2008, it is estimated that the volume of international ocean borne cargo topped a massive 8.17 billion tons and in the past decade, the maritime transport trade has been growing at an annual average rate of roughly 3% (UNCTAD, 2009; OECD, 2008). Considering that the volume of international air cargo in the same year was 28 million tons, it is clear that by weight, the overwhelming majority of global overseas merchandise trade occurred by ocean vessel rather than airplane (Bureau of Transportation Statistics, 2010). Consequently, seaports face several challenges imposed by the huge volumes of goods that they deal with, including, congestion.

Seaports are an important hub in the intermodal exchange of goods between ocean shipping and land transportation modes. The goods exchanged occur in different forms: liquid bulk, dry bulk, general, autos and containers. In Mombasa Port, while the non-containerized cargo is delivered directly from ship to truck or conveyors, containers are first stored in container yards for several days before being released. Since their advent in the late 1950s, containers have revolutionized maritime transport (Iannone *et al.*, 2007). Over 60% of the world's deep sea general cargo now moves in containers (Muller, 1995) and their share of maritime transport has been expanding. In 1970, world ocean container traffic was estimated at 4-5 million TEUs (Twenty-foot Equivalent Unit), in 2007, it stood at 130 million TEUs while it grew to 137 million TEUs in 2008 (Iannone *et al.*, 2007; UNCTAD, 2009). Container transport is a major component of freight intermodality, providing a unitised and seamless cargo transportation by a combination of truck, rail and shipping.

The Mombasa Port has two types of facilities, specialized and conventional container terminals, for handling container cargo. However, the terminals are relatively small, giving rise to debilitating congestion (Nathan Associates Report, 2011). To mitigate congestion at the marine terminal, 17 Container Freight Stations (CFSs) have been established around the port's vicinity to handle domestic import container cargo.

A CFS is a facility, usually, near a port where cargo is loaded ("stuffed") into or unloaded ("stripped") from containers (ILO, 1995). In addition, CFSs are also supposed to deliver import cargoes to inland transport and to store import and export cargoes temporarily

between the times of unloading and loading, while various documentary and administrative formalities are completed (ILO, 1995). However, some authors, notably in the Nathan Associates Report of 2011, have argued that the use of CFS to refer to the container handling facilities in Mombasa is a misnomer, as the facilities carry out little stuffing and stripping of imported containers. Instead, they propose that the facilities be referred to as Inland Container Depots (ICD). The functions that the CFSs associated with the Mombasa Port actually provide have not been comprehensively documented. It is therefore germane to describe the functions the CFSs actually provide, in order to determine the extent to which they complement the port.

However, since the establishment of the CFS at the Mombasa Port, the problem of the congestion at the port has still persisted. This raises two questions. Are the CFSs themselves efficient? Secondly, has the insertion of CFSs in the chain of ship, port, and customer complicated the process and even worsened congestion? Several factors may be conceptualized to affect the efficiency of CFS. Such factors could include the type of infrastructure present (such as roads, port, rail, and communication network), the systems used to receive and release containers and the machinery employed (Nathan Associates Report, 2011). However, there is a paucity of information on whether and how each of these factors could influence the efficiency of CFSs in handling container-related functions. It is therefore pertinent to determine the relative importance of each of these factors in influencing the efficiency of CFSs.

1.2 Statement of the problem

Container Freight Stations (C.F.S) is an important intervention aimed at easing congestion in the marine terminal at Mombasa Port (Nathan Associates, 2011). For the CFSs to accomplish this task were established at Mombasa Port, the port still experiences congestion, as evidenced between themselves must first be efficient and their insertion into the ship-port-customer chain must be such as to promote the quickest and cheapest transfer of containers. However, although CFSs had December 2011 to January 2012. Studies suggested that the type of infrastructure present (such as roads, port, rail, and communication network), the systems used to receive and release containers and the machinery/equipment employed influenced the efficiency of CFSs. (Nathan Associates, 2011; Iannone et al., 2007; UNCTAD, 1991) However, these factors were not empirically investigated in the CFSs of Mombasa Port. In addition, their relative importance in promoting efficiency was unknown. Therefore,

this study constructed a regression model that simultaneously tested the factors influencing the efficiency of CFS and the relative importance of the factors.

1.3 Purpose of the study

The purpose of this study was to investigate the factors affecting the efficiency of container freight stations of the Mombasa Port in Mombasa County.

1.4 Objectives of the Study

The specific objectives of this study were:

1. To assess the extent to which infrastructure endowment by the CFSs of Mombasa Port affects their efficiency.
2. To determine how the systems employed by the CFSs to receive and release containers affect their efficiency.
3. To determine the extent to which the equipment used by the CFSs of Mombasa Port affects their efficiency.

1.5 Research questions

The study sought to answer the following questions in order to achieve the study objectives.

1. To what extent does the infrastructure endowment by the CFSs of Mombasa Port effect their efficiency?
2. To what extent does the system employed by the CFSs to receive and release containers affect their efficiency?
3. How do the types of equipment used by the CFSs of Mombasa Port affect their efficiency?

1.6 Research Hypothesis

The research tested these three hypotheses.

H0: There is no relationship between infrastructure endowment and the efficiency of container freight stations in Mombasa port.

H1: There is relationship between infrastructure endowment and the efficiency of container freight stations in Mombasa port.

H0: There is no relationship between the systems employed and the efficiency of container freight stations in Mombasa port.

H1: There is relationship between the systems employed and the efficiency of container freight stations in Mombasa port.

H0: There is no relationship between the equipment used and the efficiency of container freight stations in Mombasa port.

H1: There is relationship between the equipment used and the efficiency of container freight stations in Mombasa port.

1.7 Basic Assumptions of the study

The study was based on assumptions that respondents would spare their time to answer questionnaires in the study and that they would be sincere in their responses. Also the researcher would have enough funds for the study and adequate time to carry out the research.

1.8 Significance of the study

The findings from this study would be useful in various ways:

To the CFSs themselves, they would be in position to know how they could improve and provide more efficient services to the customers.

To KPA, the study would enable KPA to come out with the best model of container transfer from ship to land and vice versa.

To the customers/clients, they would benefit from a higher turn-round of ships as this would mean efficiency in import and export of goods (trade).

To the researcher, the study would be of academic importance to the researcher as it would help to potentially isolate the factors that influence the efficiency of CFSs.

1.9 Delimitations of the study

The study focused on the factors affecting efficiency of container freight stations a case of Mombasa Port" in Mombasa County. The research was conducted within the container freight stations of Mombasa and specifically looked at how some factors contributed to the efficiency of container freight stations in Mombasa. ". The independent variables were limited to three ie the type of infrastructure, systems used when receiving and releasing

containers, and the type of equipments employed by the CFSs while the dependent variable was the efficiency of the CFSs.

1.10 Limitations of the Study

Because of the constraints imposed by time, the study only focused on three possible factors that affect the efficiency of CFS, namely, infrastructure, systems used when receiving and releasing containers, and the type of equipment used. However, these allowed for a more in depth analysis of these variables. The collection of data proved to be hard since the management of the CFS was adamant to give information on the efficiency of their CFSs. However, well structuring of the questionnaires and assurance of confidentiality of the information actually helped the research to be successful.

1.11 Definition of significant terms

EFFICIENCY- Efficiency connotes an effective way of doing things. The American Heritage Dictionary of the English Language (2009), defines efficient, the adjective of efficiency, as, “Acting or producing effectively with a minimum of waste, expense or unnecessary effort”. This is similar to the definition given by the Collins English Dictionary (2003), which defines efficient as, “functioning or producing effectively and with the least waste of effort; competent”. Thus, applied to CFSs, efficient ones will be expected to perform the duties

CONTAINER FREIGHT STATION- A CFS is a facility, usually, near a port where cargo is loaded (“stuffed”) into or unloaded (“stripped”) from containers (ILO, 1995). According to UNCTAD (1991), a CFS is a shed where break bulk cargoes from several different consignors are received, aggregated, and stuffed into a container or where cargoes for several consignees are unpacked from a container for delivery. In addition, CFSs are also supposed to deliver import cargoes to inland transport and to store import and export cargoes temporarily between the times of unloading and loading, while various documentary and administrative formalities are completed (ILO, 1995). Container reloading from/to rail or motor carrier equipment is a typical activity.

PORT- A place on a waterway with facilities for loading and unloading ships.

MOMBASA PORT -A city or town on a waterway with such facilities for loading and unloading ships.

ELECTRONIC SYSTEM- Electronic systems are groupings of

electronic circuits and components which are designed to accomplish one or more complex functions. Include simba system & CaMIS for KRA and KWATOS for KPA

THROUGHPUT MEASURES-These measures show the effort involved in moving cargo expressed in terms of container movements per unit time.

TRAFFIC MEASURES-Refers to quantity of the cargo passing through a terminal in unit time. In this study were the number of containers, containers expressed in TEUS, total weight of cargo excluding the container tare weight and the value of shilling of the goods handled by each CFS in a typical day.

