ST MARY’S UNIVERSITY
SCHOOL OF GRADUATE STUDIES

DETERMINANT OF DRY PORT OPERATIONAL PERFORMANCE OF ETHIOPIAN SHIPPING AND LOGISTIC SERVICE ENTERPRISE (ESLSE): THE CASE MODJO AND KALITY DRY PORT BRANCHS

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THESIS SUBMITTED TO ST. MARY’S UNIVERSITY, SCHOOL OF GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION IN GENERAL MANAGEMENT PROGRAM

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This is to Certify that the thesis prepared by *Eyerusalem Erkyehun*, entitled: Determinant Of Dry Port Operational Performance Of Ethiopian Shipping And Logistic Service Enterprise (ESLSE): The Case Modjo And Kality Dry Port Branches Submitted In The Partial Fulfillment Of The Requirements For The Degree Of Master Of Business Administration In General Management Program with the regulations of the University and meets the accepted standards with respect to originality and quality.

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ACRONYMS

CTP:	Container Throughput
DEA:	Data Envelopment Analysis
DMU:	Decision Making Units
ESLSE:	Ethiopian Shipping and Logistic Service Enterprise
FL:	Fork Lift
GDP:	Gross Domestic Product
ICD:	Inland Clearance Depot
RBV	Resource Based Views
RS:	Reach Stackers
SFA:	Stochastic Frontier Analysis
TA:	Terminal Area
TC:	Terminal Chancy
TEM:	Technical Efficiency of Multi-Port
TFP:	Total Factor Production
TT:	Terminal Tractor

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ABSTRACT

Objectively the study to examines the factor affecting dry port performance efficiency of port and terminal branch in the ESLSE. The study adopted a quantitative research approach with explanatory design. Container throughput (OUTPUT) was used to measure and explain the performance of selected ESLSEs port and terminal branches from 2008-2020. The explanatory variables (IMPUT) were Terminal Tractor (TT), Terminal chancy (TC), Reach Stackers (RS), Fork Lift (FL), Terminal area (hectare) (TA). And also control variable Inflation and foreign trade was adopted to investigate their effects on dry port operation performances. Secondary data was collected in panel form for 2 purposively selected ESLSE port and terminal branch for 5 years (2008-2020). DEA and SFA models were adopted to examine the relationship between the study variables using both parametric and nonparametric approaches. Data was analyzed using descriptive statistics and inferential analysis using DEAP and Frontier 41 software.

The finding generally concludes that the most important determinant of port productivity, was technical efficiency. As the Stochastic Frontier Analysis production function estimation results reveal that infrastructure inputs are important to predict the level of container throughput, but that the highest elasticity's are associated with Terminal chancy and Richs-tracker. In addition, the control variables of inflation and foreign trade had no significant and positive coefficients in the estimations. thus, the increase of economic inflation level and value of foreign trade in the country doesn't plays a significant role in the technical efficiency of the port and terminal operation of ESLSE. Based on the study result the researcher recommend that: both of the sample ports on the ESLSE, technical efficiency is relatively low, and port resources are wasted. it is necessary to improve the economy and technical efficiency of ports by controlling and grasping external environmental variables

Key-words: productivity; technical efficiency; ports and terminal

CHAPTER-ONE

INTRODUCTION

This chapter introduces the research area by providing information relating to this study. It starts by outlining background the study, background of the organization and problem of the study so as to highlight the aim of the subject under investigation in the study. The later sessions present the research questions, research objective, and significance of the study and research scope. The chapter finalize with the summary of the research structure.

1.1 Background of the Study

Economic development is one of the main objectives of every society in the world. The economics literature supports the argument that development requires economic growth, and greater access to world markets is perceived as a necessary condition for more rapid growth. Hence, Reliable logistics is crucial to integrate global value chains and reap the benefit of trade opportunities for growth and poverty reduction. According to Verhetsel et al. (2015) performing logistics at a low level may isolate a country from the world markets.

The efficiency of the whole logistics supply chain largely depends on dry ports as they act as the integrating and coordinating mechanism between different components, e.g., shipping lines, inland transportation and warehousing (Bichou and Gray, 2004; Miyashita, 2004). Ports are well known as playing an important role in multimodal transport systems and international supply chains, apart from their traditional role as clusters of economic activities. Ports add more value to shipments that are in the port area by further integrating themselves into value chains. Many ports are increasingly being perceived as integrated and inseparable nodes in their customers' supply chains. Ports play a critical role in the effective and efficient management of this industry. Ports engage in various activities: provide customs control and clearance, container handling, stuffing & unstuffing and acting as warehouse and distribution centers (World Bank, 2014). Another major reason for the rising importance of dry ports is it promote regional development and which are especially useful in land-locked countries like Ethiopia whose shipments come through a neighboring sea port. This may require shipping lines to carry cargo further inland with a much more flexible schedule and it will need dry ports to cope with it since, the logistics process depends on the port operation efficiency. Operational efficiency means speed and reliability of port services, so a very reliable and quick service should be provided by terminal operators for their better performance (Tongzon, 2002). Besides, Marlow and Paixao Casaca (2003) and Kaplan and Norton (2004) emphasized that the port needs investment in intangible assets such as human resources as employees who have the right skills, talent and knowledge contribute the most in enhancing the organization's internal processes and performance.

Ethiopia, as a landlocked country, has established its trade route along the Ethio-Djibouti corridor. The Ethio-Djibouti corridor is a main outlet to the sea. It is the main route for Ethiopia's import and export trade which is dominated by freight transport. In response to the steadily growing volume of cross boundary trade, Ethiopia has moved to establish various inland dry ports. The first dry port in Ethiopia was established at Modjo, nearly 75 km East of Addis Ababa, and started operations in the first half of 2009. The port has a capacity to handle 6,000 containers, measuring 20-ft (six meters), on 2012. Now the port has reached the capacity of accommodating more than 14,000 containers at time, with 1000 containers in and out per day. Currently ESLSE is administering eight dry ports those connected to Djibouti and were built with the Purposes of providing, receiving and delivering cargoes, loading and unloading, stuffing and unstuffing of container goods, temporary storage for import and export cargoes, container cleaning and maintaining, weight bridge, customs control and clearance, banking and insurance, container depot service and engage in other related activities (ESLSE annual report 2019). In order to achieve this purpose, efficient and effective operational performance of the dry ports is very crucial and to do that it is important to assess the Determinate factors affecting performance efficiency and effectiveness of ESLSE's dry ports and terminal services.

1.2 Statement of the Problem

Reliable logistics is crucial to integrate global value chains and reap the benefit of trade opportunities for growth and poverty reduction. In today's interdependent and globalized world, efficient and cost-effective transportation systems that link global supply chains are the engine fueling economic development and prosperity. As Ethiopia struggles to become a competitive in the international trade, it is imperative that intensive efforts are channeled towards the advancement of an efficient and effective maritime transport with simplified and minimized formalities and procedures to enhance the competitiveness of Ethiopian trade (Ashenafi, 2020).

Nevertheless, Ethiopian trade are not able to be competitive in the international market, since, the existing trade logistics system of Ethiopia is characterized by inefficient, time taking and complex. Ethiopian Logistics performance index is low even as compared to countries with similar economic development. according to Arvis et.al, (2018), report on easiest countries to do business and Trade Logistics performance, Ethiopia is ranked 131rd out of 167 countries and 159th out of 183 countries respectively. According to Ashenafi, (2020) Ethiopian Logistics performance is poor; there is inefficiency of customs clearance process at the ports, fragmented and poor quality of infrastructure, poor service quality, high service charge, increased congestion around the facility which introduces long delays, significant uncertainties and unnecessary costs to port users.

Hence, as a major trade facilitator and a component in the total logistics chain, ensuring efficiency and effective dry ports operation performance is very important to improve the ability of the Ethiopian trade to be competitive at international level. According to Song and Cullinane (1999), as a major trade facilitator and a component in the total logistics chain, a port and/or terminal should be managed and operated in a way which maximizes efficiency and performance of their operation. Therefore, improving inland ports efficiency is critical as it could Boost a country's competitiveness and economy.

The above problem can be solved by investigating the contributing factor affecting the dry port operation performance efficiency. Prior studies conducted overseas such as, Nyema, (2014) and Arya and Lin, (2007) conducted on operational performance revealed that internal factor such as tangible and intangible resources lead to higher operational performance. This study also shows that, infrastructure (both hard and soft) is the necessary condition for efficient cargo handling operations and adequate infrastructure is needed to avoid congestion, foster trade development and increase terminal efficiency. Accordingly, Yoon, (2015); stated that various factors such as facilities, location, cost, and service and softer factors including human resource, network, customers, government support policy, and reputation determines port operation performance, as unavailability or insufficiency in these factors leads to poor performance. From port development progress, port efficiency is not only affected by the above internal factor (tangible and intangible resources, but also influenced by External (environmental) factors. In this context, an increasing number of studies have been conducted on improving the efficiency of inland ports. However, most of these studies have focused on measuring efficiency using operational variables. Little attention has been given to exogenous factors that could influence inland ports efficiency. Consequently, the knowledge on the relationship between operational efficiency and these exogenous factors is limited. Also, most of these studies focused on container ports in developed countries, while none so far has examined the influence of exogenous factors on the efficiency of inland ports in developing countries especially. In Ethiopia context the existing literature mainly focus on limited dimensions of port operation or specific areas of ports, such as practice, challenges and Prospect of port operation. While the critical factors that affecting port operation performance were not seen very well.

Hence, the rationality of the paper is to fills the observed gap through determine and evaluate the influence of both operational and exogenous factors on the efficiency of ESLSE's port and terminal service using the Three-Stage DEA Model.

Therefore, this study will attempt to identify and evaluate the major factors that influence the performance of ESLSE's dry port and terminal services the case of Modjo and Kality branches with the following basic research questions.

1.3 Basic Research Questions

1. Which Decision Making Units (Modjo or Kality dry port branch) operation performance is relatively efficient?
2. Dose the internal (infrastructural resource) and external (environmental) factors influence the operation performance of Modjo and Kality dry port branch?
3. To what extent the internal (infrastructural resource) and external (environmental) factors influence the performance of Modjo and Kality dry port?

1.4 Objectives of the Study

1.4.1 General Objective of the Study

The key objective of this study is to examine the determinant factor affecting operational performance efficiency of ESLSE's dry port the case of Kality and Modjo branch based on three-Stage DEA Model.

1.4.2 Specific Objective of the Study

1. To measure the relatively operation performance efficiency of the sample DMU (Modjo and Kality dry port branch)

2. To examine the influence of internal(infrastructural resource) and external (environmental) factors on the ESLSE's dry port operation performance the case of Kality and Modjo branch
3. To masseur their degree of influence on the ESLSE's dry port operation performance the case of Kality and Modjo branch

1.4.3 Significance of the Study

The common purposes of performance management are to reduce cost and to improve efficiency and effectiveness. Performance measurements play an essential role in evaluating productivity and efficiency, because it can define not only the current state of the system but also its future. Performance measurement helps to move the system in the desired direction through the effect.

Therefore, this study will help policy makers, port operators and authorities and other stakeholders to recognize areas which needed improvement to enhance the performance of the ports in the enterprise to have a glance of what was missing in the total picture of their logistics performance and take necessary directions towards improving it in the future. Thereby, contribute to betterment of ESLSE's dry port performance management practice in terms of the efficiency and effectiveness of the country's trade flow.

Finally, Managers of Ethiopian maritime or transportation sectors can use the findings as sources of reference to manage maritime sector to improve their performance, and academicians can use the finding for application of the dry port management field and further extension of this topic or related topics.

1.5 Scope and Delimitation of the Study

The objective of this study is to empirically examine the factors affecting operational performance of inland port operation of ESLSE's the case of Kality and Modjo dry port branch. To this end, achieve the research's objectives, the scope of this study will delimit as follow; Methodologically, this study will delimit to explanatory research design and longitudinal quantitative research approach and the three Stage Data Envelopment Analysis (DEA) approach will used to measure the technical efficiency of individual decision-making units (DMUs) within a group then SFA to investigate the possible relationship between the dependent (contender Throughput) and independent variables if it has any effect and to what extent.

