Effect of new technology adoption on logistics performance of transport operators at inland container depot Nairobi

Caroline Murugi[1]

Received 25 May 2022
Accepted for publication 03 June 2022
Published 20 June 2022

Abstract

Logistics companies suffer from inefficiency and insecurity in order to guarantee their profitability and growth. This has prompted integration of new technology into their operations through automation adopted by the customs department under Kenya Revenue Authority. This is to improve supply chain agility, power up operations, reduce cycle time, achieve higher efficiency and deliver products on time and reduce operations costs. From the selection of information, sorting of information, strengthening custom's protection of consumers from counterfeit products to the real-time tracking of cargo, it is becoming a requirement to use new technologies to meet customer service expectations and raise the productivity of the workforce. This study sought to investigate the effect of new technology adopted by customs on logistics performance in Nairobi. The specific objectives were to determine the effect of the adoption of the single window system, cargo scanner management system, and electronic cargo tracking system on logistics performance. Resource advantage theory of competition, task technology fit theory and instrumental theory of technology are the theories that guide the study. It adopted an explanatory research design. The target population were 300 customs officers and managers of logistic companies within Nairobi. A sample of 171 customs officers and logistics managers were selected using stratified random sampling technique. Data was collected using structured questionnaire. The descriptive and inferential statistical analysis techniques were employed by the study. To investigate the relationship between the independent variables and dependent variable, correlation and multiple regression analysis was used. Correlation analysis established the strength of linear association between the variables. On the other hand, a multiple linear regression model tested the significance of the influence of the independent variables on the dependent variable. Findings revealed that single window system (β=0.389, p=0.000), electronic cargo tracking management systems (β=0.268, p=0.000) and cargo scanner management solution (β=0.330, p=0.000) have a positive and significant effect on the logistics performance of transport operators. The study concluded that single window system, electronic cargo tracking management systems and cargo scanner management system contribute significantly to increase in logistics performance. The study recommended that customs department needs to constantly update its information technology infrastructure to incorporate the latest artificial intelligence software. This helps in speeding up the tracking systems and providing real time and reliable information. The study likewise recommends the adoption of e-government standards and in particular of standardized e-customs solutions as well as political and societal impact of e-customs policies. The customs department officials, logistics companies, and technological providers need to scale up their collaborative activities in advancing the application of single window system, electronic cargo tracking management systems and cargo scanner management system in supply chains for better performance of logistics.

ISSN (online) 2664-9535 (print) 2664-9527 https://atcr.kra.go.ke

1.Introduction

This chapter provides background information on research, problem definition, objectives, hypotheses, interests and scope of research. The purpose of this study was to examine the effect of new customs technology on logistics performance at ICD Nairobi.

1.1Background of the Study

1.1.1 Logistics performance

In today's globalized world, logistics has become a key factor in facilitating international trade and an important player in economic development. To increase business performance, good logistics results necessitate a compromise between the requirement to lower total inventory levels in the supply chain and lead times while leveraging economies of scale and increasing customer service (Mohan & Sahay, 2007). Logistics management's major goal is to plan, implement, and control the flow and storage of goods, services, and information between points of origin and locations of use in supply chain activities in order to meet customer needs swiftly and efficiently. Automation is promoted as one of the factors that have been shown to improve logistics competence and at the same time reduce operational costs (Gudehus & Kotzab, 2009). As such, new technologies adopted in the customs departments have helped in making the logistics work easier and better in the process of improving service delivery.

The growth of international trade has gone high and customs departments play a very crucial link in the international supply chains. According to Christopher (2016), logistics involves the management of goods and carrying out information and services from the point of origin to the point of consumption. It aligns the complex patterns of traffic and shipping, transportation and storage, export and import operations. Logistics is a key contributor to a country's' economy as it is important to different stakeholders. These include manufacturers, importers, exporters, consumers and government among others. Efficient logistics ensure timely, safe and cost effective delivery of goods to the final destination of consumption. While logistics is key to economic development of a country through promoting growth in Gross Domestic Product through penetration and tapping of more markets, a government can benefit greatly from logistics through its customs clearance processes. An efficient clearance process of goods in timely manner translates to more goods being moved across markets which contribute to more income in terms of duties to the economy. Due to the losses in time, customs need to make changes in their operations through the adoption of new technologies. Some of the key forms of technology adopted in customs departments include cargo scanner management system, electronic cargo tracking system and the single window system. These new technologies have revolutionized logistics performance in the industry.

The automation of customer-specific processes has resulted in a seamless flow of information and offers easy connections between suppliers, shippers, shippers and customers. This new system allows for real-time tracking of items from point of origin to customer location by exchanging data with all parties participating in the supply chain process.

In their study of the Kenya Ports Authority (KPA), Ruto and Datche (2015), found that logistics problems often bring businesses to a halt. They state that technological issues happen almost everywhere from a few times, to even every day of the week. They reported that the frequency of the technical problems is increasing every day. However, they noted that despite these problems, new technology has revolutionized the logistics operations in the country since the past decade. With this said, it is clear that in Kenya, there are challenges that come with the adoption of new technology as much as it improves performance and customer satisfaction.