EXPORT- This term **export** is derived from the conceptual meaning as to ship the goods and services out of the port of a country. The seller of such goods and services is referred to as an "exporter" who is based in the country of export whereas the overseas based buyer is referred to as an "importer". In International Trade, "exports" refers to selling goods and services produced in the home country to other markets.

IMPORT- The term **import** is derived from the conceptual meaning as to bring in the goods and services into the port of a country. The buyer of such goods and services is referred to an "importer" who is based in the country of import whereas the overseas based seller is referred to as an "exporter". Thus an import is any good (e.g. a commodity) or service brought in from one country to another country in a legitimate fashion, typically for use in trade. It is a good that is brought in from another country for sale. Import goods or services are provided to domestic consumers by foreign producers. An import in the receiving country is an export to the sending country.

1.12 Organization of the report.

Chapter one presents the background of the study where the researcher outlined the study objectives, the problem and the significance of the study. It has also stated the significance the study, delimitation and limitations.

Chapter two of the report gives an outline of the literature review in relation to factors affecting efficiency of container freight stations. They include infrastructure endowment, systems used to receive and release goods, and the equipment employed by the CFSs and how they could influence their efficiency. The chapter concludes with a presentation of the conceptual framework of the study and a summary of the revised literature.

Chapter three gives the research design which was employed, the descriptive survey research design; this allowed in-depth investigation on the factors affecting efficiency of container

freight stations. The methods of data collection are also explained which are mainly questionnaire and observation and data analysis.

Chapter four presents how data is presented, analyzed, and interpreted. Finally chapter five presents the summary of research findings, discussion of the findings, conclusion, and recommendations. The study proposed for further studies on how CFS should improve on performance.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature reviewed in areas related to the objectives of the study. It focuses on the meaning of definition of container freight stations and their functions. It then presents the extant literature on how infrastructure endowment, systems used to receive and release goods, and the equipment employed by the CFSs could influence their efficiency. The chapter concludes with a presentation of the conceptual framework of the study and a summary of the revised literature.

2.2 Container Freight Stations

A CFS is a facility, usually, near a port where cargo is loaded (“stuffed”) into or unloaded (“stripped”) from containers (ILO, 1995). According to UNCTAD (1991), a CFS is a shed where break bulk cargoes from several different consignors are received, aggregated, and stuffed into a container or where cargoes for several consignees are unpacked from a container for delivery. In addition, CFSs are also supposed to deliver import cargoes to inland transport and to store import and export cargoes temporarily between the times of unloading and loading, while various documentary and administrative formalities are completed (ILO, 1995). Container reloading from/to rail or motor carrier equipment is a typical activity.

According to a Report by the Inter Ministerial Group (2005), a CFS is an extended arm of Port/ ICD/ Aircargo Complex, where import/ export goods are kept till completion of their examination and clearance. The imported goods can be immediately shifted from the port to CFS which also helps in the reduction of port congestion. All the activities related to clearance of goods for home consumption, warehousing, temporary admissions, re-export, temporary storage for onward transit and outright export and transshipments take place from such stations. Therefore, clearance of goods from CFS is an important point of consideration for trade in respect of export/ import Cargo as it is the final Customs contact point.

CFSs are also variously called Inland Container Depots, dry ports or off-dock container yards. The United Nations (1982) defines ICDs as: “facilities located inland or remote from port(s) which offer services for the handling, temporary storage and customs clearance of containers and general cargo that enters or leaves the ICD in containers. The primary purpose of Inland Container Depots is to allow the benefits of containerization to be realized

on the inland transport leg of international cargo movements. ICD's may contribute to the cost-effective containerization of domestic an ICD is under customs bond, and shipping companies will normally issue their own bills of lading assuming full responsibility for costs and conditions between the in country ICD and a foreign port, or an ICD and the ultimate point of origin/destination".

A CFS appears to differ from an ICD on the basis of the distance of location from a port. While the CFSs are much closer, ICDs can be situated further into the hinterland. ICD appear synonymous with dry ports, also called Inland Clearance Depots. It has been observed that dry ports could be inland terminals within a country that has a gateway port or they could even be located in adjacent land-locked countries (UNCTAD, 1991), which implies that a dry port could be several thousands kilometers away from a sea port to which it is attached. Dry ports have been defined as " inland terminals to which shipping companies issue their own import bills of lading for import cargoes assuming full responsibility of costs and conditions and from which shipping companies issue their own bills of lading for export cargoes", (United Nations, 1982).

From the foregoing, a CFS is a facility that is quite near a sea port, which is supposed to perform certain functions.

2.3 Functions of Container Freight Stations

ILO (1995) representatively explained the role of CFS as designed to serve the needs of consignors and consignees who need to transport cargo in break-bulk form and wish to gain as many of the benefits of containerized, intermodal transport as possible. According to the ILO (1995), the functions of CFS include the following: to receive, sort, and consolidate export break-bulk cargoes from road vehicles, rail wagons and inland waterway craft; to pack export cargoes into containers ready for loading aboard a vessel; to unpack import containers, and sort and separate the unpacked cargoes into break-bulk consignments ready for distribution to consignees; to deliver import cargoes to inland transport –road vehicles, rail wagons and inland waterway craft; to store import and export cargoes temporarily, between the times of unloading and loading, while various documentary and administrative formalities are completed (e.g. customs inspection, settling of charges for packing, unpacking and storage, arranging transport).

Some authors, notably in the Nathan Associates Report of 2011, have argued that the use of CFS to refer to the container handling facilities in Mombasa is a misnomer, as the facilities carry out little stuffing and stripping of imported containers. As such, they have proposed

that the facilities be called off-dock container yards, to differentiate them from on-dock container yards, or those within the marine terminals. It is therefore important to document just what type of services is provided by the CFSs located in Mombasa Port.

2.4 Efficiency of Container Freight Stations

Efficiency connotes an effective way of doing things. The American Heritage Dictionary of the English Language (2009), defines efficient, the adjective of efficiency, as, "Acting or producing effectively with a minimum of waste, expense or unnecessary effort". This is similar to the definition given by the Collins English Dictionary (2003), which defines efficient as, "functioning or producing effectively and with the least waste of effort; competent". Thus, applied to CFSs, efficient ones will be expected to perform the duties listed in section 2.3 above effectively and with minimum waste of effort.

To measure productivity of CFSs, two broad types of measures, traffic and throughput, will be adopted (Nathan Associates Report, 2011). Whereas traffic measures indicate the quantity of cargo passing through a terminal in unit time, throughput measures show the effort involved in moving cargo, usually expressed in terms of container movements per unit time. Most of these measures were developed to measure productivity of the sea ports. Thus, this study will modify some of them to apply in the measurement of the efficiency of CFSs.

This study will adopt three throughput measures to gauge the efficiency of CFSs. These will include the average roundtrip time it takes for containers to be moved from the port to the CFS facility and vice versa, the average dwell time of containers at the CFS facility and the waiting time for outside trucks (UNCTAD, 1991). For traffic measures, this study will measure the number of containers in terms of TEUS, and the total weight of the cargo (including packing but excluding the container tare weight) handled by each CFS facility (UNCTAD, 1991). This way, sensible comparison between different CFSs can be done, as containers could differ in size, number and the weight of the contents therein.

2.5 Factors affecting efficiency of Container Freight Stations

Very few studies have empirically investigated the direct relationship between various factors and the efficiency of CFSs. However, a study of the literature allowed a reconstruction of the possible factors that could influence the efficiency of CFSs. This study divided these factors broadly into three groups, infrastructural factors, systems employed in receiving and releasing containers, and the type of machinery/equipment employed by the CFSs.

2.5.1 Infrastructural factors in efficiency of Container Freight Stations

The CFSs at the Mombasa Port are connected to the Port and the hinterland by a system made up of mainly roads and railways (Kenya Ports Authority Handbook, 2012 – 2013). It is therefore expected that the status of the roads and the distance of the CFS to the port will affect the efficiency of the CFS in terms of the average roundtrip time taken to move the containers from the port to the CFS and vice versa. The CFSs located close to the port and provided with better roads or a functioning rail service will be expected to have short round trip times. Studies suggest this conclusion to be tenable. For instance, in the comparison of the average roundtrip taken by two CFSs, TRH and Azam located in Dar Es Salaam Port. Nathan Associates (2011), found that the former, located only 2 km away from the port took four hours while Azam located much farther reported a much longer roundtrip time of 8 – 10 hours.

The importance of infrastructural factors in the proper functioning of the CFS is demonstrated by the fact that Kenya Revenue Authority only licenses CFSs after it has taken into consideration factors such as location, facilities, security and equipment of the CFS (Kenya Ports Authority Handbook, 2012 – 2013). A nearby railway line has been found to be important for CFS developers. However, following the poor performance of the Rift Valley Railways in recent times, several of the recently gazetted CFSs affiliated to the Mombasa Port are located several kilometres away from Kenya's lines (Nathan Associates Report, 2011). It will be therefore interesting to compare the functioning of the CFSs located near the railway lines with those located further away.