And geographically this study will delimit to the two major branches out of eight branches, of Ethiopian Shipping and Logistics Service Enterprise those provide main dry port and terminal services from 2016 – 2020 and used all of the variable that considered in the study. The selected branches (DMU) are: Modjo and Kality.

1.6 Organization of the Study

This research paper contains five chapters. The first chapter deals with the introductory part which includes background of the study, statement of the problem, objective of the study, research hypothesis and model, justification of the study, significance of the study, delimitation of the study and operational definition of key terms. The second chapter contains review of related literature, under which dry port concepts, sustainability issues in dry port operation, and dry port performance will discuss. The third chapter will about Research design and methodology. In the fourth chapter the results and discussions of the study will present. Finally, chapter five provides the summary, conclusion and recommendations arising from the finding of the study result.

CHAPTER-TWO

LITERATURE REVIEW

In the previous chapter, the main problems and objectives to be addressed have been stated. This chapter deals with the related literatures of the study. In the previous chapter, the main problems and objectives to be addressed have been stated. This chapter deals with the related literatures of the study which of Three main section; considering about theoretical review, about empirical review and summary of literature review and research gap.

The 1st section consists sub section of the theoretical review which discusses about; definition, role, and concepts of the dry port, the theories that states about; Dry port Operational performance, performance measurements, Operational performance efficiency, and the determinant factor affecting Dry port Operational performance efficiency. The 2nd section consists sub section of the empirical review which discusses about (i.e., relationships between variables,). Finally present summary of literature review, research gap as well as develop conceptual framework of the study.

2.1 Theoretical Review

2.1.1 Definition

There are different definitions of dry port, according to Rosoet al. (2008) define dry port as; "an inland intermodal terminal directly connected to seaport(s) with high-capacity transport mean(s), where customers can leave/pick up their standardized units as if directly to a seaport." A dry port can be understood as an inland setting with cargo-handling facilities to allow several functions to carry out, for example, cargo consolidation and distribution, temporary storage of containers, custom clearance, connection between different transport modes, allowing agglomeration of institute on (both private and public) which facilitates the interactions between different stakeholders along the supply chain, etc (Ng and Gujar, 2009).

Dry ports could be inland terminals within a country that has a gateway port or they could be located in adjacent land-locked countries in the hinterland of one or more sea ports. The concept came into wide spread use in conjunction with containerization and this is the context in which the term is used here. Dry Port or Inland Clearance Depot (ICD) also defined as: " A common user facility with public authority status, equipped with fixed installations and offering services for handling and temporary storage of any kind of goods (including containers) carried under customs transit by any applicable mode of transport, placed under customs control and with customs and other agencies competent to clear goods for home use, warehousing, temporary admissions, re-export, temporary storage for onward transit and outright export." (UNCTAD, 2002). Simply stated, dry ports are specific sites to which imports and exports can be consigned for inspection by customs and which can be specified as the origin or destination of goods in transit accompanied by documentation such as the combined transport bill of lading or multi-modal transport document.

By definition, dry ports are located inland from sea ports but are linked directly to the sea port(s) or, in the case of international land movements, are in contact with the sources of imports and destinations of exports. Dry ports may be used whether a country has sea ports or is land-locked, but only surface modes of transport are involved in giving access to them.

Roso, Woxenius and Lumsden (2009) defined dry port as: an inland intermodal terminal directly connected to a seaport, with high-capacity traffic modes, preferably rail, where customers can leave and/or collect their goods in intermodal loading units, as if directly to the seaport. Moreover, the authors stated that services such as trans-shipment, consolidation, depot, track and trace, maintenance of containers, and customs clearance should be available at dry ports.

Similarly, Trainaviciute, Lina, july (2009) defined dry port as: an intermodal terminal situated in the hinterland servicing a region connected with one or several ports by rail and/or road transport and is offering specialized services between the dry Port and the overseas destinations. Normally the dry Port is container oriented and supplies all logistics facilities, which are needed for shipping and forwarding agents in a port.

In general, a dry port conducts functions very similar to contemporary seaports, especially its role as the distributional nodal points along intermodal supply chains (Meersman, et al. 2005).

2.1.2 Dry Port Concepts

Many landlocked developing countries continuously face the challenge of physical isolation, supply chain related barriers from the sea and the high costs of trading with the rest of the world (United Nations Economic Commission for Africa, 2011). In order to counter these challenges associated with landlocked-ness, the dry port concept evolved.

The word dry port has been defined by many scholars and the definitions reflect the broad view of the concept from different perspectives. Important to note is that the definitions emanate from the perspective of the physical facility, function and purpose. The definitions were also born of the fact that the periodical steep rise in container flows resulted in crowded terminals, congestion and prolonged dwell time for containers. As a solution to these problems at the main sea ports, the trans-ocean vessels started to call at single hub port while feeder vessels, haulages, trucks and trains connected to many smaller inland or dry ports, (Baird A.J, 2002)

Academic research on dry ports has grown exponentially in recent years as exemplified by the special issues on dry ports in Maritime Economics and Logistics (vol. 14, 2012) and Research in Transportation Economics (vol. 33, 2011). The first mention of dry ports in academic literature goes back to 1980 (Munford, 1980). A United Nations text of 1982 provides an early definition of the dry port concept: an inland terminal 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 cargos,. In this paper researcher follow the definition of Roso et al. (2009): „a dry port is an inland intermodal terminal directly connected to sea port(s) with high capacity transport mean(s), where customers can leave/pick up their standardized units as if directly to a sea port,.This definition takes into account the fact that a dry port does not only do the traditional role of transshipment as inland terminals but in addition to this role, it provides other services like; consolidation, storage (both cargo and empty containers), maintenance and repair of containers, and customs clearance.

Dry port functions include distribution, consolidation, storage, customs services, and possibly equipment maintenance (Wang and Wei 2008). In this context, the implementation of the dry port concept has not only support extensively expansion of container terminal capacity, but it has also impacted the relationships between sea ports and the distribution network of the hinterland (Notteboom, 2008).

Containerization and global trade are conjoined twins indicating that one cannot live without the other. The ease with which containerization facilitates door to door delivery of cargo has facilitated the growth of global trade. The actual process of container transport is affected by simultaneous use of multimodal carriers combining sea/river going ships/barges and land based services such as trucks and trains (Bichou, 2004; Schoenherr, 2009).

Dry ports may be used whether a country has sea ports or is land-locked, but only surface modes of transport are involved in giving access to them. In general, a dry port conducts functions very similar to contemporary seaports, especially its role as the distributional nodal points along intermodal supply chains (Meersman, et al. 2005). As a crucial part of the international transportation systems, ports are not solely independent and natural area for the transfer of physical goods, but also a systematic element of (often multimodal) logistical supply chain (Gujar, 2011). Therefore, the role of a dry port within this system is becoming particularly important. Due to the roles of dry ports in the coordination of materials and information flows; minimization of costs; as well as reliable cargo handling which is becoming crucial as a functional part of the global logistics and supply chain management. In view of consistently rising expectations of shippers/consignees for faster, efficient and low-cost services, the logistics services providers had no alternative but innovate new concepts to improve their services while simultaneously endeavoring to lower costs. According to PORTOPIA, 2015 the following are supposedly put as advantages of the growth of inland ports:

- Increasing land value: inland ports transfer parts of the seaports activity to the hinterland to unburden the territory surrounding the seaports.
- Reducing costs: inland ports reduce the costs of the ports since the hinterland land value is normally lower than coastal one.
- Decreasing congestion: building inland ports is a proved strategy for decreasing the congestion generated in the big sea ports terminals due to the truck transport.
- Improving hinterland access: this kind of facilities certainly stimulates the transportation of the goods to hinterlands, as well as the exportation of key products from local markets.
- Managing the supply chain: the inland port is not only a strategy to improve the capacity and the accessibility of the hinterland transport it is also a location that plays a key role in the supply chain management. Nowadays, inland ports are considered logistical centers where a good can be stored or even transformed before reaching other destinations. In addition, an inland port can also act as a buffer depot if necessary (capacity management).

2.1.3 Dry port Operational performance,

Operational performance refers to how well an organization achieves its business goals including financial and non-financial aspects (Lu et al., 2009). Performance has many definitions. According to Marlow and Casaca (2003) generally defined performance as: "An investigation of effectiveness and efficiency in the accomplishment of a given activity and where the assessment is carried out in relation to how well the objectives have been met". Mentzer and Konrad (1991) have defined it as the ratio of actual output to standard output, which requires establishing a goal and a strategy to meet such standard output. This definition was based on differentiating between productivity, utilization and performance. They discussed that productivity refers to the ratio of output to input, while utilization is the ratio of used facilities to available facilities. In order to meet a standard output, a goal tends towards minimizing operating costs and improving the service levels requiring a balance between efficiency and effectiveness. For both these dimensions, they measured efficiency in terms of how well the resources are utilized, while the effectiveness has been measured if a goal or a strategy has been accomplished.

Although performance is a relative concept, it is defined as the degree of success in achieving specified goals (Devine and Ostrom, 1985). Performance can also be explained by the production function. Production processes transform specific inputs into specific outputs.

The production function also explains the relationship between changes in the amount of input and the amount of output in this process. Nicholson (1995), by making the basic definition of the production function for a product, tried to determine the maximum amount of product that can be produced with alternative input combinations (frontier models) such as labor, capital, warehouse space. Although productivity and efficiency, which are concepts related to performance, are often used interchangeably in the literature, they are defined differently by many researchers. Productivity is defined as producing the output with the least cost or obtaining the optimum output with the resources available, while efficiency is defined as reaching the maximum output by utilizing the resources in the best possible way (Yükcü and Atağan, 2009). Productivity and efficiency are also different in terms of process. While the efficiency period is short, the productivity process is usually longer. For example, while the process of becoming more effective as a result of a manufacturer company using all inputs at the optimal level is short, the process of increased productivity by minimizing the residues of resources is generally longer (Çağlar and Oral, 2011).

Understanding performance is a concept essential to an logistics business, whether it is the measuring of accomplishments against set goals and objectives or, against the competition. Ports are no exception and it is only by comparison that performance can be evaluated. Ports are, however, a complex business with many different sources of inputs and outputs which make direct assessment among apparently homogeneous ports seem difficult (Valentine and Gray, 2002).

2.1.4 Performance measurements,

Performance evaluation plays an important role in all areas of business management, both in private and public sectors, because it explains how much and how organizations have reached their goals besides providing subsidies about how they can promote improvements. Forslund (2007) defines the steps of performance management as follows: set objectives and strategies; define metrics; set targets; measure; analyze; evaluate; and then act to improve the process. The common purposes of performance management are to reduce cost and to improve efficiency and effectiveness. Fatimazahra B., Charif M., Alami S., (2015). “If you cannot measure it, you cannot control it. If you cannot control it, you cannot manage it. If you cannot manage it, you cannot improve it” (Harrington, 1991)

As with other businesses, evaluating port performance or measuring terminal efficiency is very important from an economic, functional and strategic perspective. In Today’s complex and competitive environment, container terminals need to measure, monitor, control, and improve the performance of the container terminals in order to sustain and increase competitiveness Hari, Vijaya, Ashok, and Sudheer (2015). Understanding the levels of performance achieved is at the core of the strategy of port authorities and operators, in order to deploy strategies that address the needs of port users, increase competitiveness, and thus market shares.

Fraj-Andres et al. (2009) categorized performance measures into operational performance (e.g. cost efficiency), commercial performance (e.g. corporate reputation), and economic performance (e.g. sales growth). Port performance is assessed from different perspectives such as effectiveness, relative and technical efficiency and cost efficiency against the optimum throughput (Tulley, 2007). The cost efficiency measures relate to profit maximizing for the port.

European Commission (CEU, 2007) mentioned that port users and their views are important elements in the whole process and deserve further attention endorsing in essence that port performance is a construct of two components, namely efficiency and effectiveness (Brooks and Pallis, 2008; Brooks et al, 2011; Brooks and Schelinck, 2013). Some examples of the broad taxonomy used to measure performance are production, efficiency and productivity indicators.