To reduce the average dwell time of containers at the CFS, it will require other key facilities including warehouses, gate complexes, cargo handling equipment such as cranes, haulers and trolleys and premises to house customs and other agencies (Raghuram, 2006). A warehouse is needed to provide storage and working area for non containerized cargo. Enough space is needed to isolate the separate export bound cargo from the imports which are unpacked and distributed to individual owners. A gate complex is required for proper regulation of entry and exit of vehicles carrying cargo and containers through the terminal. It is where documentation, security and container inspection procedures are undertaken.

2.5.2 Systems used to Receive and Release Containers

Directly influencing most of the parameters of the CFS efficiency adopted by this study (such as, average dwell time of containers at the CFS facility, waiting time for outside trucks, and the total volume of cargo handled by the CFS) will be the systems that the CFS uses to receive and release containers. It is expected that more efficient systems will result in an overall improved functioning of the CFS and vice versa.

CFSs follow certain procedures when they receive imports and exports. For imports, the goods received at ports are brought to CFS and stacked in CFS after verification of the seal by Customs Officers. In respect of import consignment, the Steamer Agents/liners/Importers desiring to take the consignment to CFS, file Import General Manifests in the port. After obtaining permission, the Container moves to CFS under Customs escort or under bond and bank guarantee, where de-stuffing of the goods could occur. The importer files the Entry through clearing agent at Customs House and then Customs formalities of assessment, examination and payment of duty are completed. Thereafter, Customs gives “Out of Charge” or release order and the Custodian releases the goods from CFS by issuing a Gate-Pass (Kenya Ports Authority Handbook, 2012-2013).

For exports, exporters based in hinterland could either move cargo by road or rail to the CFS where the cargo is stuffed into containers or factory stuffed containers could be moved to the CFSs (Faust, 1985). Once the CFSs receive the goods, they then transmit the cargo to port premises for loading on board the ship (Kenya Ports Authority Handbook, 2012-2013). For exports that are stuffed at CFS facilities, the procedures may be enumerated as follows: transfer of cargo into truck, storage of cargo in truck, road (truck) journey, breaking out of cargo from truck, transfer of cargo from truck to storage point/shed/yard in CFS, unpacking for customs examination, repacking for customs examination, consolidation of cargo according to destination, stuffing of cargo in the container, locking and sealing of container, loading of container on truck, and then transportation container yard (Bubeer, 1983).

A CFS that can accomplish the above tasks quickly enough will be expected to have a short dwell time of containers in its yard. These could encompass several factors, such as, the level of automation and technology adoption in the facility, the design of facility, the type of workers and their motivation, and the management style (Thomas and Roach, 1988; Frankel, 1987; Agerschou and Lundgen, 1983). For example, Cheon (2007) found that improvement in port and container yard productivity among the Pacific Rim countries such as Australia, New Zealand, Singapore and China, was due to improvement in management of capital inputs, production scale adjustment and technological progress.

2.5.3 Machinery/Equipment employed

To move containers from trucks/rail to container yards and back will require the possession of specialised equipment by the CFS facility. The equipment required will include a number of loading/discharge appliances such as stevedoring pallets, hand trucks, hydraulic hand lift trucks, pallet trucks and fork-lift trucks (Brinkmann, 2011; Guler, 2001; UNCTAD, 1991). Others will consist of tractors and trailers for horizontal transport over long distances, conventional hoists and gantry cranes for hoisting (UNCTAD, 1991). It will be expected that CFSs that are well equipped will be expected to have a shorter container dwell time and will handle more cargo by volume (Nathan Associates Report, 2011).



2.6 Conceptual Framework

Independent variables

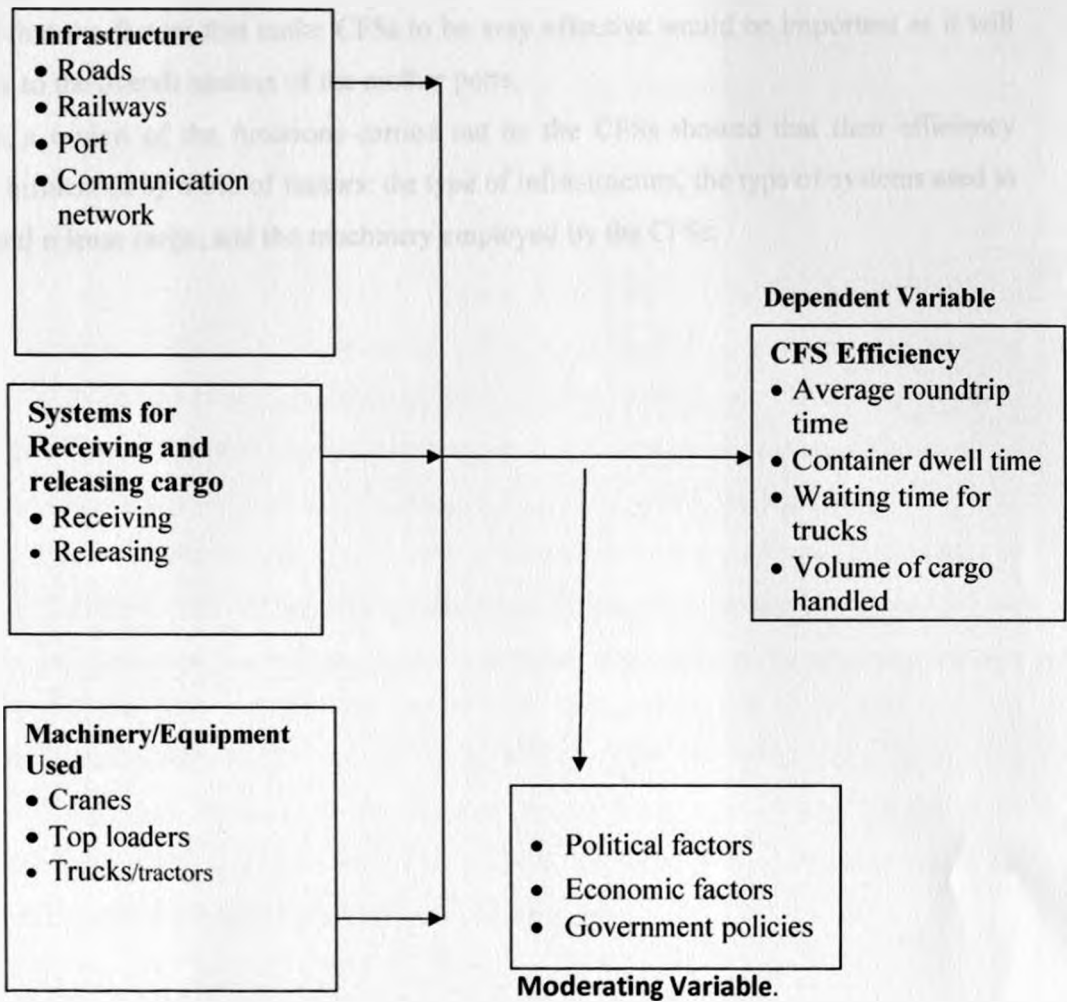


Figure 1: Conceptual framework

This study conceptualizes that the efficiency of CFSs could be affected by infrastructure, the type of systems used to receive and release cargo, and the machinery employed by the CFSs. The purpose of this study is therefore to test the nature and the strength of these relationships.

2.7 Summary of the Literature

A search of the literature revealed a dearth/ shortage in studies that have empirically investigated the factors responsible for the efficiency of CFSs. This was surprising, considering the importance of CFSs in easing congestion at the mother ports. It would be expected that the factors that make CFSs to be very effective would be important as it will contribute to the overall success of the mother ports.

However, a review of the functions carried out by the CFSs showed that their efficiency could be influenced by a trio of factors: the type of infrastructure, the type of systems used to receive and release cargo, and the machinery employed by the CFSs.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research design and research methodology that was employed in this study. It has been set out under the sub-headings containing research study site, research design, target population, data collection instruments and procedure, and finally, the data analysis and presentation methods used in the study.

3.2 Research Design

A research design is a plan, structure and strategy conceived in order to obtain answers to research questions and control variables. It helped to control the experimental, extraneous and error variables of a particular research problem being investigated. This study employed a descriptive survey research design that enabled it collect requisite information about the factors that influence the efficiency of CFS, as they existed within the population. Mugenda and Mugenda (1999) defined descriptive survey research as a systematic empirical inquiry in which the researcher does not have direct control of independent variables because they are inherently not manipulable. Inferences about relations among variables are made without direct intervention from concomitant variation of independent and dependent variables (Mugenda and Mugenda, 1999). As this design will not allow the researcher to manipulate either the independent variables or the research setting, it was appropriate, because of its higher external validity and less cost. This allowed the study to be completed within the constraints imposed by limited time and financial resources.

3.3 Target population.

The target population was all the 17 CFSs of the Mombasa Port. From each CFS, one manager or responsible officer provided the pertinent information for the study. These were Africanline, Awanad, Bossfreight, CB2, CCF, FFK, Focus, Interpel, and Kencot. Others were Kipevu, Makupa CFS, MICT, Mitchelcott, and Portside. Others CFS are CPC, Regional and Shimanzi. Of the 17 CFS studied, two of them, Bossfreight and Africanline handled car imports while the rest dealt with containerized goods.

3.4 Data Collection Instruments/ Tool

A combination of data collection techniques/instruments was employed in the study to gather both primary and secondary data, which was qualitative and quantitative in nature.

3.4.1 Collection of Primary Data

Primary data was mainly collected through administration of pre-tested structured questionnaires in the field. According to Nkapa (1997), a questionnaire was carefully designed instrument for collecting data in accordance with the specification of the research questions. The questionnaire was chosen because they are convenient tool for data collection. One officer at each CFS was identified to fill the questionnaire. The questionnaires were personally administered by the researcher to the respondents in order to reduce incidences of missing data and dampen the low rate of return that could occur. Structured questionnaires were used to ensure that all respondents in all the CFS answer the same set of questions. Questions that were asked were both closed-ended and open-ended. This ensured the easy handling and amenability to statistical analysis of closed-ended questions that were combined with the free-flowing opinions from open-ended questions.

3.4.2 Secondary Sources of Data

Secondary data was used to provide background and supplementary information on the factors that could affect the efficiency of CFSs in the study area. The secondary sources were subjected to general content analysis and provided updates and theoretical insights into the aspects under study. These data came from records available at KPA and at the CFS themselves.

3.5 Data Collection procedure

The procedure for data collection involved distribution of questionnaires. 17 questionnaires were distributed to seventeen CFS responsible officers. Secondary data was obtained from the literature review of resources such as books, internet and publications on the area of the study.

3.6 Validity and Reliability of the Research instrument

The study adopted validity and reliability measures to improve the reliability and replicability of the instruments used. Each of these measures is discussed in sections below.

3.6.1 Validity of the Research instrument

According to Cochran (1977), validity is the quality attributed to a proposition or a measure of the degree to which they conform to established knowledge or truth. An attitude scale is considered valid, for example, to the degree to which its results conform to other measures of possession of the attitude. Validity therefore refers to the extent to which an instrument can measure what it ought to measure. It therefore refers to the extent to which an instrument asks the right questions in terms of accuracy. Mugenda and Mugenda (1999) looked at validity as the accuracy and meaningfulness of inferences, based on research results.

Coolican(1994) validity refers to whether a measure is really measuring what it intends to measure. The content validity of the instrument was determined in two ways. First, the researcher discussed the items in the instrument (questionnaire) with supervisors, and lecturers from University of Nairobi. Since the determination of content validity is judgmental, all these people helped to refine the definition of the topic of concern, the items to be scaled and the scales to be used. Secondly, content validity of the instrument was determined through piloting, where responses of the subjects were checked against the research objectives.

3.6.2 Reliability of the Research instrument

According to Mugenda and Mugenda (1999), the reliability of an instrument is the measure of the degree to which a research instrument yields consistent results or data after repeated trials. Test-retest method in the pilot CFS was used to test the reliability of the instrument. While according to Cooper and Shindler (1998) reliability refers to being able to secure consistent results with repeated measures of the same person with the same instrument. The questionnaire will be administered twice within an interval of two weeks. The Pearson product moment correlation coefficient between the items in the two tests were computed. If the correlation coefficients of the items become 0.5 or more, the items were considered reliable. If it was less, the items were judged not to be reliable and would consequently be revised.

3.7 Data Analysis methods.

Descriptive statistics were used to analyse the data. These methods allowed the data to be condensed in the form of frequencies and percentages of the variables, which was displayed using tables. Where meaningful, the means (the arithmetic average of values in a set) of the variables was calculated. Both qualitative and quantitative data were analyzed using the Statistical Package for Social Science (SPSS) a computerized analysis.

Chi square (χ^2) tests of goodness of fit were conducted to test the null hypothesis that observed the differences in the way respondents answered.

All the above tests were two – tailed. Significant levels were measured at 95% confidence level with significant differences recorded at $p < .05$.

3.8 Ethical Consideration.

The researcher ensured that all the respondents were treated with respect and that the process of eliciting information from them did not interrupt their working time. The researcher also ensured that the collected data as kept with the highest degree of confidentiality.

Table 3.10 Operationalized variable table.

The below table gave the variables, indicators and the instrument used to collect data.

Variables		Indicators	Instrument used	Scale
Dependent variable	Independent variables			
CFS Efficiency	Infrastructure	Roads Networks Railways systems Ports Communication Net	Questionnaire	Nominal
	Systems for Receiving and Releasing Cargo	Cargo monitoring information systems (CAMIS) for receiving cargo Tradex simba systems 2005 for releasing cargo	Questionnaire	Nominal
	Machinery / Equipments used	Cranes Top loaders Trucks/Tractors	Questionnaire	Nominal

CHAPTER FOUR

DATA PRESENTATION, INTERPRETATION AND ANALYSIS

4.1 Introduction

In this chapter, the results from the study are presented, analysed, and interpreted. The interpretation is done based on the objectives and research questions that guide the study. The results are based on the analysis of 17 questionnaires administered to the 17 CFSs operating at Mombasa port.

4.2 Response Rate.

The researcher conducted a census of 17 CFS in Mombasa County. Questionnaires given out, completed and all of them were returned (100% response rate). The high response rate could be attributed to the way the questionnaires were laid out (structured).

4.3 Demographic Characteristics of Respondents.

To understand the provenance of the information used in the study, it was pertinent to document the demographic information of the officers who provided the information. This information is presented in Table 4.1.

Table 4.1 Demographic characteristics of respondents.

Bio-graphic information	Categories	Frequency	Percent
Age of respondent	26 – 30 years	6	35.3
	31 – 40 years	10	58.8
	Above 40 years	1	5.9
	Total	17	100
Gender of respondent	Male	8	47.1
	Female	9	52.9
	Total	17	100
Marital status	Single	3	17.6
	Married	14	82.4
	Divorced/widowed	0	0
	Total	17	100
Education	Diploma	1	5.9
	Degree	9	52.9
	Masters	7	41.2
	Total	17	100
Position	Revenue officer	7	41.2
	Supervisor	7	41.2
	Manager	1	5.9
	Customs officer	2	11.8
	Total	17	100

The larger number of the officers was relatively young, with 94.1% (n-16) of them aged 40 years or below. The gender of the respondents was almost evenly balanced, with males constituting 47.1% (n-8) of them while females made up 52.9% (n-9) of the respondents. The majority of the officers, n-14 (82.4%) were married. They were also well educated, with 52.9% (n-9) and 41.2% (n-7), having undergraduate and master's degrees, respectively, which suggested that they could provide the right information desired by the study. The

respondents were mainly supervisors (n-7, 41.2%) and revenue officers (n-7, 41.2%), who were well suited to provide the pertinent information required by the study.

4.4 Descriptives Statistics of the Dependent Variable in the Study

The purpose of this study was to investigate the factors affecting the efficiency of CFS of the Mombasa port. The way the CFS would function well, the dependent variable of this study, was investigated by several elements, divided into two broad groups, throughput and traffic measures, in order to provide a more comprehensive coverage. This study adopted four throughput measures, the average roundtrip time it takes for containers to be moved from the port to the CFS facility and vice versa, the average dwell time of containers at the CFS facility, the port waiting time for outside trucks and the average time it took to load and unload one container (UNCTAD, 1991). For traffic measures, this study measured the number of containers handled by each CFS, the number of containers expressed in terms of TEUS, the total weight of the cargo (including packing but excluding the container tare weight) handled by each CFS facility and the monetary worth of the goods handled.

4.4.1 Descriptives for Throughput Measures

The descriptive statistics for the throughput measures employed in the study are presented in Table 4.2.

Table 4.2 Descriptives for throughput measures

Name of CFS	Port to CFS time (hours)	Port waiting time (hours)	Yard time (days)
Focus	2	2	21
Kencot	6	1	30
CPC	3	3	Few
Mitchelcott	6	2.5	10
Kipevu	6	1	7
Awanad	9	3	Few
Portside	4	4	Few
Bossfreight	2	1	4
Interpel	2	1	Few
CB2	4	1	Few
Africanline	2	2	Few
CCF	5	5	1
FFK	4	6	5
Regional	10	4	Few
Shimanzi	6	4	Few
Makupa	½	-	21
MICT	3	6	3
Mean	4.382	2.91	

Two questions on the questionnaire, ‘how long does it take your CFS to move a container/cargo from its facility to the port?’ and ‘how long does it take your CFS to finish processing cargo it has delivered to the port?’ were left unanswered by all the CFS. The study found that this was because no CFS at the Mombasa port handled containers/cargo emanating from the hinterland that were destined for export. All of them handled cargo that was incoming into the country through the port; by transporting it from the port, storing it for days before releasing it to the clients.

The time it took to move a container/cargo from the port to the CFS ranged from as few as 30 minutes for Makupa to up to 10 hours for an Shimanzi CFS. Among the CFS that were also found to take the shortest time were Focus, Bossfreight, Interpel and Africanline, which take two hours to move their containers from their facilities to the port. The other CFS that were found to take long included Kencot, Mitchelcott, Kipevu and Shimanzi (each taking 6 hours), and Awanad (9 hours).