2.1.4.1 Performance production measures

These are the level of activity of the business. In the ports industry a number of different terms are used to represent this category such as „trade", „traffic", „throughput" and „output" Traffic measures, which indicate in various ways the quantity of cargo passing through a port or terminal in unit time, and throughput measures, which indicate the effort involved in moving that cargo, in terms of tones handled or containers movements per unit of time.

Throughput measures include: container moves/unit of time. The value of this measure is very important when estimating resource needs and the actual costs of handling the cargo.

Most of the studies as shown in the literature use total tonnage throughput or container throughput to assess the port performance. Roll & Hayuth (1993) in their port performance comparison study used service level as the output variable. Annual container throughput is the dependent variable of the study. The Bureau of Transportation Statistics (BTS) (1992) defines the container throughput, as "A measure of the number of containers and tonnage cargo handled over a period."

The literature as discussed in the previous chapter shows that the standard measure of productivity of shipping services is total shipped goods measure in tonnage and the container throughput measure in TEU. As far as the output variable of Port performance is concerned, container throughput is unquestionably the most important and widely accepted indicator of port or terminal output. The total amount of container that is being transferred within the operational shore zone during the year can be measured by container throughput in TEUs. Almost all previous studies have treated it as an output variable, because it relates closely to the need for cargo-related facilities and services and is the primary basis upon which container ports are compared, especially in assessing their relative size, investment magnitude or activity levels. Most importantly, it also forms the basis for the revenue generation of container port/terminal (Cullinane and Wang, 2006; Pjevčević et. al., 2011).

According to Moon (2018), to determine the maximum capacity of a container terminal the main factors to consider. The container terminal capacity is the maximum number of TEU moves that the terminal can achieve per annum (TEU moves/year). The number of TEUs handled per square meter of storage area in a given period. It also considers the equipment productivity measure (the number of container moves made per working hour). The Container Stacking Yard Capacity which is the number of TEU moves/year that the container stacking yard generates and other constraints which affect the capacity such as container crane capacity, rail terminal capacity and road terminal capacity.

2.1.4.2 Dry port Operational performance efficiency Measures

Efficiency has been addressed by port-related literature from many different perspectives. Essentially, port efficiency analyzes established relationships between inputs (mainly a port's physical facilities and its labor force) and outputs (such as quantities or movements in ports). To that purpose, it is necessary to estimate a production or cost frontier – i.e., the set of maximum outputs given different levels of inputs or the set of minimum inputs given the different levels of outputs. In this context, the production frontier represents the optimal combination of inputs in a certain industry. Thus, a producer is considered inefficient if it operates beneath the frontier. (Moon, 2018).

According to this literature, efficiency can be estimated as the gap between the position assigned to each observation – which depends on the relationship between its inputs and outputs and the estimated best practices located on the production frontier. The construction of an efficient frontier has been addressed from two different approaches: parametric, with Stochastic Frontier Analysis (SFA), and nonparametric, with Data Envelopment Analysis (DEA). Both methodologies have proven to be useful for conducting efficiency studies in that they provide valuable information on whether a port or terminal is employing its inputs appropriately, and thus making proper use of investments (Suárez-Alemán et al, 2014).

As a nonparametric estimation, DEA revolves around a programming approach that does not assume a statistical function underpinning the data. SFA represents a parametric approach that assumes the existence of a statistical function and allows for hypothesis testing (Farrel (1957), Aigner et al (1977), and Meeusen and van den Broeck (1977)).

2.1.4.3 Dry port Operational performance Productivity Measures

The concept of productivity, used frequently to measure and compare the performance of firms, refers to the ratio of outputs over inputs. It analyzes how well a firm employs its input endowment to produce its outputs. Two other measures of measure productivity, i.e. single and total factor of productivity analysis (Moon, 2018).

Single factor analysis: - This is the measure of one factor of production by most ports, using a comparison of the percentage of utilization to optimum throughput. However, Moon (2018) argues that it ignores the substitution and collaboration between the factors of production. Furthermore, indicates the association of high quay productivity with the high number of vessel waiting outside the port, which results in congestion.

Total factor analysis:- This uses Data Envelopment Analysis (DEA) and various frontier statistical models that have been developed to give a more precise degree of the technical efficiency of multi-port performance, by using throughput (TEUs) as output and input measures respectively. The frontier analysis can measure technical efficiency simultaneous for each input. Most of the literature uses terminal infrastructure to measure performance.

Although productivity and efficiency oftentimes are used interchangeably, the former is comprised of a broader concept. Port efficiency, on the one hand, analyzes the ability of a port to obtain the maximum output under a given amount of inputs or through the use of the minimum amount of inputs under a given amount of outputs. Efficiency gains, therefore, represent a movement to a situation closer to optimal. On the other hand, changes in port productivity may be derived from efficiency gains or from changes in technology. In a production frontier context, this could be represented by an upward shift in the frontier over time, for example. Ports commonly have different outputs (handling of containers, liquid, solid or break bulk, general cargo, etc.) and inputs (cranes, labor, terminal facilities, etc.). Thus, a simple ratio of an output over an input may not properly represent the reality of a port. We have to employ methodologies that account for all inputs required to produce one or more outputs, which is known as total factor productivity (TFP). A wide range of methodologies to determine TFP have been implemented in recent decades, mainly based on the use of market prices (e.g., price-based index numbers) or on the estimation of a production frontier. This latter methodology allows for the decomposition of TFP into different components through panel data on different firms.

2.1.4.4 Services Measures

These measures indicate the satisfaction of the customers with the services offered to them in terms of reliability, regularity and rapidity. The principal external service measures include:

Ship turnaround time: One of the most significant indicators of service to ship operators is ship turnaround time. This is the total time, spent by the vessel in port, during a given call. It is the sum of waiting time, plus berthing time, plus service time (i.e. ship's time at berth), plus sailing delay. Ideally, ship turnaround should be only marginally longer than ship's time at berth and thus waiting time in particular should be as near to zero as possible.

Road vehicle turnaround time: For shippers/receivers (and trucking companies) the most important measure of a terminal's service quality is the time required to collect a container from the terminal or deliver one.

Ports are located geographically in strategic locations to enable connection with the broader global supply chain. Each port differs in terms of cargo handling capacity (throughput), available infrastructure, ship size that can be handled, etc., although it is a ports' cargo handling capacity that is used to classify port size. Common to any port is infrastructure that provides maritime access and connection to land-based transportation networks. A port is regarded as an infrastructure serving the international and domestic trade as well as the entire economy of the country.

Port performance assessment is an important issue for most ports. The increased use of containerization and supply chains, the development of new production-distribution consumption systems and increased specialization of the different port markets have all affected port organization management and operation and it is also challenging issue measuring the performance of ports supported by Notteboom and Rodrigue, (2008). Understanding the levels of performance achieved is at the core of the strategy of port authorities and operators, in order to deploy strategies that address the needs of port users, increase competitiveness, and thus market shares.

Most port authorities and operators have made significant infrastructure investments in order to reduce operational costs and improve service quality, which are important factors that influence terminal performance (Cullinane and Wang, 2009). Furthermore, investments in inland accesses are very important to expand the hinterland and contribute to improve port performance. Inland accessibility and terminal hinterland are driven by transport costs, alternative modes, capacity and quality of inland connections and transport service quality, as well as integration on the main land transport networks or at the crossroads of inland trade routes. Productivity gains and improved efficiency and operational performance are becoming even more important, given recent developments affecting the liner shipping market. Adapting to the new paradigm means that ports will need to upgrade their performance, including in terms of turnaround time (time in port of ships), dwell time (time in port of cargo), gate operations, hinterland connections and intermodal connectivity UNCTAD (2017).

2.1.5 The critical factors influencing Dry port operation performance efficiency

Port performance measurement is a challenging issue for most ports. The improved use of containerization and supply chains, the development of new production-distribution consumption systems and increased specialization of the different port markets have all affected port association organization and operation (Notteboom and Rodrigue, 2005).

Performance measurement of container terminals is considered as multi-criteria decision making problem as the performance of container terminals depends on multiple criteria (Hariet al 2015). Several port performance indicators have been used with the aim of improving port operations and providing useful information for port development planning and strategy. Talley (2006) defines these indicators as choice variables' i.e., variables that can be controlled by port management for optimizing economic objectives. These indicators may assess port operations from different viewpoints (UNCTAD, 1976).

The performance of ports and terminals is not a simple issue to address because there are several determinants that affect port performance such as worker-related issues, number and type of cargo handling equipment used, quality of port support areas, land access, customs efficiency and concessions (UNCTAD, 2015). Based on the foregoing literature reviews, the determinants of port performance may be classified into internal (resource-based) and external (environmental) factors.

2.1.5.1 Internal(resource-based)

Port associated literature has been used to determine efficiency from many perspectives using the established port performance indicators. Port production analyses require several input and outputs. Therefore the evaluation of performance has evolved to a total measure of port performance taking into consideration the combined inputs such as technology to produce outputs (Suárez-Alemán, Morales Sarriera, Serebrisky, & Trujillo, 2016). The evaluation of port efficiency varies with the input data, geographical location and methodology used (Odeck and Bråthen, 2012).

MIN -HO HA (2017) also argue on using a tangible resource, some intangible resources may be found to be of importance to port operational capabilities. Specifically, intangible but important resources such as linear shipping connectivity, port infrastructures, operating efficiency, human capital, organizational capital and information capital may enhance operational performance of port industry. These indicators may assess port operations from different viewpoints (UNCTAD, 1976).

According to Coates and McDermott (2002) the resource-based view (RBV) theory of the firm widely acknowledges that capabilities that are unique and are important for achieving sustained competitive advantage. It has been argued in the manufacturing literature that manufacturing facilities, technology and policies are central factors to gain performance efficiency. Research on resource based views (RBV) is about the use of assets, skills, abilities and knowledge within the firm. The resource-based perspective of the firm states that the firm,s strategy and success is based on its resource profile (Amit and Schoemaker, 1993).

RBV theorists argue that firms enable themselves to improve their efficiency and effectiveness by using their own tangible and intangible resources (Peteraf, 1993). However, even if research on the RBV has scratched the surface of the maritime industry, there is lack of research for the container port industry and particularly for inland dry container port. Cruz et al. (2013) argued both operational performance indicators and physical capacity indicators are important measures for port operation performance.

2.1.5.2 Environmental Variable

From port development progress, port efficiency is not only affected by the above input and output variables, but also influenced by environmental factors. Many researchers (such as

Bougheas et al, 1999; Limao and Venables, 2001; Francois and Manchin; 2006 and World Bank report 2013) suggest different factors for the port performance inefficiency in developing countries. such as foreign trade, economic development in the hinterland, poor government policies, cumbersome bureaucracy, poor infrastructure, institutional inefficiency and landlockedness. Environmental variables refer to factors that affect port efficiency but without the subjective controllable range of the samples. However, there is no argument on which one of these factors is the most influential causes for countries like Ethiopia.

2.2 Review of Empirical Studies

This basically looks into a direct analysis of published works which includes; periodicals and books and further explains the theory that brings out findings about that are pertinent to the research theme within reach (Zikmund et al., 2010), unlike in review of literature which brings forth the overlook and an analyzed survey of the former queries which were brought up and which related to a research question. Outlining the study straightforwardly identified with the research hypothesis as compared to the overall studying of the wide in scope and covering a number of years should be upheld (Kaifeng & Miller, 2008). It can hence be concluded that review of literature permits an investigator to put up into intellectual and historical context the research by the help of systematic approach to previous scholarship and it also helps the researcher affirm the importance of their research. Researches about dry port have done by some academicians by different people at different times while they have their own limitations evaluated empirically. Accordingly, the researcher has evaluated the following research titles which were directly related the study under investigated.

Previous studies with regard to port performance assessment reviewed and examined by many scholars and industrial practitioners for the past three decades. The concept of port performance is notably associated with operational issues, i.e. the efficient use of infrastructure, superstructure, and all other resources used. The majority of the indicators, or relevant exercises applied are constructs dealing with the operational productivity of the assets, equipment and productivity factors available (Brooks et al, 2011).

Gujar G., (2011) conducted study titled essay on dry ports. His study shows that as port infrastructure, usually container handling equipment are viewed as the main machines for dry ports as well as seaports, and they can greatly influence both the container handling capacities and, in turn, the performance of the dry port.