The time that CFS wait at the port for a container/cargo to be processed before collection was found to be non-uniform. The shortest waiting time was reported by Kencot, Kipevu, Bossfreight, Interpel, and CB2 (which took 1 hour) while among the CFS that recorded the longest waiting time were FFK and MICT (6 hours) and CCF (5 hours).

The average length of time that containers remained in the CFS yard after being brought from the port (Yard time) was found to range from as low as 3 days to up to 30 days. However, according to some CFS, the yard time depended upon how fast the client was able to process the container; those who were fast had the containers released much earlier compared to those who took a longer time. This suggested that the Yard time for some CFS could be more than 30 days given in Table 4.2 for customers who took inordinately long time to process their goods.

Furthermore these were reasons put up by the CFS in the study to identify ways in which time is wasted during the movement of containers between the port and the CFS. These results are presented in Table 4.3.

Table 4.3 How time is wasted during movement of containers

Reason	Frequency	Percentage
1. Network system failure	8	20.5
2. Lack of trucks/vehicles or their breakdown	5	12.8
3. Congestion at the port	3	7.7
4. Traffic jam	5	12.8
5. Slow processing of documents at the port	10	25.6
6. Breakdown of KPA loading machines	3	7.7
7. Police crackdown	2	5.1
8. Bad roads	3	7.7
Total	39	100

From Table 4.3, the results suggested that the two most important causes for the delay in the movement of cargo between the port and the CFS were the slow processing of documents at the port and network system failure, which were cited by 10 and eight CFS, respectively. The slow processing of documents by the port is supported by the information in Table 4.2, which indicated that the minimum time that CFS have to wait at the port before a container can be processed and released was 1 hour. The results indicated that the slow processing of documents could result from poorly motivated workers, uncoordinated work shifts between the various stakeholders and poor operation planning at the port. The systems which were cited as frequently breaking down were CAMIS and TRADEX used by the KRA and KWATOS employed by the KPA.

The other significant reasons cited for causing delay were lack of trucks by the CFS or their frequent breakdowns (n=5, 12.8%) and traffic jams (n=5, 12.8%). Others were congestion at the port, breakdown of KPA loading machines and bad roads (all were mentioned by 3 CFS). It was also germane to determine the average time it took for each CFS to load and unload a single container/cargo to or from a truck, as this also indicated their efficiency. These results are presented in Table 4.4.

Table 4.4 Descriptives for loading/unloading times

Name of CFS	Unloading time (minutes)	Loading time (minutes)
Focus	20	30
Kencot	30	45
CFC	10	15
Mitchelcott	10	10
Kipevu	10	5
Awanad	15	15
Portside	1	1
Bossfreight	20	30
Interpel	1	1
CB2	10	15
Africanline	-	-
CCF	10	10
FFK	30	20
Regional	10	10
Shimanzi	10	10
Makupa	10	15
MICT	10	20
Mean	12.94	15.75

Africanline provided no results on their loading and unloading time, probably because they dealt with motor car units rather than containers. A Pearson's correlation conducted to test the relationship between loading and unloading times was found to be positive and significant, $r = .844$, $p < .001$. This indicated that the CFS that took short time to unload containers also required short time to load containers and vice versa. The results from Table 4.4 showed that Portside and Interpel had the shortest loading and unloading times – taking just one minute to load or unload a container. On the other hand, Kencot took the longest time to load and unload a container, 45 and 30 minutes, respectively. The other CFS which also required appreciably long times to load and unload containers were Focus, Bossfreight, FFK, MICT, Makupa and Awanad, which needed at least 15 minutes to either load or unload a container. All the remaining CFS on average required about 10 minutes to either load or unload a container. The mean for unloading time was 12.94 while that for loading time was 15.75.

which indicated that generally, the CFS required more time to load a container compared to unloading it.

4.4.2 Descriptives for Traffic Measures

The traffic measures investigated in this study were the number of containers, containers expressed in TEUS, total weight of cargo excluding the container tare weight and the value of shilling of the goods handled by each CFS in a typical day. These results are presented in Table 4. 5.

Table 4.5 Descriptives for traffic measures

Name of CFS	Number of containers/units	Containers in TEUS	Total weight (metric tons)	Value (millions of shillings)
Focus	200	300	30000	40
Kencot	120	300	6000	20
CPC	60	100	7000	20
Mitchelcott	145	410	8000	35
Kipevu	75	170	3000	20
Awanad	140	-	300	32
Portside	200	450	9000	50
Bossfreight	70 units	-	-	56
Interpel	175	400	9000	60
CB2	60	-	-	12
Africanline	50 units	-	-	10
CCF	140	500	12000	70
FFK	150	340	700	50
Regional	55	150	4000	30
Shimanzi	50	100	-	25
Makupa	180	550	300	130
MICT	45	200	2000	10
Mean	112.65	443.85	27792.3	39.41

A significant and positive correlation was found between the number of containers and the value in shillings of the goods handled ($r = .623, p = .008$). This indicated that the more containers a CFS handled in a day, the more the value of goods it handled. However, no significant relationships were found between the number of containers and containers in

TEUS ($r = -.146$, $p = .635$), the number of containers and cargo weight ($r = .395$, $p = .182$), the weight of cargo and containers in TEUS ($r = -.119$, $p = .713$), and the weight of cargo and value ($r = -.036$, $p = .907$). This suggested that there was an absence of a linear relationship between the number of containers and their value with containers expressed in TEUS or total weight of the cargo.

The CFS which were found to handle the highest number of containers in a day were Focus and Portside (each handling 200 containers), Makupa (180), Interpel (175), FFK (150), Mitchel Cott (145), and Awanad and CCF (140 each). Those found to handle the lowest number were MICT (45), Shimanzi (50) and Unamed 2 (55). This profile was generally replicated with regard to value of the cargo.

Although no linear relationship was found between the number of containers with containers expressed in TEUS or with the weight of the cargo, generally, the CFS handling the highest number of containers also had more containers in TEUS and the weight of the cargo. For instance, among CFS with the highest TEUS were Makupa (with 550 TEUS), CCF (500), Portside (450), and Interpel (400) while in terms of weight were Focus (30,000 tonnes), Portside (9,000 tonnes), Interpel (9,000 tonnes) and CCF (12,000 tonnes).

4.5 The Functions performed by CFS

Since the functions actually performed by CFS at port of Mombasa Port had not been comprehensively documented, it was germane to describe them, in order to determine the extent to which the CFS complemented the port. The study found that the functions performed by all CFS at the port were generally similar. These included container/cargo transfer from the port to CFS i.e. decongestion of the port, acts as customs verification yard, acts as warehousing of the cargo under customs, cargo clearance point for the importers, create employment for Kenyans, acts as clearing and forwarding firms, breaking of consolidated cargo and export yard as summarized in table 4.6.

Table 4.6 Functions performed by CFS.

Function	Frequency	Percentage
1. Container transfer	17	17
2. Verification yard	17	17
3. Warehousing of cargo	17	17
4. Clearance point	17	17
5. Clearance of employment	17	17
6. Clearing and Forward firm	10	10
7. Breaking consolidated cargo	7	7
8. Export yard	0	0
Total	100	100

4.5 Descriptive Statistics of the Independent Variables

Three independent variables, infrastructural endowment, systems employed in receiving and releasing cargo, and the equipment used by the CFS, were investigated.

4.5.1 Descriptives for infrastructure endowment

The infrastructural factors examined by this study included the distance of the CFS from the port, whether the CFS moves cargo between it and the port by road, rail or water, the status of the road linking it to the port and the preference of the CFS for use of either road or rail for communicating with the port if both happened to be available. These results are presented in Table 4.7.

Table 4.7 Descriptives for infrastructural factors

Name of CFS	Distance of CFS from port (km)	How cargo is moved	Status of road	Prefer road or rail
Focus	2	Road	Good	Rail
Kencot	3	Road	Bad	Rail
CPC	4	Road	Bad	Rail
Mitchelcott	7	Road	Bad	-
Kipevu	12	Road	Good	Rail
Awanad	10	Road	Bad	Road
Portside	3	Road	Bad	Rail
Bossfreight	3.1	Road	Good	-
Interpel	3.5	Road	Good	Road
CB2	4	Road	Bad	Rail
Africanline	14	Road	Good	Road
CCF	20	Road	Bad	Rail
FFK	12	Road	Good	Rail
Regional	15	Road	Bad	Rail
Shimanzi	10	Road	Bad	Rail
Makupa	-	Road	Good	Road
MICT	5	Road	Good	Rail
Mean	7.98			

The CFS which were found to be nearest the port included Focus (which was just 2 km away), Kencot and Portside (each located 3 km away), Bossfreight (3.1 km away) and Interpel (3.5 km away). CCF was the furthest CFS from the port, being located some 20 km away, followed by Regional (15 km away) and Africanline (14 km away). In all the CFS, cargo is moved between them and the port by road rather than rail. Nine out of the 17 CFS described the roads linking them with the port as being bad while the remaining CFS described the connecting roads as being good. In the event that both road and a functioning rail were present, a majority of CFS (n=11) would prefer to move their cargo by rail rather than by road, with only four CFS favouring the latter. The CFS which preferred rail cited the absence of traffic jams, unnecessary police crackdown and considered it a more efficient and reliable mode of transport while those who preferred roads deemed them to be faster.

4.5.2 Systems employed in Receiving and Releasing Cargo

The system discussed in this study were divided into two types ie one that received cargo and the one that released cargo. But before the systems were discussed, procedure for receiving and releasing and time trucks to wait at the gate to guide us on the best systems to use as shown below;

i) Procedure for Receiving and Releasing Cargo

This study established that the Mombasa port's CFS only handled import cargo rather than cargo and containers meant for export. The study also found that barring minor differences, the procedure for receiving import cargo is similar for all the CFS. First, the CFS receives the gate pass from the driver of the truck or unit, in case of import vehicle. It then confirms the correctness of the gate pass and the marks and numbers of the container or chassis of the unit. This information is captured in the excel computer sheet and validated against information received electronically through the Cargo Management Information System (CAMIS). The container is then stored in the CFS yard until it is claimed by the owner. During claiming of the goods, the clearing agent brings the file for the cargo to customs for verification. The examination account is written into the SIMBA system basing on the verification of customs and the requisite taxes are then paid. The cargo is then released from the system, the CFS is paid its fees, and the owner receives the cargo.

ii) Gate Waiting time for Trucks

Since the procedure followed by the CFS to receive import cargo was largely similar, it was necessary to adopt another measure that could indicate how fast each CFS is able to complete processing the cargo before delivering it to the owner. The measure adopted was the length of time that a truck at the gate of the CFS had to wait from the time of arrival before it could collect the cargo. CFS with shorter gate waiting time for trucks indicated faster and more efficient systems for receiving and releasing cargo while those with longer waiting times indicated slower procedures. Table 4.8 presents the gate waiting time for the various CFS.

Table 4.8 Gate waiting time for trucks

Name of CFS	Gate waiting time (minutes)
Focus	5
Kencot	30
CPC	45
Mitchelcott	20
Kipevu	35
Awanad	25
Portside	5
Bossfreight	40
Interpel	10
CB2	45
Africanline	50
CCF	25
FFK	18
Regional	52
Shimanzi	50
Makupa	8
MICT	60
Mean	30.76

These results indicated that some CFS took only a short time to process and release cargo to owners while others took quite long. For instance, Focus and Portside required only 5 minutes to process the cargo for their customers while the CFS that were found to require a lot of time to process goods were MICT (60 minutes), Regional (52 minutes), Shimanzi and Africanline (50 minutes) and CPC and CB2 (40 minutes). The mean for the waiting time at the gate was 30.76 minutes, which indicated that most firms, on average, required this time to complete processing of cargo.

To determine the specific ways in which the time used for the processing of cargo by the CFS could be reduced, an open-ended question was put to respondents to suggest ways by which the process could be made more efficient. These suggestions included reducing of procedures involved in document processing, proper planning of the CFS yard space, trucks to be only called when the procedures have been completed, and entry and exit gates of the CFS to be different. Others were to have more and proper equipment/machines for handling cargo.

queuing order to be strictly followed, and for the CFS to employ enough and quality staff and to ensure that they are properly motivated.

iii) Electronic Systems for Receiving and Releasing Cargo

Without fail, all the CFS were found to employ computerized systems for receiving and releasing cargo. The system used during receiving of goods was the Cargo Management Information System (CAMIS) while the SIMBA system was used during releasing of cargo. When these systems were down, the CFS resorted to manual mechanisms for receiving and releasing cargo.

4.5.3 Equipment/Machinery used by the CFS

Table 4.9 presents the equipment/machinery that the CFS in the study were found to possess.

Table 4.9 Machinery possessed by the CFS

Name of CFS	Toploader	Forklift	Crane	Truck/ lorry	Stacking machine	Car carriers	Weigh bridge	Climbing lane	Machine index
Focus	√	-	-	√	-	-	-	-	2
Kencot	√	-	-	√	-	-	-	-	2
CPC	√	√	-	√	-	-	-	-	3
Mitchelcott	√	√	-	√	-	-	-	-	3
Kipevu	√	-	-	√	-	-	√	-	3
Awanad	√	-	-	√	-	-	-	-	2
Portside	√	√	√	√	√	-	-	-	5
Bossfreight	-	-	√	√	-	-	-	-	2
Interpel	√	√	√	√	√	-	-	-	5
CB2	√	-	-	√	-	-	-	-	2
Africanline	-	-	-	-	-	-	-	-	0
CCF	√	√	-	√	-	-	-	-	3
FFK	√	√	-	√	-	-	-	-	3
Regional	√	√	-	√	-	-	-	-	3
Shimanzi	√	√	√	√	-	-	-	-	4
Makupa	√	√	-	√	-	-	-	-	3
MICT	-	√	√	√	-	-	-	-	3
Total	14	10	5	16	2	0	1	0	

√ = own machine, - = do not own the machine

These results suggested that every CFS owned a toploader except for Bossfreight, Africanline and MICT. Ownership of trucks/lorries was also found to be ubiquitous among the CFS with only Africanline reporting that it did not own them. The next piece of machinery that was prevalent among the CFS was forklift, which was owned by 10 of the 17 CFS, followed by cranes, which were possessed by five of the CFS. On the other hand, a weighbridge was found to be owned by only one CFS while only two out of the 17 CFS were found to possess stacking machines. No CFS was found to have a climbing lane or a car carrier.

The machine index was computed by summing the types of machines each CFS possessed. The index was used an indicator of machine deficiency or endowment by a CFS. A high machine index indicated a rich endowment of machinery by the CFS while a low machine index indicated a deficiency. The CFS with the largest endowment of machines were found to be Portside and Interpel, which had a machine index of five out of a maximum possible eight, followed by Shimanzi, with an index of four. The CFS that was found to be the most deficient in machinery was Africanline, with an index of zero.

4.6 Analysis of the Research Questions/ Testing of Hypotheses

This study investigated three questions, what is the effect of infrastructure endowment by the CFSs of Mombasa Port on their efficiency? How do the systems employed by the CFSs to receive and release containers affect their efficiency? and How does the type of equipment used by the CFSs of Mombasa Port affect their efficiency? These questions were answered by running a series of regression analysis of each of the three independent variables against the appropriate dependent variable. This was important since the dependent variable was measured by several disparate elements, and hence, it would not have made any sense to combine them.

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4.6.1 The Effect of Infrastructure on the efficiency of the CFS

The infrastructural factors examined by this study included the distance of the CFS from the port, whether the CFS moves cargo between it and the port by road, rail or water, the status of the road linking it to the port and the preference of the CFS for use of either road or rail for communicating with the port if both happened to be available. This study found that all the CFS moved cargo by road while the preferences of the CFS were merely wishes. Thus, the infrastructural factors used in the regression analysis were the distance of the CFS from the port and the status of the road. The dependent variables conceptualized to be affected by these factors were the throughput measures. These measures were the time it took a CFS to

move cargo from the port to its yard, the time it took for a CFS to wait at the port before collecting cargo, and the time cargo stayed in the CFS's yard before collection by a customer. Since, the last variable really depended on the effort of the customer and not the CFS, it was omitted from the analysis. Table 4.10 shows the Pearson correlation between the relevant variables.

Table 4.10 Correlations between throughput measures and independent variables

Variable (n = 17)		Port to CFS time	Port waiting time	Distance from port	Status of road
Port to CFS time	r	1			
Port waiting time	r	.168	1		
Distance from port	r	.453	.418	1	
Status of road	r	-.641*	-.099	-.101	1

r = Pearson correlation coefficient; * = correlation significant at .01 level (2-tailed)

The dependent variables were port to CFS time and port waiting time while the independent variables were distance from port and status of road. The Pearson correlation coefficient ranges from 0 (if no relationship exists) to 1 (for a perfect relationship). The only significant relationship at $p < .05$ found was between the port to CFS time and the status of the road ($r = -.641, p = .006$). However, status of the road was not found to be significantly correlated with the port waiting time ($r = -.099, p = .709$) while no significant relationship were also found between the distance from the port with either port to CFS time ($r = .453, p = .078$) or with the port waiting time ($r = .418, p = .107$). This suggested that only the status of the road, not the distance, was likely to influence the time it took for CFS to move cargo from the port to their yard. This relationship was found to be fairly strong (about 64%) and negative. This implied that when the independent variable increased the dependent variable decreased and vice versa. Thus, when the status of the road improved, there was a reduction in the time required for CFS to move cargo from the port to their yard and vice versa.

Based on the results of correlation analysis, only port to CFS time was regressed against the status of the road. These results are presented in Table 4.11.