Rajasekar and Deo (2014) tried to identify the contributing factors for port performance of major ports in India during 1993 – 2011. For recognizing the factors panel data models like pooled normal least square method, fixed effect model and random effect model are used. The results of the study indicated that berth output, operating expenses, number of employees, cargo equipment and idle time showed significant effect on port performance.

Marlow and Paixão Casaca, (2003) conduct studies using resource-based approach referred to the human knowledge that increases their professional qualifications or productivity were reviewed, which is called human capital or human resources in the RBV. This indicator measures the strength of human resources, whether employees have the right level of skills to perform their jobs.

Ojala R., (2015) conducted the study titled The World Bank's Logistics Performance Index (LPI) and drivers of logistics performance and presented on international transport forum in Finland. His study shows that Capacity management plays vital role for infrastructure efficiency. As he found most of the transport facilities operate with low utilization rates, yet suffer from capacity constraints in peak periods due to high variability of demand. He recommended that flexible transport systems, better resource allocation, and higher utilization of existing physical infrastructure provide less costly and more efficient improvement opportunities than capacity extension and a superior transport infrastructure supports intermodal transport systems, including access roads to terminals and seaport channels.

Nyeme S., 2014 conducted research on factors influencing container terminal efficiency in Kenya Mombasa, and the study shows that, infrastructure both physical (hard infrastructure) and soft (Management of port operations) inversely influence container terminal efficiency. He added that, infrastructure is the necessary condition for efficient cargo handling operations and adequate infrastructure is needed to avoid congestion, foster trade development as well as securing deep-sea container connectivity for economies heavily dependent on international trade. According to his study factors like limited yard capacity to store container before collection and congestion problem due to over capacity are factors associated with infrastructure.

Hales, Douglas N. etal (2016) conducted research titled "An Empirical Test of the Balanced Theory of Port Competitiveness". Their study shows that as infrastructure becomes congested, port fees rose, service levels dropped, and port facilities expanded.

As more stated by Florin N, et al (2015), reasons for poor port performance are time lost due to interruptions in operation, poor utilization of provided equipment, week stacking and handling practices, insufficient training activity and / or its poor organization. Although poor performance and port congestion is due mostly to poor organization of cargo-handling activities and inefficient use of available resources, the ports tend to eliminate the congestions by investing in additional berths or new facilities. This will result in a temporary reduction in congestion without thereby eliminate the real causes of poor performance. The costs of such a large investment will be covered by increased port fees and charges, negatively influencing once more transport and products costs.

Based on the above discussion:

Min, H. and Park, B. (2005) used DEA window analysis model to evaluate variation in for 11 container terminals over a period of 4 years. The number of port workers, total quay length, storage size and the number of cranes were used as the input measures, while cargo throughput was used as the output.

Hercules, H., Girish, G. and Mukul, J. (2011) applied data envelopment analysis (DEA) technique to analyze the efficiency of the dry ports located in the JNPT region of India. One of their main conclusions is that capital investment is essential for implementing container security. In this paper, this invaluable decision making model is used to determine the efficiency of selected dry ports in Africa. This analysis will be performed over a period of four years based on a range of inputs and with container throughput as the model output. It will serve as a basis for efficiency evaluation as more dry ports are either constructed or upgraded in different countries to meet the logistical demands of the African continent.

In determining sources of inefficiency, Judit, et.al. (2018) applied DEA to the Portuguese port industry again for the years 1990 and 2000. The author found that although Portuguese ports exhibited high levels of technical efficiency over the period under study, technological change had superseded any advancement in the ports sector in Portugal. The paper attributed greater efficiency in the port sector to financial aid from EU Single Market program. Additionally, Tobit regression analysis applied in the study found that multi-cargo ports were less efficient than container ports. Market share and efficiency were found to be positively related and the study found that ports with greater public sector involvement exhibited relatively lower levels of efficiency. The DEA model was also applied to estimate the relative efficiency of Portuguese and Greek ports by Hercules, H., Girish, G. and Mukul, J. (2011) in order to benchmark and compare management practices and strategies within these countries. The paper concluded that economic benefits could be identified and evaluated from this form of benchmarking study.

Additionally, a four-stage method for DEA was advocated for by Pjevčević. et.al. (2012) who identified a number of limitations in assessing the port efficiency exclusively based on labor and capital inputs. The four-stage DEA method involved the disaggregation of the efficiency model into individual DEA components, in order to gain insight into actual sources of port inefficiency. The model therefore determined overall efficiency in addition to efficiency related to productivity, profitability and marketability. After applying the method to a sample of ports in South Korea, the authors concluded that South Korean ports should prioritize improving their marketability.

George, K.V. (2015) the DEA and SFA techniques were compared in their application to a sample of the world's largest ports. The authors found that the efficiency estimates derived from the models applied were highly correlated. In their analysis, the authors found high levels of technical efficiency associated with scale of ports, greater levels of private-sector involvement and also with transshipment ports. The authors concluded by outlining significant shortcomings with cross-sectional data utilization in the port sector and also elaborated on some benefits of panel data application for analysis.

TLICSC (2018) applied Three-Stage DEA Mod to analyze Efficiency of Main Ports of the Yangtze River Main Line. Capita GDP and value of foreign trade two environmental variables used as explanatory variables to construct SFA regression model, One of their main conclusions is that the per capita GDP and value of foreign trade of the port have passed the test at least 10% significance level, it shows the increase of economic development level and value of foreign trade in the hinterland, it plays a positive guiding role in the development of the port economy, it is conducive to improve the port input-output ratio and can significantly affect the port economy efficiency.

2.3 Summary of Literature Review and Conceptual Frame Work of the Study

The aim of this research is to investigate the determinant factors affecting operational performance efficiency in Ethiopia the case Modjo and Kality dry port branch.

In the literature the concepts of dry port determinants from RBV approach were discussed as port infrastructure, port operating efficiency, port human capital and port information capital is also discussed. As indicated in both theoretical and empirical part of literature these variables are found to have direct on port operational performance.

The overall review of literature shows that previous research conducted in inland port are still lagging behind, especially in Ethiopia. These conducted also didn't, show the exact relationship between port resources, and operational performance. But the available literatures are mostly on sea ports and overlooked inland/dry ports. Some few available on inland port also hardly focus on environmental aspects of port operation and do not show the effect of operational efficiency on performance.

As a critical solution to improve operational performance of dry port, the researcher summarized literature concepts as follows:

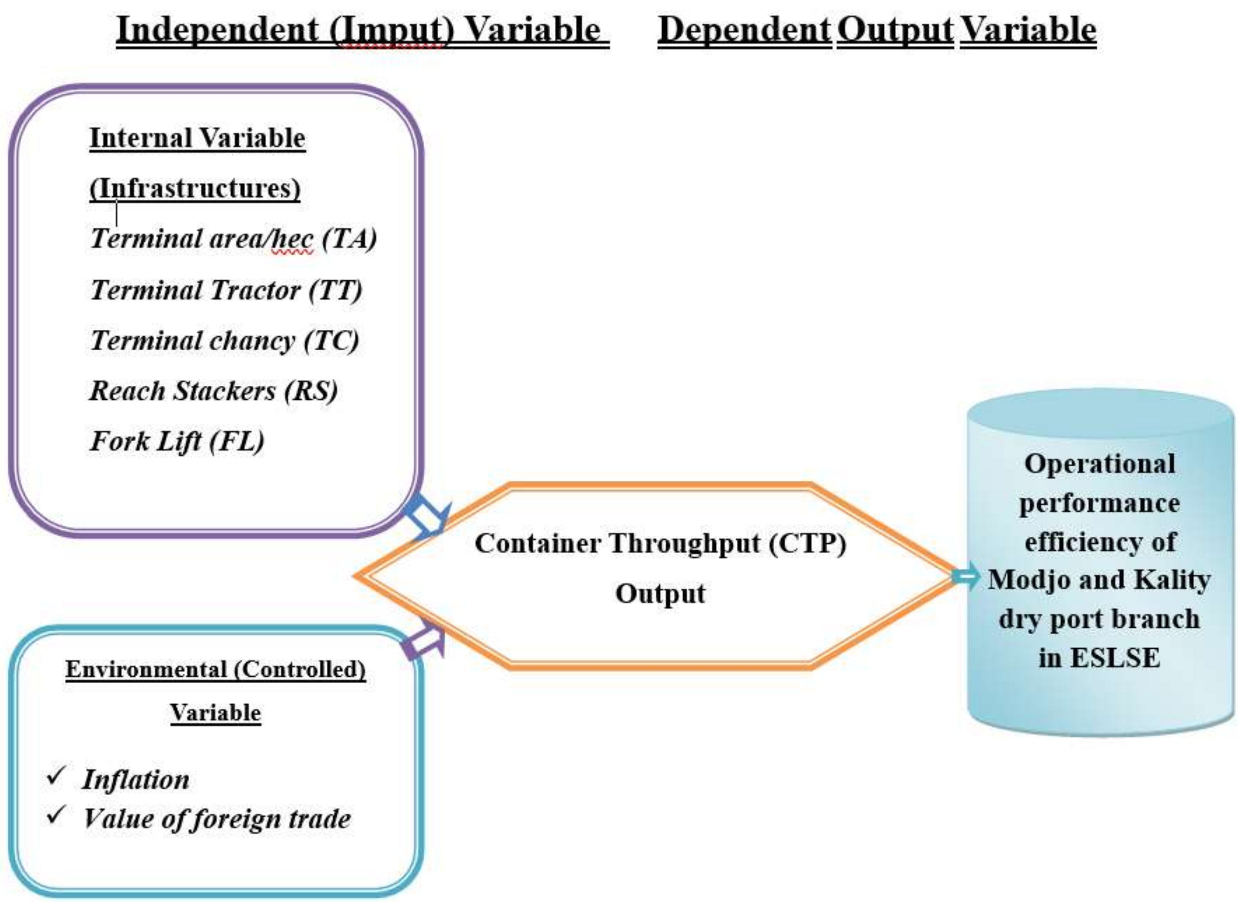
The port industry has mostly relied on the use of partial performance indicators because these metrics are simple to understand and easy to calculate. These indicators describe waiting times, service or turnaround time, labor expenditure, capital equipment expenditures per ton of cargo, and cargo handling revenues per ton of cargo, among other industry metrics. However, a port production function requires from multiple outputs and inputs. For this reason, the economic literature has evolved and increasingly focuses on total measures of port performance, that account for a mix of inputs used, technology to transform inputs into outputs, and the firm's productive scale. In this field, two different concepts stand out: efficiency and productivity.

Therefore, given the scarcity of prior studies, whether the attributes identified from literature are applicable to ESLSE's dry ports is critical for empirical investigation which validates and generalizes the findings in this research.

In this study, mainly considers internal (resource based) and external (environmental) factors for evaluation of efficiency of the port operation performance. Through internal process improvement, ports can achieve greater efficiencies in their operations, which have a win-win relationship in terms of performance incorporating economic and environmental aspects. in the process of evaluating efficiency of the port operation performance, one of the most important inputs is infrastructures which comprise property, plant and equipment. Hence, the following variable has been considered internal factors: Terminal area (hectar), No of Mobile Cranes, Reach Stackers, Fork Lift, Empty Handler, and Terminal Tractors. These are chosen to be input variables. While, two factors as environmental variables: per capita GDP, it comprehensively reflects the economic development level of a region, and value of foreign trade, it mainly reflects the demand of the port, in the cargo throughput of the port, the foreign trade volume will have an impact on the output.

Based on the previous studies conducted on sea ports in other parts of the world the researcher adopted conceptual framework for this study, which is depicted as follows:

Figure 2.1 Conceptual Framework26



Source: self-constructed

CHAPTER THREE

RESEARCH METHODOLOGY

The preceding chapter has indicated the literature on dry port performance and its determinant factors. This chapter looks at the research methodology. The research methodology is the systematic, theoretical analysis of the procedures applied to a field of study (Kothari, 2005). It describes the research design, Research approach, target population, sample design, data collection instruments, data collection procedure, data validity, data reliability data analysis and presentation. To meet the study objective, the following research methodology will follow in the course of conducting this research.

3.1 Research Design

The research purpose is to investigate and analyze determinant factors affecting performance of ESLSE' dry port the case of modjo Branch. For the purposes of this study, the researcher will used explanatory research design. According to Marczyk et al., (2005), the explanatory type of research design helps to identify and evaluate the causal relationships between the different variables under consideration. And also, the design enabled the researcher to explain the relationships between variables. Hence, in this study the explanatory research design will be employ.

This study also, adopted a quantitative longitudinal research design. A longitudinal study follows the same sample over time and makes repeated observations (Forgues, Bernard and Vandangeon-Derumez, 2011). Measurements are taken on each variable over two or more distinct time periods. This allows the researcher to measure change in variables over time. Since it is a series of data points indexed in time order. Most commonly, a time series is a sequence taken at successive equally spaced points in time.

3.2 Research Approach

There are three types of research approaches, qualitative, quantitative and mixed approach. Quantitative method is a means for testing objective theories by examining the relationship among variables. Data will collects using numerical value based on precise measurements and the final report has statistical report with correlations, comparisons of means and statistical significance of the findings. On the other hand, qualitative method is a means for exploring and understanding the meaning individuals or groups ascribe to a social or human problem. The final report is narrative report with contextual descriptions and direct quotations from research participants. The mixed method focuses on collecting, analyzing and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approach in combination provides a better understanding of research problems than either approach alone. (Kothari, 2005).

Although this study is based on theories and existing knowledge it is possible to present an alternative outcome of the research, within the unique structure of Ethiopian dry port operation. There is no one best research strategy that is superior to others. What matters most in selecting a research strategy is whether the chosen strategy fits with the assumptions of the research philosophy and whether it enables the researcher to answer the research questions and meet the objectives of the research (Saunders et al., 2003).

In this study the researcher will used quantitative approaches. As noted earlier a quantitative approach is one in which the investigatory primarily uses postpositive claims for developing knowledge, employs strategies of inquiry to provide data that can answer the research questions or achieve the research objectives. A quantitative research approach is used to investigate the possible relationship between seaports, cargo throughput, turnaround time and number of employees, in other to establish if the ship traffic calling is determined by the independent variables in ports and if it has any effect and to what extent.

Also, there are many types of research approaches, depending on the types of data that the researcher wants to collect and analyze, such as experiment, survey, case study, action research and grounded theory. However, this study employs case study because there is a wide scope of competencies to be evaluated within a serious of time in this research. These determines a long interaction time, which in turns to aimed at attracting a wider sample group with a given time interval.

3.3 Population and Sample

A study population is the aggregation of elements from which the sample is actually selected. Supporting this Zikmund, (2003) defined target population as the complete group of the specific population elements relevant to the research project. The shipping industry is heterogenous in nature and the operational features of a shipping company can be perceived differently and assessed separately. In the case of ESLSE, the enterprise is categorized into shipping service sector, corporate service sector, freight forwarding service sector, dry port and terminal service sector. The activity and operation of each sector can be defined in different perspectives. However, this study emphasizes the analysis of dry port and terminal service sector performance factors. Therefore, this study focuses on Dry port and terminal service sector in the ESLSE.

The target population of the study is all dry Port and terminal branches operating in ESLSE. Almawsheki & Shah (2015) argues that for an appropriate port Operating efficiency benchmarking, the DMUs selected must be similar/homogenies. Due to this reason, by using purposive sampling technique from eight dry Port and terminal branches operating in ESLSE (Mojo, Gelan, Combolcha, Diredewa, Semara, Kality, Worota, Mekele), two major branches those provide main dry port and terminal services since 2016 and used all of the selected variable are considered as a sample. The selected branches (DMU) are: Modjo and Kality. Due to the lack of complete and reliable data the remaining six ports are excluded from the sample. And also based on information available on their annual reports, the study used panel data over the sample period.

3.4 Data Collection Procedures

Throughout the study, the researcher used secondary data sources. The study collected data from the ESLSE's audited reports. These reports contain sufficient information about the enterprises annual performance, strategies, achievements and targets. Therefore, the researcher makes use of the reports available from 2016 to 2020.

3.5 Data Analysis

After data have been collected, data processing will have carried out. The following section discusses about the data analyzation techniques for quantitative data as this study is explanatory in design. The raw data will convert into suitable form for analysis and interpretation. This has achieved through sequences of activities including editing, coding, entry, and tabulation. The objective has to check the completeness, internal consistency and appropriateness of the data to each of the variables.

According to this literature, efficiency can be estimated as the gap between the position assigned to each observation which depends on the relationship between its inputs and outputs and the estimated best practices located on the production frontier. The construction of an efficient frontier has been addressed from two different approaches: parametric, with Stochastic Frontier Analysis (SFA), and non-parametric, with Data Envelopment Analysis (DEA). Both methodologies have proven to be useful for conducting efficiency studies in that they provide valuable information on whether a port or terminal is employing its inputs appropriately, and thus making proper use of investments (Suárez-Alemán et al, 2014). Thus, the efficiencies of Two (2) dry ports in ESLSE are evaluate using the three stage DEA and SFA analysis mo del.

The methodology was address the study objectives by covering the content necessary and draw a meaningful conclusion on port productivity capabilities and efficiency in the ESLSE. The study analyzed the data collected using DEAP and Frontier 41 software for extracted statistical discretion and graphical illustrations. The study also utilizes DEA to assess efficiency and results presented in the form of tables and figures then discussed thoroughly. The DEA recognizes the smallest set enveloping the input-output observations for all DMUs and attempts to detect a production unit in comparison with others (Kutin at al., 2017). While, the SFA model to account for institutional and demand-side variables and to single out efficiency, and also to explain the impact of port on determining Operational efficiency.

This methodology allows for the decomposition of TFP into different components through panel data on different firms (DMU). In order to verify how well the measured indicators represent the constructs and to make measurement model valid before it is used in structural model.

3.6 Model Specification

This section presents a framework of analysis on the basis of these studies, and involves adopting a model that would help demonstrate the significance (responsiveness) of certain key variables in influencing the operation performance of the selected sample dry port branches (DMU).

The researcher formulates two different approaches: parametric, with Stochastic Frontier Analysis (SFA), and nonparametric, with Data Envelopment Analysis (DEA) model to achieve the broad research objective. It is an abstraction of the real world. The specification of a model is based on the available information relevant to the study in question.

As a nonparametric estimation, DEA revolves around a programming approach that does not assume a statistical function underpinning the data and doesn't considere the impacte of environmental variables and random error on the evaluation results, resulting in lower accuracy of evaluation results. Fried (1999, 2002) explores how environmental factors and random noise can be introduced into the DEA model, which is called as the three-stage DEA model.

3.6.1 The First Stage: Traditional DEA Model

DEA is a non-parametric technique used to measure the efficiency of DMUs. One of the interesting features of DEA is that it allows each unit to identify a benchmarking group; that is, a group of units that are following the same objectives and priorities, but performing better. In this regard DEA aims to respect the priorities of each DMU by allowing each one of them to choose the weight structure for inputs and outputs that most benefits its evaluation. As a result, it aims to classify each unit in the best possible light in comparison to the other units. Another advantage of DEA is that it does not require specification of a cost or production function, allowing for richer models. A comprehensive review of the DEA technique can be found in Cook and Zhu [1978].

DEA is a data-oriented approach used to evaluate the performance of DMUs by converting multiple inputs into outputs (Cooper, Seiford & Zhu, 2004). Since the development of the DEA in 1978 by Charnes, Cooper and Rhodes, many studies have recognized the use of the technique in performance evaluation. The analysis allows the use of real-time data to obtain informed and applicable results, and it can measure the impact of similar inputs on multiple outputs. It enables the evaluation of the effect of multiple inputs of complex and unknown relations between the outputs.

The DEA method allows for estimating the distance functions required for the abovementioned Malmquist TFP analysis. Moreover, the implementation of both constant returns to scale (CCR, from Charnes, Cooper, and Rhoades, 1978) and variable returns to scale (BCC, from Banker, Charles, and Cooper, 1984) allows not only for disentangling technology and efficiency changes, but, within the latter, disentangling pure technical efficiency and scale efficiency. In order to account for these two effects, introducing BCC distance functions to obtain.

$$\frac{TFP_1}{TFP_0}=\frac{D_0{}^{BCC}(Y_0,X_0)}{D_1{}^{BCC}(Y_1,X_1)}\left[\frac{D_1{}^{BCC}(Y_1,X_1)}{D_0{}^{BCC}(Y_0,X_0)}\frac{D_0{}^{CCR}(Y_0,X_0)}{D_1{}^{CCR}(Y_1,X_1)}\right]\left[\frac{D_1{}^{CCR}(Y_0,X_0)}{D_0{}^{CCR}(Y_0,X_0)}\frac{D_1{}^{CCR}(Y_1,X_1)}{D_0{}^{CCR}(Y_1,X_1)}\right]^{\frac{1}{2}}.$$

Thus, TFP change is finally formed as the multiplication of technological, scale, and pure technical efficiency changes:

TFPCH = *EFFCH* * *TECHCH* ; *EFFCH* = *SECH* * *PECH*

Where

- *TFPCH* = total factor productivity change and represents the overall change that may vary over time because of *EFFCH* or *TECHCH*;
- *EFFCH* = efficiency change and represents the part of the productivity change due to the level of efficiency in performance, and may be decomposed into *PECH* and *SECH*;
- *TECHCH* = technical change and represents the part of the productivity change due to technological modifications (a shift in the production frontier over time);
- *PECH* = pure efficiency change and represents the part of the efficiency change due to pure efficiency considerations, once scale efficiency is removed;
- *SECH* = scale efficiency change and represents the part of the efficiency change due to size: the scale efficiency is a measure of the degree to which a firm is optimizing the size of its operations (Coelli et al., 2003).

3.6.2 The Second Stage: SFA Model

In the second stage, focusing on investing in the output slack variable [x -X λ] it can reflect the initial inefficiency, it consists of environmental factors, management inefficiency and statistical noise, regression analysis are carried out for environmental variables by constructing SFA model, the effects of the above three factors can be observed respectively. In the second stage, focusing on investing in the output slack variable [x -X λ] it can reflect the initial inefficiency, it consists of environmental factors, management inefficiency and statistical noise, regression analysis are carried out for environmental variables by constructing SFA model, the effects of the above three factors can be observed respectively.

Stochastic Frontier Analysis (SFA) was introduced simultaneously by Aigner et al. (1977) and Meeusen and van den Broeck (1977). It assumes that a parametric function exists between production inputs and outputs. The notable advantage of SFA is not only does it capture technical inefficiency, but also recognizes the fact that random shocks outside the control of DMUs can affect output. Consequently, the essential idea behind the model is that the error term is composed of two parts; a one-sided component that captures the effects of inefficiency relative to the stochastic frontier, as well as a symmetric component that permits random variation of the frontier across DMUs, and captures the effects of measurement error, other statistical noise, and random shocks outside the control of DMUs (Cullinane et. al., 2006).

Cullinane et. al. (2006) demonstrates the first step in solving a stochastic frontier model is to specify a functional form, with solutions most frequently relying upon maximum likelihood estimation. A stochastic frontier model can be expressed as Equation below, where the technical efficiency of firm k is Uk and must be positive, whereas the statistical noise component Vk can be either positive or negative.

$$Y_k = f\,(x_{1k}\,,\, x_{2k,,,,,,,}\; x_{mk},\, Z1_{k.\,+}\, Z2_k\; u_k,\, v_k)$$

The above general function form could be further expanded depending on the objective that DMU intends to fulfill (minimization or maximization), or in other words the basis of analysis (i.e. input or out oriented model) and choice of the function form. Cullinane et. al. (2006) shows that in case the output oriented model is preferred for the application of the SFA model, the estimation of relative operational efficiency of the port (container terminal) operator could be conducted by assuming the appropriateness of the log-linear Cobb–Douglas function, and could be specified in the cross-sectional case as follows:

$$\ln Y_k = \beta_0 + \beta 1 \ln \text{Terminal Tractor}_k + \beta 2 \ln \text{Terminal chancy(TC)}_k + \beta 3 \ln \text{Reach Stackers(RS)}_k + \beta 4 \ln \text{Fork Lift(FL)}_k + \beta 5 \ln \text{Terminal area (hectare)}\,(\text{TA})_k + u_k - v_k$$

The purpose of SFA regression is to eliminate the effects of environmental and random factors on efficiency measures, so adjust all decision-making units to the same external environment. The adjustment formula is as follows:

$$X_{ni}^{A} = X_{ni} + [\max(f(z_i;\beta_n)) - f(z_i;\beta_n)] + [\max(\nu_{ni}) - \nu_{ni}]\ ;\ i = 1,2,\ ,I\ ;n = 1,2,\ ,N$$ □ □

Among them, X_{ni}^{A} is the input after adjustment; X_{ni} is the input before adjustment; $[\max(f(z_i;\beta_n)) - f(z_i;\beta_n)]$ is to adjust the external environmental factors; $[\max(\nu_{ni}) - \nu_{ni}]$ is to put all decision-making units under the same luck level.