Table 4.11 Regression results between port to CFS time and road status

Variable (n = 17)	B	SE B	β
Constant	9.09	1.539	
Status of road	-3.201	.991	-.641

$R^2 = .41$; Adjusted $R^2 = .371$ *** $p < .01$

R square measures how much variability in the dependent variable the predictor accounts for. The R^2 in this model was found to be .41, which means that the single predictor, status of the road, could explain about .41% of the variation in the time that CFS took to move cargo between the port and their yards. Since R^2 values above 40% are considered high, this model could therefore explain a reasonable amount of the variation in the dependent variable. In other words, we can predict, to a great degree, port to CFS time given the status of the road. The remaining unexplained variation in port to CFS time could partly be attributed to other factors not specified in the model and partly to the error term in the regression equation.

Adjusted R square provides information on how well a model can be generalized in the population. If this model had been derived from the population rather than the sample, then it would have accounted for approximately 37.1% of the variance in the dependent variable, which is just about 3.9% less than what the model explains.

The B coefficient shows how much the value of the dependent variable changes when the value of an independent variable increases by 1. A negative coefficient means that the predicted value of the dependent variable decreases when the value of the independent variable increases. The B coefficient for status of road was -3.201, which is a sample estimate of the population parameter. It shows that when status of the road improves by one unit, port to CFS time reduces by roughly 320%. The β (beta) coefficient, also known as b-prime, or beta weight is measured in standard deviation units and is therefore not dependent on the units of measurement of the variable. It gives the rate of change in standard deviation units of Y per one standard deviation unit of X. In this study, the β coefficient for status of road was -.641, which suggested that, for an increase of one standard deviation in status of road there will likely be a decrease in port to CFS time by about 64% of its standard deviation.

The t – test for the B coefficient was found to be significant at $p < .05$ ($t = -3.231$, $p = .006$). This suggested that the population B coefficient for status of the road was unlikely to be zero. This indicated that status of the road significantly influenced the time required by CFS to transport cargo from the port to their yards. Thus, this study concluded that infrastructural factors in deed likely affected the efficiency of CFS.

4.6.2 The effect of Systems employed on the Efficiency of CFS

This study conceptualized that an indicator of the systems employed (gate waiting time for Lorries) could influence traffic measures. The traffic measures employed were the number of containers, containers expressed in TEUS, weight of cargo and value in shillings of cargo. Table 4.12 shows the Pearsons correlations between the gate waiting time and the traffic measures.

Table 4.12 Correlations between traffic measures and gate waiting time

Variable (n = 17)		Container numbers	Containers in TEUS	Cargo weight	Value	Gate waiting time
Container numbers	r	1				
Containers in TEUS	r	-.146	1			
Cargo weight	r	.395	-.119	1		
Value	r	.623*	-.074	-.036	1	
Gate waiting time	r	-.982*	.268	-.361	-.643*	1

r = Pearson correlation coefficient; * = correlation significant at .01 level (2-tailed)

These results indicated that gate waiting time was only significantly related with container numbers ($r = -.982$, $p < .0001$) and value of cargo ($r = -.643$, $p = .005$). Both relationships were negative, which suggested that when gate waiting time increased, there was a reduction in the number and value in shillings of the containers handled by the CFS. These results suggested that the systems employed influenced the efficiency of the CFS as measured by the traffic measures.

4.6.3 The effect of machinery/equipment endowment on the Efficiency of CFS

This study conceptualized machinery endowment of the CFS (as measured by the machine index) could influence loading and unloading time of containers. This objective was analysed using a correlation analysis, whose results are presented in Table 4.13.

Table 4.13 Correlations between loading/unloading time and machine index

Variable (n = 17)		Unloading time	Loading time	Machine index
Unloading time	r	1		
Loading time	r	.844*	1	
Machine index	r	-.668*	-.726*	1

r = Pearson correlation coefficient; * = correlation significant at .01 level (2-tailed)

Significant relationships were found between machine index and with both unloading time ($r=-.668$, $p=.005$) and loading time ($r=-.726$, $p=.001$). Both relationships were negative which indicated that when machine index increased, both loading and unloading times reduced and vice versa. The correlation coefficient between machine index and loading time was stronger (73%) than with that of unloading time (67%), which suggested that machine endowment might influence more loading time compared with unloading time. These results suggested that machinery endowment by the CFS likely influenced their efficiency as measured by the time it took to load and unload cargo.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presented the discussion of the research findings in relation to the study objectives and hypothesis. The findings were used to draw conclusions and the recommendations made were based on the conclusions drawn. Summary of results are presented in section 5.2, discussions are made in section 5.3, conclusions in section 5.4, recommendations in section 5.5, while Suggestions for further study in section 5.6.

5.2 Summary of Findings

The overarching aim of this study was to explore the factors affecting the efficiency of container freight stations at the port of Mombasa. The specific objectives of the study were aimed at determining the extent to which infrastructure endowment, systems employed in receiving and releasing cargo, and machinery/equipment by the CFSs of Mombasa Port affected their efficiency. No CFS at the Mombasa port handled containers/cargo emanating from the hinterland that were destined for export instead all of them handled import cargo. The time it took to move a container/cargo from the port to a CFS ranged from as few as 30 minutes to up to 10 hours. Correlation and regression analysis revealed that when the status of the road improved, the time it took for a CFS to move cargo from the port reduced. However, the distance of CFS from the port was found not to be significantly related to port CFS time. Port waiting time was found not to be significantly related to either distance of the CFS from the port or with status of the road. Yard time was found to be variable, ranging from three to 30 days, depending on the client. If available, most CFS would prefer to move cargo by rail rather than by road.

Although the procedure for receiving and releasing goods was similar for all the CFS investigated, differences were observed in how fast each CFS was able to accomplish these tasks, as measured by the gate waiting time for trucks. This time ranged from 5 minutes to 60 minutes. A significant and negative relationship was found between gate waiting time and container numbers and value of cargo but not with containers expressed in TEUS or their weight. Most CFS owned toploaders, trucks/lorries, and forklifts. However, a majority or all of the CFS lacked cranes, stacking machines, weighbridge, climbing lanes and car carriers. Correlation analysis indicated that when machine index (a measure of the richness of

machines owned by a CFS) increased, both loading and unloading times reduced and vice versa.

5.3 Discussions

This study found that no CFS at the Mombasa port handled containers/cargo emanating from the hinterlands that were destined for export instead all of them handled import cargo. According to the ILO (1995), among others, some of the functions of CFS include receiving, sorting, and consolidating export break-bulk cargoes from road vehicles, rail wagons and inland waterway craft and to pack export cargoes into containers ready for loading aboard a vessel. However, none of these functions is carried out by CFS at the Mombasa Port. This suggested that the main function that the CFS at the port were set up was to reduce congestion at the port, by quickly transferring some of the containers arriving by ship at the port to the CFS, where their processing, temporary storage and release can be accomplished. Indeed, a full examination of the question on functions carried out by the CFS in this study appeared to confirm this conclusion. These included container/cargo transfer from the port to CFS, acting as customs verification yard, acting as warehousing of the cargo under customs, cargo clearance point for the importers, acting as clearing and forwarding firms and breaking of consolidated cargo.

Once the containers reached the CFS, they generally stayed in the yards until they were released to the clients after the necessary documentation was complete. It was found that very little stuffing and stripping of this cargo was done at the CFS yards. This finding is in agreement with some authors, notably in the Nathan Associates Report of 2011, who have argued that the use of CFS to refer to the container handling facilities in Mombasa is a misnomer, as the facilities carry out little stuffing and stripping of imported containers. Based on this, they have proposed that the facilities be referred to as Inland Container Depots (ICD) rather than CFS.

The time it took to move a container/cargo from the port to a CFS in the study ranged from as few as 30 minutes to up to 10 hours, with the mean port to CFS time being about four hours. Considering the distance of the CFS from the port, this time was found to be far too long, which suggested that the CFS could be wasting a lot of time during the transportation of cargo from the port to their yards. The CFS in the study were found to be located quite near the port, the distance ranging from two to 20 km, with the average being about eight kilometres. Taking the CFS which was located furthest from the port, CCF, which is 20 km

away and assuming a speed of transporting containers by trucks to be 30 km/h, it should take only 40 minutes for this CFS to get cargo from the port to its yard, yet the trip actually takes five hours. Using the average distance of eight kilometres, CFS should only need 16 minutes to transport cargo from the port to their yards at a speed of 30km/hr, yet in actual sense the average time they take is four hours.

To further buttress the finding that the distance of CFS from the port is relatively short and might therefore not influence port to CFS time, a correlation analysis between these two variables was found not to be significant. However, a significant and negative relationship was found between status of road and port to CFS time. Given that nine out of the 17 CFS investigated reported that roads linking them with the port were bad, it implied that a key element in shortening the port to CFS time will involve improving the status of the roads. Indeed a regression model developed in the study predicts that if the status of the road improves by one unit, port to CFS time is likely to reduce by roughly 320%. However, a long term solution will be to develop rail connections between the CFS and the port, which was preferred by a majority of CFS because of the absence of traffic jams, unnecessary police crackdown and was considered a more efficient and reliable mode of transport. Currently, no CFS at the Mombasa port uses rail to move cargo between it and the port, with all transport occurring by road.