3.6.3 The Third Stage: DEA Model after Adjustment

The Third Stage: DEA Model after Adjustment is constructed, namely the values of the input variables adjusted in the second stage are re-substituted into the BCC model of the first stage, and the DMU efficiency after deducted the environmental variables and the random error terms is calculated. The efficiency value obtained by this method excludes the influence of the operating environment and statistical noise, and it is more objectively and truly reflects the actual efficiency. The calculation tools used in this paper are DEAP2.1 and FRONTIER4.1 software.

3.7 Variables Definition

The scientific definitions of input and output variables are critical to the application of DEA. The specification of erroneous or ill-defined variables inevitably leads to the wrong conclusions emerging; however elaborate the models employed may be. Input and output variables should reflect the actual objectives and process of container port production as accurately as possible (Norman and Stoker 1991, Wang 2004). As far as the former is concerned, the observed performance of a port is closely related to its objective. In this paper, the main objective of a port is assumed to be the minimization of the use of input(s) and maximization of the output(s).

3.7.1 Dependent Variable(output): Container throughput (TEUs)(CTP)

As far as the output variable of container terminal production is concerned, container throughput is unquestionably the most important and widely accepted indicator of container port or terminal output. Almost all previous studies have treated it as an output variable, because it relates closely to the need for cargo-related facilities and services and is the primary basis upon which container ports are compared, especially in assessing their relative size, investment magnitude or activity levels. Most importantly, it also forms the basis for the revenue generation of a container port or terminal. Therefore, the dependent variable (Output) is the container throughput.

3.7.2 Independent Variables (Input)

A container terminal depends crucially on the efficient use of labor, land and equipment. The total quay length, the terminal area, the number of gantry cranes, the number of yard gantry cranes and the number of straddle carriers have been deemed to be the most suitable factors to be incorporated into the models as input variables. Other input factors that possibly influence the efficiency estimates that may be derived from this analysis include aspects such as Terminal occupancy, proximity to major trade lanes, crane operating hours, different handling speeds of cranes, equipment age a maintenance, the capital invested in a terminal and associated equipment. However, the practical problem of obtaining data on each of these variables across the whole sample is likely to prove impossible. In addition, with the vast number of potential input variables that may be hypothesized as influencing container port efficiency, the issue of multicollinearity becomes noticeable.

In the light of the unavailability or unreliability of direct data, information on labor inputs is derived from a predetermined relationship to terminal facilities (De Neufville and Tsunokawa 1981, Notteboom et al. 2000). It is very important to note, however, that this predetermined relationship is not applicable to all types of ports with different characteristics of production. It is also dangerous to apply this relationship to container ports of different production scale (throughput) because of the different equipment and labor arrangements employed. Therefore, the following key variables will be of interest: In this study, the following variable has been considered: Terminal Tractor (TT), Terminal chancy (TC), Reach Stackers (RS), Fork Lift (FL), Terminal area (hectare)(TA). These are chosen to be input variables.

3.7.3 Environmental (Control) Variable

From port development progress, port efficiency is not only affected by the above input and output variables, but also influenced by environmental factors such as foreign trade, economic development in the hinterland, and macroeconomic policies. In order to isolate the effects of input and output variables on port performance efficiency, it is needed to control for other factors that are expected to have some influence on port performance efficiency.

Environmental variables refer to factors that affect port efficiency but without the subjective controllable range of the samples. Although there are other variables that affect port performance efficiency this paper mainly considers the following two factors as environmental variables: (1) per capita GDP, it comprehensively reflects the economic development level of a country, it is not only a demand factor for port development, but also affects supply from port construction; (2) value of foreign trade, it mainly reflects the demand of the port, in the cargo throughput of the port, the foreign trade throughput occupies a considerable proportion, under the same input level, the foreign trade volume was have an impact on the output.

Table 3.1: Inputs and Output Variables for Each Port and terminal branch operate in the ESLSE 38

Year	**Branch**	**Output**	**Input**				
		container throughput	Terminal Tractor	Terminal chancy	Reach Stackers	Fork Lift	Terminal area (hectare),
		CTP	TT	TC	RS	FL	TA
2008	Modjo	484163	9	16	10	19	27.17
2009	Modjo	534376	9	16	10	19	27.84
2010	Modjo	520167	9	16	10	10	27.84
2011	Modjo	507702	11	16	17	44	29.12
2012	Modjo		11	16	16	60	29.12
2008	Kality	73440	1	2	3	10	2.17
2009	Kality	81477	1	2	3	10	2.17
2010	Kality	73947	1	2	3	10	2.17
2011	Kality	88136	1	2	4	14	2.17
2012	Kality		1	2	4	14	2.17

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION OF FINDINGS

4.1 Introduction

To meet the broad research objective and to answer research questions under it the research design used for this study also discussed in the preceding chapter. In this chapter the data collected were organized into a systematic format to enable analysis. The raw data has converted into suitable form for analysis and interpretation. This has achieved through sequences of activities including editing, coding, entry, and tabulation.

The efficiencies of two dry ports in Ethiopia are calculated using the three stage analysis approach of the DEA. The selected dry ports are; the Mojo and Kality dry ports in ESLSE. The choice of input and output variables is very important in the model construction and since the input-output approach is chosen for this work, it is important to define the measures to be used as the inputs and outputs. The dependent variable (Output) used in this study in order to measure the sample ESLSE's port and terminal branches operation performance. The output measure would be the container throughput in TEUs per annum whereas the explanatory (input) variables has been considered: Terminal Tractor(TT), Terminal chancy(TC), Reach Stackers(RS), Fork Lift(FL), Terminal area (hectare)(TA).

The study analyzed the data collected using DEAP and Frontier 41 software for extracted statistical discretion and graphical illustrations. The study also utilizes DEA to assess efficiency and results presented in the form of tables and figures then discussed thoroughly. While, the SFA model to account for institutional and demand-side variables and to single out efficiency, and also to explain the effect of port infrastructural resource on determining operational performance efficiency, over the multiple periods of five years ranging from 2016-2020. The researcher also analyzed the data in line with the three specific objectives of the study.

The 1st objectives "To measure the relatively operation performance efficiency of the sample DMU (Modjo and Kality dry port branch)" have been addressed with the 1st stage of DEA analysis. In this stage DEA aims to respect the priorities of each DMU by allowing each one of them to choose the weight structure for inputs and outputs that most benefits its evaluation. In the first stage, As a result, it aims to classify each unit in the best possible light in comparison to the other units. The original input-output data is used to construct an input-oriented BCC (variable return to scale) model for initial efficiency evaluation.

The 2nd objectives "To examine the influence of internal (infrastructural resource) and external (environmental) factors on the ESLSE's dry port operation performance the case of Kality and Modjo branch" have been addressed with the 2nd stage of DEA analysis. In this stage, it can reflect the initial inefficiency, it consists of environmental factors, management inefficiency and statistical noise, regression analysis are carried out for environmental variables by constructing SFA model, the influence of the above three factors can be observed respectively. The purpose of SFA regression is to eliminate the effects of environmental and random factors on efficiency measures, so adjust both decision-making units (sample branches) to the same external environment.

The 3rd objectives "To masseur their degree of influence on the ESLSE's dry port operation performance the case of Kality and Modjo branch" have been addressed with the 3rd stage of DEA analysis. In this stage: DEA Model after Adjustment is constructed, namely the values of the input variables adjusted in the second stage are re-substituted into the BCC model of the first stage

4.2 Descriptive Statistics

The study take into account the performance of as both the independent (input) and dependent (output) variables are measurable. Descriptive statistics such as mean, minutemen, maximum and standard divination have been employed.

The descriptive statistics of the study variables of selected ESLSE's port and terminal branches in Table 4.1; the table presents mean, standard deviation, maximum, minimum and median values for the dependent and independent variables to give a deeper analysis of data. Descriptive statistics therefore enables us to present the data in a more meaningful way, which allows simpler interpretation of the data. The research statistics of each variables of the study have been discussed here under.

Table 4.1 Descriptive statistics41

Variables	Mean	Standard Deviation	Minimum	Maximum	Obs
CTP	295,426.00	228,236.37	73,440.00	534,376.00	10.00
TT	5.40	4.70	1.00	11.00	10.00
TS	9.00	7.38	2.00	16.00	10.00
RS	8.00	5.42	3.00	17.00	10.00
FL	21.00	17.13	10.00	60.00	10.00
TA	15.19	13.74	2.17	29.12	10.00
inf	111.22	16.32	92.00	132.80	10.00
FORTRAD(in bill)	18.32	1.72	15.10	19.60	10.00

Source; own computations

As depicted on the above table 4.1, the mean, maximum, minimum and standard deviation values of variables, a dataset of 10 observations provides the basis for descriptive analysis.

As we see from table 4.1 shows that during 2016 to 2020 the average CTP, measured by the total contender thruput, there were a branch which was as high as 534376, there were also a branch with low performance reported at 73,440. It has a mean value of 295,426 with a standard deviation of 228,236. According to Brooks (2019) the standard deviation reveals how much dispersion exists from the average value. A low SD indicates that the data points are very close to the average value. While high SD reveals the data point are spread out over a large range of values. Hence, the standard deviation shows the existence of high level of variation in the group performance. And also there were significant port infrastructural heterogeneity among the two sample branches. Modjo has more port infrastructure and annual throughput than kality port. The above table reviled that there was much variation in the input and output variables the range shows the existence of great variation in performance among the selected dry port branch in ESLSE. Therefore, it can be concluded that the two sectors have been experiencing relatively continuous increases in output during the study period (2011 – 2018).

In case of control variable, which is external variables show that annual inflation rate mean, maximum and minimum observation is shows, 111.22, 132.80 and 92.00 and the standard deviation is16.32%. This implies that the volatility of inflation rate varies from the mean by 16.32 %. there was no much variation. While, regarding foreign trade mean, maximum and minimum observation is shows 18.32, 19.60 ,15.10 and the standard deviation is 1.72. This could be one source of inefficiency, since there is almost stagnated increase in inflation and import-export trade variables.

4.3 Correlation Analysis

This section of the study deals with the correlation analysis of the studied variables. The correlation between dependent, independent and control variables along with the causal effect was analyzed. The purpose of undertaking correlation analysis is to indicate whether the variables move together or not in the same direction and the correlation coefficient indicates the strength of a linear relationship between two variables as well as to check whether there is multicollinearity problem in the model. The correlation coefficient ranges between +1 and -1. +1 indicates the strongest positive correlation possible, and -1 indicates the strongest negative correlation possible. Therefore the closer the coefficient to either of these numbers the stronger the correlation of the data it represents. On this scale 0 indicates no correlation, hence values closer to zero highlight weaker/poorer correlation than those closer to +1/-1. The correlation matrix reveals a first insight in the direction and the strength of the relationships between variables. According to Brooks (2008), if it is stated that y and x are correlated, it means that y and x are being treated in a completely symmetrical way. Thus, it is not implied that changes in x cause changes in y, or indeed that changes in y cause changes in x rather, it is simply stated that there is evidence for a linear relationship between the two variables, and that movements in the two are on average related to an extent given by the correlation coefficient.

Table 4. 2 shows a correlation analysis for the sample period.42

CORRELATIONS	CTP	TT	TS	RS	FL	TA	INF	FORTRAD(IN BILL)
CTP	1.000							
TT	0.985	1.000						
TS	0.998	0.988	1.000					
RS	0.892	0.953	0.895	1.000				
FL	0.574	0.691	0.579	0.850	1.000			
TA	0.998	0.993	0.999	0.912	0.608	1.000		
INF	0.012	0.103	0.000	0.330	0.562	0.029	1.000	
FORTRAD (IN BILL)	0.036	0.040	0.000	0.132	0.151	0.019	0.598	1.000

The correlation matrix table 4.2 above, showed the relationship between the dependent variable and independent variables, and also between the independent variables each other used in this study. Based on the correlation matrix the dependent variable (CTP) had a positive correlation with all independent variable(CTP, TT, TS, RS, FL, TA, INF and FORTRAD), with correlation value of 0.985, 0.998, 0.892, 0.574, 0.998, 0.012 and 0.036 respectively. except INF and FORTRAD all internal variables has closer the coefficient to 1. Means, there is a presence of stronger correlation with the output variable (CTP). Which indicated when those variables increased (CTP) would also be increased with the same correlation coefficient. Therefore, it can be seen that there a great relationship between the container throughput, which is the model output and Terminal Tractor, Terminal chancy, Reach Stackers, Fork Lift and Terminal area (hectare),. This presents an opportunity that can be exploited to improve the efficiencies of the dry ports.

4.4 The relatively operation performance efficiency of the sample DMU (Modjo and Kality dry port branch)

This sub section covers the first stage of the analysis, which presents the results of traditional DEA Model. This section analyzes TFP changes in two dry port and terminals branch of the ESLSE. Following the theoretical framework introduced in model specification section.

In the first stage, DEAP2.1 was used to analyze the efficiency level of mojo and kality port and terminal branches in the ESLSE. This result addresses the first and second objective of the study and answers research questions 1 and 2.

1.1.1 The First Stage: Analysis Results of Malmquist DEA Model

The analysis is carried out in terms of means TFP changes. As the results are shown in Table 4.4 the TFP changes and their components. It can be seen that when does not consider environmental variables and random factors, the average overall efficiency (TFPCH) during sample period from 2008-2012 is 0.931, the average technical efficiency was 0.931 too, while pure technical and scale efficiency was 1. According to the mean score of productivity during the study period (five year), for modjo and kality Port & terminal branch is 0.875 and 0.989 respectively. This implies that a decrease in productivity registered for both branch (modjo 12.5 percent and kality1.1percent). With respect to the TFP decomposition for both branch the main source of productivity is technical change.

In general, the overall efficiency of kality was perform relatively better than modjo dry port and terminal branch.

Table 4.4 shows the summery results derived from a DEA Malmquist analysis of TFP changes. The detail **Results from DEAP Version 2.1** attached in **Annex 1,3&3:**.

Table 4.3: Results of the Empirical Analyses (2008 – 2012)44

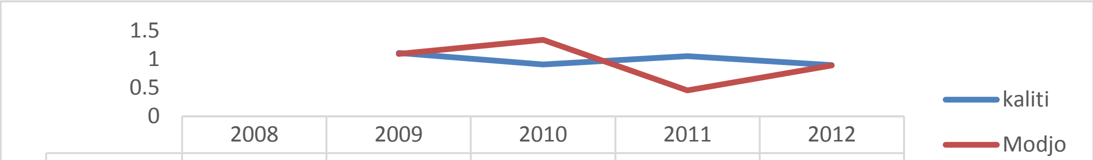
ESLSE SECTPRS	EFFCH	TECHCH	PECH	SECH	TFPCH
Modjo	1.000	0.875	1.000	1.000	0.875
KAlity	1.000	0.989	1.000	1.000	0.989
Mean	1.000	0.931	1.000	1.000	0.931

Source: Author

According to results above, it is clear that the two branch in the ESLSE are different in terms of productivity. Considering these remarkable differences between the branch, it is reasonable to analyze the evolution of TFP over the 2005–2012 period.

In this section, In order to account for timeframes that allow for productivity changes in terms of efficiency or technical changes, for five different periods. the study carried out a disaggregated analysis of the productivity changes. Figure 1 graphically shows TFP evolution of the branches.

Fieger 4.1: TFPCH for Modjo and Kality port and terminal branches 44

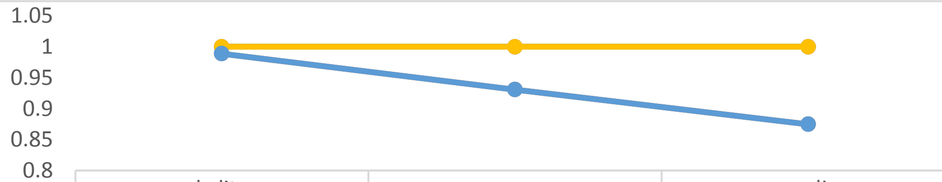


	2008	2009	2010	2011	2012
kaliti		1.109	0.908	1.057	0.899
Modjo		1.093	1.342	0.451	0.889

The evolution of TFP clearly shows that the highest performance registered was 34.2 %(1.342-1) by modjo port and terminal branches and also this branch registered the worst performance -55 %(1-0.541) which is decreased its overall performance efficiency by 55% during 2011. whereas, kality Port & terminal branches registered increased overall performance efficiency by 10.9%(1.109-1) during 2009 and decreased its overall performance efficiency by 9.2% during 2009) In general, during 2012 both branches were performed Below the number 1, which means productivity decreased by 10.1% and 11.1% for kality and modjo branch respectively.

Since TFP may be decomposed into technical changes and efficiency changes, our empirical strategy is to analyze trends in these two components. Figure 2 plot the evolution of EFCH, TECH, PECH, SCCH and TFPCH separately for ESLSE port and terminal branch separately.

Fieger 4.2: EFCH, TECH, PECH, SCCH and TFPCH for ESLSE port and terminal branch45



	kality	mean	modjo
Sum of effch	1	1	1
Sum of tech	0.989	0.931	0.875
Sum of pech	1	1	1
Sum of scch	1	1	1
Sum of tfpch	0.989	0.931	0.875

Fieger 4.2, above shows the results for the analysis and averages for both dry ports considered over the five years' period. It can be seen that when does not consider environmental variables and random factors, the average overall efficiency (TFPCH) and technical efficiency (TECH) during the study period were 0.931 and the average pure efficiency (PECH) and the average scale efficiency (SECH) is 1, this indicate, the overall efficiency of the sample ports inefficiency registered due to technical inefficiency.

For the entire study period the men score of total factor productivity change was 6.90%(1-0.931*100). This is due to a decrease on technical efficiency change(tech) only, but pure and scale efficiency change remained stagnant. however, in the study period the modjo port and terminal branch was more inefficient than Kality port and terminal branch since the total factor productivity change was decried by 12.50, for modjo while 1.10 for kality). This is due to a decrease on technical efficiency change (tech) only, but pure and scale efficiency change remained stagnant as well.

The efficiency gap among the ESLSE port and terminal branch is obvious from the comparison of ports. and it shows that the two ports themselves have the phenomenon of input redundancy and output insufficiency, it is necessary to further optimize the port scale to achieve higher economic benefits. since, the comprehensive efficiency of the two por has not reached an effective frontier, and it is mainly due to low technical efficiency, redundant input and insufficient output and the input factors should be adjusted according to specific conditions, and improve port infrastructural capacity utilization, optimize the input-output structure and improve the efficiency of port operation.

The decomposition of the productivity changes enables us to acknowledge the key role of efficiency in explaining differences between branches (DMU). In other words, there have been productivity changes over the five year because technical efficiency changed. And this efficiency varied among branches (DMU) because of the pure efficiency component. Findings of this study show that however modjo port and terminal branch being relatively smaller compared to the kality branch; both present almost equal scores of relative technical efficiencies. This emphasizes that the size of port (bigger/small) in terms of infrastructure, operational equipment or the volume of traffic, should not be the only factor to compare performance between sectors (DMU). Other operational arrangements (such as the improvement in utilization of available space and operational practices) could enhance the efficiency of ports regardless of their sizes. However, competition practices tend to push port authorities to consider development of terminals with excess capacity as an operational necessity. To the researcher view, such practices may technically result to unnecessary over investment of capital and eventually become a drawback to meet an overall goal of achieving clients' satisfaction at lowest possible logistics costs.

Thus, by identifying the drivers of technical efficiency, we will be able to explain an important part of port productivity and the differences in that productivity between DMU. This more detailed analysis of efficiency and its determinants is important for a clearer understanding of the port productivity that can provide a foundation for enterprise policy decisions by concerned authorities.

To this end, the next section shows the results of a SFA that determines technical efficiency by port with the estimation of a production function controlling for variables that drive port demand and other port-specific variables. Sins it is difficult to form scale effect, while the relatively low technology efficiency is subject to the rapid development of regional economy and foreign trade, port cargo throughput and container throughput continue to increase, and the established investment in port resources has produced high economic benefit.

1.1.2 The Second Stage: SFA Regression Analysis Results

In this stage, it can reflect the initial inefficiency, it consists of internal (infrastructural) inefficiency or external (environmental) factors and statistical noise, regression analysis are carried out to examine this variables by constructing Stochastic Frontier Analysis (SFA) model, the influence of the above three factors can be observed respectively. The purpose of SFA regression is to eliminate the effects of environmental and random factors on efficiency measures, so adjust both decision-making units (sample branches) to the same external environment. The SFA allows for a parametric estimation of technical efficiency in ports, as highlighted in Section of model specification. The researcher used the SFA model to account for institutional and demand-side variables and to single out efficiency, and also to explain the impact of port and country characteristics on determining technical efficiency. This stage, therefore, achieved the research objectives 2 and 3, and answered the research questions 2 and 3 as well. The result is shown in table.4.4.

The empirical study model;

$\ln Y_k = \beta_0 + \beta 1 \ln \text{Terminal Tractor}_k + \beta 2 \ln \text{Terminal chancy(TC)}_k + \beta 3 \ln \text{Reach Stackers(RS)}_k + \beta 4 \ln \text{Fork Lift(FL)}_k + \beta 5 \ln \text{Terminal area (hectare)} (TA)_k + \beta 6 \ln INF_k + \beta 7 \ln FRNTRAD_k + u_k - v_k$

Table 4.4 Stochastic Frontier Analysis (SFA) estimation model 47

Beta	variable	coefficient	standard-error	t-ratio
beta 0	constant	10.44535	1.000	10.44535***
beta 1	TT	-0.45787	1.000	-0.45787
beta 2	TS	1.05249	1.000	1.05249
beta 3	RS	0.471617	1.000	0.471617
beta 4	FL	-0.14516	1.000	-0.14516
beta 5	TA	0.088821	1.000	0.088821
beta 6	Fortrd	-0.06321	1.000	-0.06321
beta 7	INF	-0.00951	1.000	-0.00951
gamma		0.050000		0.0500
sigma-squared				0.0000
log likelihood function				40.382628

As observed from the result of SFA production function estimation model in table above that the coefficient value of terminal track(TT) ,fork-lift (FL), foreign trade and Inflation variable was -0.458, -0.14516, -0.06321 and -0.00951 respectively. And also their t-ratio is indicate that their P value was grater then 10%. Which means their elasticity is negative and insignificant. Holding other variables constant, when value of terminal track(TT), fork-lift (FL), foreign trade and Inflation variable increased by one percent, the productivity of container throughput (CTP) of sampled ESLSE port would be decreased by 0.458, 0.14516, 0.06321 and 0.00951 percent on average respectively. But, it's not statistically significant. While, the coefficient value of terminal chancy (TS), Reach stackers (RS), and Terminal hectare (TH), elasticity is positive and insignificant. This implies that the terminal chancy (TS), Reach stackers (RS), and Terminal hectare (TH), has an important contribution to the performance improvement of technical efficiency of the port and terminal operation of ESLSE but not significant.

According to the regression results in Table 4.5 above, it can be seen that the inflation and value of foreign trade have not passed the test at least 10% significance level, it shows the increase of economic inflation level and value of foreign trade in the country but doesn't plays a significant role in the technical efficiency of the port and terminal operation of ESLSE, hence it is not conducive to improve the port input-output ratio. Also, the statistically significant indicator reveals that most of the variation in production is due to random noises, while a smaller portion of this variation is due to technical inefficiencies factors which is consistent with the 1st stage DEA operational performance efficiency result. The gamma value of the SFA production function estimation model in table above is 0.05, this value is statically not significant implying that the 0.5 percent of variability of operational output (CTP), is attributed to the technical inefficiency in port operation performance. and the rest (95 percent) is due to random noises.