The time that CFS wait at the port for a container/cargo to be processed was found to range between one and six hours, with a mean waiting time of roughly three hours. Taking this time and adding on the already lengthy times that CFS spend on the road between the port and their yards, shows that CFS might be wasting considerable time, possibly reducing their efficiency. For instance, taking the average port to CFS time of four hours and adding the mean port waiting time of 3 hours, a typical CFS at the Mombasa port spends on average seven hours to collect a container form the port and get it to its yard. Similar times were found in a study done on CFS operating in Dar Es Salaam Port. For instance, TRH and Azam located in Dar Es Salaam Port, EAC (2011), found that the former, located 2 km away from the port took four hours while Azam located much farther reported a much longer roundtrip time of 8 – 10 hours. The main reasons established by this study for longer than necessary port waiting time were the slow processing of documents by KPA and network system failures. Similar reasons were cited by EAC (2011) in a Diagnostic study of central corridors. Thus, also important in reducing port to CFS time will be an improvement in the efficiency with which KPA processes the relevant documents before the cargo is released to the CFS.

The average dwell time of containers was found to be variable, ranging from three to 30 days, depending on the client. This time was found to depend with the client, with those able to finish quickly having their cargo being released much more quickly. Most CFS reported the length of this time to be a few days, which suggested that most clients might be collecting their cargo much earlier. This could be as a result of the punitive tariff system, whereby cargos staying longer than five days have to pay \$20/TEU-day storage charges plus re-marshalling charge of \$100/TEU (EAC, 2011).

This study found that the procedures followed in receiving and releasing cargo by the CFS at the Mombasa port were largely similar. The possible explanation for this finding is that all the CFS were established to perform one single purpose – to ease congestion at the main port by having some containers being transferred to them and being temporarily stored there before being released to their clients (Kenya Ports Authority Handbook, 2012-2013). Hence, they perform similar functions and hence the procedures for doing them are likely to be similar. All CFS were also found to possess computerized systems for receiving and releasing cargo. The system used during receiving of goods was the Cargo Management Information System (CAMIS) while the SIMBA system was used during releasing of cargo. When these systems were down, the CFS resorted to manual mechanisms for receiving and releasing cargo.

However, the efficiency with the CFS received and released cargo was found to differ amongst them, as measured by the gate waiting time for trucks. This time ranged from five to up to 60 minutes, with an average of 30 minutes. The study found that this time could be reduced by minimising of procedures involved in document processing, proper planning of the CFS yard space, trucks to be only called when the procedures have been completed, and entry and exit gates of the CFS to be different. Others were to have more and proper equipment/machines for handling cargo, queuing order to be strictly followed, and for the CFS to employ enough and quality staff and to ensure that they are properly motivated.

A correlation analysis indicated that the relationship between gate waiting time and container numbers and value of cargo was significant and negative, suggesting that when gate waiting time increased, there was a reduction in the number and value in shillings of the containers handled by the CFS. This relationship could be simply explained by the fact if the procedure of receiving and releasing cargo by a CFS is fast, then the time that lorries have to wait at the gate will be reduced. However, no significant relationships were found between gate waiting time and containers in TEUS and cargo weight. This was unexpected but might be explained by the lack of linear relationships between the four traffic measures, the number of

containers, containers expressed in TEUS, total weight of cargo excluding the container tare weight and the value of shilling of the goods handled by each CFS.

This study found that most CFS owned toploaders, trucks/lorries, and forklifts. Trucks/lorries were owned by all the CFS except Africanline because they are used to transport containers from the port to their yard. Africanline might have lacked them because it dealt with motor car imports, which are driven on their own. Toploaders and forklifts are required to hoist and unhoist containers from the trucks (UNCTAD, 1991). However, a majority or all of the CFS lacked cranes, stacking machines, weighbridge, climbing lanes and car carriers. These are specialized machinery that can greatly accelerate the hoisting and unhoisting of containers from trucks (UNCTAD, 1991). Correlation analysis indicated that when machine index (a measure of the richness of machines owned by a CFS) increased, both loading and unloading times reduced and vice versa. The probable explanation of this finding was that if the CFS had enough quantity of the right machinery, it could be able to load and unload containers more efficiently; leading to reduction in loading and unloading times (UNCTAD, 1991). This finding merely reaffirmed the importance of the CFS having enough machinery to increase its efficiency.

5.4 Conclusions

This study explored the factors affecting the efficiency of container freight stations at the port of Mombasa. The conclusions from this study were:

Infrastructural factors, especially, the status of road but not the distance of the CFS from the port, were found to affect the efficiency of the CFS. For instance, an improvement in the status of the road and the processing of documents by the KPA will shorten the port to CFS time.

Although the procedure for receiving and releasing goods was similar for all the CFS investigated, some of them are faster at carrying out these processes than others, as measured by the gate waiting time for trucks. The speed at which the CFS carried out these activities was found to influence the number containers and the value in shillings of the cargo handled by the CFS but not containers expressed in TEUS or the weight of the cargo.

Most CFS owned toploaders, trucks/lorries, and forklifts. However, a majority or all of the CFS lacked cranes, stacking machines, weighbridge, climbing lanes and car carriers. When machine index (a measure of the richness of machines owned by a CFS) increased, both loading and unloading times reduced and vice versa.

5.5 Recommendations

From the findings of this research study, all factors were found to influence the efficiency of CFS in Mombasa port. Therefore the Status of the road should be improved to shorten time between Port and CFS, Railways should be developed as a means of transport between the CFS and the port because its more efficient, reliable and lacks unnecessary delays, CFS should improve its internal efficiency such as to reduce the time taken to receive and release cargo and CFS should acquire the requisite machinery in order to improve their efficiency. Hence, the researcher recommends the CFS should also handle containers destined for export instead of only handling the incoming/import containers for them to be called CFS otherwise they are supposed to be ICD.

5.6 Suggestions for further studies.

This study covered the factors affecting efficiency of container freight stations in Mombasa port: It will be interesting for more research to be done on;

1. Factors that influence licensing of container freight stations.
2. The employment structure of container freight stations
3. The reasons why other CFS are more busy than others or the gap between CFS and yet all are serving the port.

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APPENDIX 1: Transmittal Letter to the respondents

P.O BOX 40684

MOBASA

Dear respondent,

I am a postgraduate student in the **DEPARTMENT OF EXTRA MURAL STUDIES** of the University of Nairobi, conducting research titled, “**Factors affecting Efficiency of Container freight stations: A case of Mombasa Port, Mombasa county-Kenya**”. The purpose of this questionnaire is to collect data for purely academic purposes and all information will be treated with the utmost confidentiality. Kindly spare a few minutes and complete this questionnaire. There is no right or wrong answer. Your opinion is the most important. Do not put your name on this questionnaire.

Yours faithfully,

FREDRICK WESONGA

L50/65614/2010

APPENDIX 2: QUESTIONNAIRE

Answer all questions as indicated by either filling in the blank or ticking the options that apply.

SECTION A: DEMOGRAPHIC INFORMATION

1. Please, state your position in the firm.....

2. Age

Below 25 years

26 – 30 years

31 – 40 years

Above 40 years

3. Gender

Male

Female

3. Marital status

Single

Married

Widowed/divorced

4. Education level

Certificate

Diploma

Degree

Masters

Section B: Efficiency of CFS

1. Please, state the average time your CFS takes to do the following (please, state whether they are hours or days):

(a) Move a container/cargo between the port to the CFS _____

(b) Move a container/cargo between the CFS and the port _____

(c) The time you wait at the port for a container/cargo to be processed before you collect it _____

(d) The time it takes for you to finish processing a container that you have delivered to the port _____

(e) Suggest ways you think time is wasted during the movement of containers between CFSs and the port and vice versa.

2. Suggest the time you take to complete the following (Please, state whether they are hours, minutes or days)

(a) It takes you to finish unloading one container/cargo and move it into your yard _____

(b) It takes you to finish loading one container/cargo from the yard and into a truck _____

(c) It takes for a container/cargo to remain in your yard _____

3. (a) How long do trucks wait at your gate before they collect containers? _____

(b) Suggest ways in which the process can be improved so that the waiting time for trucks is reduced _____

4. Give an average amount of cargo your CFS handles in a day

(a) The number of containers _____

(b) Containers expressed in TEUS _____

(c) Total weight of cargo excluding the container tare weight _____

(d) The value in shillings of the goods handled _____

Section C. Functions of CFSs

1. Please, list down all the functions your CFS performs

Section D Infrastructure/Equipment.

1. How does your CFS move containers between it and the Mombasa Port (e.g. by road, rail e.t.c) _____

2. How is the status of the road (e.g. good, bad) _____

3. If both rail and road were available, which one would you prefer to use to communicate with the port? _____ Explain your preference

4. List down all the procedures your CFS follows when it

(a) when it receives containers for export

(b) when it receives imported containers from the port

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5 (a) List down all the machinery your CFS use to move containers.

(b) List down any machinery which you think is important but which you firm lacks.

Section E-SYSTEMS

1 a) which systems do use to receive containers/cargo?

.....
.....

b) Which systems do you use to release containers/cargo?

.....
.....
.....

END OF QUESTIONNAIRE

Thank you.