Therefore, the operational efficiency of ESLSE's dry ports is significantly affected by random noises, while the influence of external environmental factor is not significant. Since, if the effects of random factors and environmental variables are not removed; it is likely that efficiency assessment errors will occur. Therefore, based on the regression results at the 3rd stage, this paper readjusts the port operation input variables, keeps the original output variables unchanged, and obtain the true efficiency values of the ports that are affected by the environment and random variables.

1.1.3 The Third Stage: Empirical Analysis of DEA after Input Adjustment

According to the adjusted input variables of the second stage, the traditional DEA model is used again to analyze the performance efficiency of the sample dry ports, and the final efficiency values of each port are shown in Table 4.6

Table 4.5. Efficiency evaluation and comparison of the sample ports under the same environment in the study period. 49

	ESLSE SECTPRS	EFFCH	TECHCH	PECH	SECH	TFPCH
original value using only internal factor	Modjo	1.000	0.875	1.000	1.000	0.875
	KAlity	1.000	0.989	1.000	1.000	0.989
	Mean	1.000	0.931	1.000	1.000	0.931
Adjusted value (After removed the influence of random and environmental factors)	Modjo	1.000	0.999	1.000	1.000	0.875
	KAlity	1.000	0.999	1.000	1.000	0.989
	Mean	1.000	0.999	1.000	1.000	0.931

By comparing the DEA results of the third stage and the first stage, namely original DEA and adjusted DEA efficiency analysis resalt of each DMU, it can be seen that the efficiency of the decision-making unit is significantly different after the effects of environmental and random variables are eliminated. Specifically. technical efficiency of the both ports are affected by environmental variables and random noises, under the same conditions. As shown from the above comparation table; the average mean value of the technical efficiency score improved upward from 0.931 to 0.999 after adjustment of environmental and random noises. Therefore, the efficiency value obtained by this method excludes the influence of the environment and statistical noise, and it is more objectively and truly reflects the actual efficiency and the degree of Internal influencing factors on the DMUs operational performance efficiency.

CHAPTER FIVE

SUMMARY OF MAJOR FINDING, CONCLUSION AND RECOMANDATIONS

The previous chapter presented the analysis of the findings and discussions of the study. The essence of this chapter is to Summarize the major findings of the study result, to make conclusion, to forward recommendation and suggest future research directions. Accordingly, the chapter has organized in three sections, the first section presents the summary of findings, the second section presents the conclusions with respect to the specific objectives of the study and the third section presents the recommendations based on the findings of the study.

5.1 Summary of the study findings conclusions

The study was conducted with the aim of examining the factor affecting operation performance efficiencies of two selected sample dry ports in ESLSE. The selected dry ports were; Mojo and Kality dry ports in ESLSE for the period of 2012 to 2020.

The dependent variable (Output) was the container throughput in TEUs per annum whereas the explanatory(input) variables: Terminal Tractor(TT), Terminal chancy(TC), Reach Stackers(RS), Fork Lift(FL), Terminal area (hectare)(TA) were considered as internal factor. And also, the control variable Inflation (INF) and foreign trade were considered as external factors.

The researcher applying explanatory design and quantitative research approaches using longitudinal data from 2012 to 2020 to addresses both general and specific objectives of the study using two different approaches: nonparametric, with Data Envelopment Analysis (DEA) model to achieve the broad research objective, and parametric, with Stochastic Frontier Analysis (SFA). Thus, the efficiencies of Two (2) dry ports in ESLSE were evaluated using the three stage DEA and SFA analysis model.

The descriptive statistics of the study variables of selected ESLSE's port and terminal branches presents mean, value of 295,426 and standard deviation, of 228,236. Hence, the standard deviation shows the existence of high level of variation in the input and output variables. it can be concluded that the two branch have been experiencing relatively continuous increases in output during the study period (2011 – 2018). In case of control variable, which is external variables show that annual inflation rate mean, 111.22 and the standard deviation is16.32%. This implies that there was no much variation. While, regarding foreign trade mean, observation shows 18.32 and the standard deviation is 1.72. This could be one source of inefficiency, since there is almost stagnated increase in inflation and import-export trade variables.

Based on the correlation matrix the dependent variable (CTP) had a positive correlation with all independent variable(CTP, TT, TS, RS, FL, TA, INF and FORTRAD), with correlation coefficient of 0.985, 0.998, 0.892, 0.574, 0.998, 0.012 and 0.036 respectively. Therefore, it can be seen that there a great relationship between the container throughput, which is the model output and Terminal Tractor, Terminal chancy, Reach Stackers, Fork Lift and Terminal area (hectare),. This presents an opportunity that can be exploited to improve the efficiencies of the dry ports.

5.1.1 The relatively operation performance efficiency of the sample DMU (Modjo and Kality dry port branch)

In the first stage of the analysis, presents the results of analysis on efficiency of the two port and terminal branch of ESLSE namely modjo and kality. This result addresses the first objective.

As the study result revealed, the mean score of productivity during the study period (five year), for modjo and kality Port & terminal branch is 0.875 and 0.989 respectively with the average mean score of 0.931 respectively. For the entire study period the men score of total factor productivity change was 6.90% (1-0.931*100). This is due to a decrease on technical efficiency change(tech) only, but pure and scale efficiency change remained stagnant. however, in the study period the modjo port and terminal branch was more inefficient than quality port and terminal branch since the total factor productivity change was decried by 12.50, for modjo while 1.10 for kality). In general, the overall efficiency of the sample ESLSE's port and terminal branches is low.

As the study result revealed, it can be seen that when does not consider environmental variables and random factors, the average overall efficiency during the study period is 0.931, while the average pure efficiency, and the average scale efficiency is 1which remained stagnant.

The result revealed from TFP clearly shows that the highest performance registered was 34.2%(1.342-1) by modjo port and terminal branches and also this branch registered the worst performance -55%(1-0.541) which is decreased its overall performance efficiency by 55% during 2011. Whereas, kality Port & terminal branches registered increased overall performance efficiency by 10.9% (1.109-1) during 2009 and decreased its overall performance efficiency by

9.2% during 2009). In general, during 2012 both branches were performed Below the number 1, which means productivity decreased by 10.1% and 11.1% for kality and modjo branch respectively.

5.1.2 The influence of internal(infrastructural resource) and external (environmental) factors on the ESLSE's dry port operation performance the case of Kality and Modjo branch

The 2nd objectives addressed with the 2nd stage of DEA analysis. In this stage, it consists of environmental factors, management inefficiency and statistical noise, by the SFA model to account for institutional and demand-side variables and single out efficiency, and also explained the effect this factor on determining Operational efficiency of the selected sample DMU, based on the technical efficiency of container ports obtained from first stage of DEA. This stage, therefore, achieved the research objectives of 2 and 3, and answered the research questions 2 and 3 as well.

As the study result revealed that the coefficient value of terminal track(TT),fork-lift (FL), foreign trade and Inflation variable was -0.458, -0.14516, -0.06321 and -0.00951 respectively. And also their t-ratio is indicate that their P value was grater then 10%. This implies, their elasticity is negative and insignificant. While, the coefficient value of terminal chancy (TS), Reach stackers (RS), and Terminal hectare(TH), elasticity is positive and insignificant. This implies that the terminal chancy (TS), Reach stackers (RS), and Terminal hectare (TH), has an important contribution to the performance improvement of technical efficiency of the port and terminal operation of ESLSE but not significant too.

According to the regression results of the study, it can be seen that the inflation and value of foreign trade have not passed the test at least 10% significance level, it shows the increase of economic inflation level and value of foreign trade in the country but doesn't plays a significant role in the technical efficiency of the port and terminal operation of ESLSE, hence it is not conducive to improve the port input-output ratio.

Also, the statistically significant indicator reveals that most of the variation in production is due to random noises, while a smaller portion of this variation is due to technical inefficiencies factors which is consistent with the 1st stage DEA operational performance efficiency result. The gamma value of the SFA production function estimation model the study is 0.05, this value is statically not significant implying that the 0.5 percent of variability of operational output (CTP), is attributed to the technical inefficiency in port operation performance. and the rest (95 percent) is due to random noises.

Therefore, the operational efficiency of ESLSE's dry ports is significantly affected by random noises, while the influence of external environmental factor is not significant.

Therefore, based on the regression results at the 3rd stage, this paper readjusts the port operation input variables, keeps the original output variables unchanged, and obtain the true efficiency values of the ports that are affected by the environment and random variables.

As the stud result discovered that the technical efficiency of the both ports are affected by environmental variables and random noises. Accordingly, the average mean value of the technical efficiency score improved upward from 0.931 to 0.999 after adjustment of environmental and random noises. Therefore, the efficiency value obtained by this method excludes the influence of the environment and statistical noise, and it is more objectively and truly reflects the actual efficiency and the degree of Internal influencing factors on the DMUs operational performance efficiency.

5.1.3 Conclusions

As the main gateways for international trade, ports are directly associated with competitiveness, integration, and logistics costs. The literature has demonstrated how improving port productivity has a direct impact on reducing port-related logistics costs, and therefore on trade and global competitiveness.

However, this paper has shown that technology is not the driver of the observed variance in productivity growth. The study also have observed how ESLSE port and terminal branches have experienced very similar behaviors patterns with respect to technological changes. In addition, the paper has revealed that the selected sample branch behaved similarly in terms of scale efficiency that is, the ability of ports to optimize the size of their operations in need to improve. The most important determinant of port productivity, according to the study results, was technical efficiency. This finding reinforced the need to carry out a detailed efficiency analysis to pinpoint technical efficiency per port and determine the drivers of port efficiency in the developing world.

As the Stochastic Frontier Analysis production function estimation results reveal that infrastructure inputs are important to predict the level of container throughput, but that the highest elasticity's are associated with Terminal chancy and Richs-tracker. In addition, most control variables related to port demand and other port characteristics had no significant and positive coefficients in the estimations. thus, the increase of economic inflation level and value of foreign trade in the country doesn't plays a significant role in the technical efficiency of the port and terminal operation of ESLSE.

After adjustment of the external factor and random noise effect, on average ports in the sample had operate under efficiency level of 0.999 percent which mean the enterprise operational efficiency change remained stagnant.

In conclusion, the results show that ESLSE's port and terminal branches relatively have the same level of productivity and efficiency, regardless of their operation scale infrastructural facility in which they are located. Thus, in this context ports in the ESLSE, should be considered as homogenous units of production. Moreover, greater efficiency, which translates into higher productivity, is not directly linked to a single characteristic. The researcher believe that a more thorough examination of the determinants of efficiency, especially by introducing variables related to port management and governance is necessary to provide clearer policy recommendations.

5.1.4 Recommendation

Based on this, this paper proposes the following recommendation:

- ❖ Optimizing the resources allocation of ports and strengthening cooperation among ports in the enterprise. Strengthening cooperation between ports and hinterland enterprises, extending the port industry chains and promoting scale development.
- ❖ For Modjo and kality port and terminal and Ethiopian dry ports specially, Modjo is the model port in Ethiopia. · To stay competitive and encourage economic growth Modjo dry port and terminal must address a host of new challenges, including increasing trade volumes and transport industry complexity.
- ❖ To promote job creation, economic growth, sustainable development, and improve the living standard of Ethiopians, both dry port terminal plays crucial role. To meet this mission the terminal need new ways to achieve efficiencies of its operations and

the flow of cargoes by having open dialogue with port communities and stakeholders.

- ❖ The efficiency and productivity of both Ethiopian dry ports and their infrastructures is crucial to our country,s ability to successfully compete in global market places. As over 95% of Ethiopian import and export flows through Modjo dry port and terminal that links our producers with their sources, their customers and with global markets this port need special attention. The ports' ability to facilitate this trade flow is essential deliver goods to customers on time and at lowest possible cost, which is crucial to exporter,s ability to compete at global market place and take advantages of expanded sales opportunities, there should be an enough resource at the port to improve performance.

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