The growth and evolution in international trade has been quite intensive in the past two decades. According to Arvis et al. (2016) many economies across the world have recognized that trade plays a crucial role in economic growth. International trade involves the movements of goods across borders involving numerous procedures. The competitiveness of a country's logistics depends on its customs clearance efficiency and effectiveness. Therefore, the effectiveness of customs clearance in regard to logistics performance of a country leads to trade facilitation which is quite pivotal to its development. Efficient logistics fosters a country's competitiveness as it allows it to trade services and goods on a timely basis and at lower costs of transaction (Martí, Martín & Puertas, 2017). On the other hand, inefficient logistics pose a significant obstacle to trade in the country since it makes it difficult for it to develop or tap new markets and to improve its overall competitiveness in the trading system. That is, the customs department has an important role in improving a country's logistics performance to facilitate trade and improve the country's economy.

Logistics includes a network of services that support the physical movement of goods across and within borders. This is an estimated $4.3 trillion industry (Gani, 2017). The Logistics Indicator Index (LPI) provides countries with an assessment of how efficiently they move goods across and within borders. According to Mwangangi (2016), the developing country's capacity to move goods from one country or region to the other efficiently and connecting consumers and manufacturers with international markets is considered to have improved in the past few years –albeit slowly. However, much remains to be done to bridge the existing "productivity gap" in logistics between the lowest and the best. Ojala and Celebi (2015) agree that the supply chain

is seen as its weakest link and continuous improvement requires complex changes in a number of policy dimensions, including trade facilitation, services and infrastructure. This effort requires persistence and focus; the combination of several countries has been achieved according to a study by the World Bank for Retail Logistics.

According to the World Bank, Kenya's logistics performance is termed as the best in East Africa due to the continued removal of administrative controls as well as the continued improvement of infrastructure. Ojala and Celebi (2015) indicate that according to the LPI, Kenya ranks at position 42 globally with a score of 3.33 points in 2019. By comparison, the surveys conducted in 2019 placed Uganda and Tanzania at positions 58 and 61 with a score of 3.04 and 2.99 respectively. Mwangangi (2016) asserts that Kenya's logistics performance is second in the African continent after South Africa which is in the 20th position on the global survey with a score of 3.78. This LPI indicates that Kenya has greatly reduced the costs of doing business and it has improved its trade flow for exporters and importers. According to the World Bank report (2019), efficient logistics connect forms to international and domestic trade through reliable supply chain networks which is a major characteristic of the Kenyan trade. Also, the adoption of new technology is credited as a key aspect of the good performance of the customs departments in Kenya, making it a viable topic for research.

The customs department in Kenya under the Kenya Revenue Authority (KRA) has a fundamental role in collecting and accounting for import, VAT and duty on imports. Other taxes levied by this department include oil exploration fees, road maintenance fees, import declaration fees (IDF), civil aviation directorate fees, passenger service fees, airport authority concession fees in Kenya, and various motor vehicle fees (Mutula, 2018).

The Customs Service Department (CSD) implements bilateral regional and international trade arrangements. Nandagopal (2018) asserts that the department also provides support to global enforcement efforts against smuggling and other vices that negatively affect trade, illegal importation, regularly abused drugs and exportation and importation of arms, as mandated through the various international legal instruments. As a state authority, the customs service is responsible for the control and monitoring of imports and exports; act based on customs clauses in regional trade agreements (Nandagopal, 2018).

In the field of logistics, each country issues its own foreign trade policy, which determines the conditions under which goods and services can be exported or imported. According to Jiang (2017), the Customs Service applies the provisions of the Directive in accordance with the rules of the World Customs Organization (WCO), national laws and regulations. The duties assigned to this must be paid before the goods are cleared. Cargo imported into a country from each entry point is kept in the customs area under customs sovereignty until it is issued after clearance. Therefore, customs departments have a greater mandate in international and local trade in many countries and favourable logistics performance is vital to support such functions.

The Nairobi Inland Container Depot (ICD) is owned and operated by KPA and is connected to the Mombasa port by rail. It provides dry port facilities for freight forwarders in the commercial heart of the country and was founded in 1984. The main goal of ICD is to bring port services closer to customers. Some of the services offered by ICD include container and bulk handling, container transfer and filling, consolidation or bulk/bulk storage for export, storage and handling of empty containers, rental of labor and equipment, container weighing and cargo documentation (KPA, 2020).

1.1.2 New Technology

In the past, lack of technology was a major problem in the logistics sector across the globe. In the 1990s, the logistics sector landscape as management systems did not have modern forms of technology to revolutionize the processes and performance. Pugliese et al. (2017) noted that during this period to early 2000, paper work, manual data entry task interleaving among other tasks in logistics was done manually by workers as automation was not yet in place to improve efficiency. However, in the late 2000s to date, things have changed in the logistics industry and customs departments across the world. Technological advances have allowed these players to accomplish a lot in a short time and effectively with high levels of accuracy and with effective financial sustainability (Kalinicheva et al., 2016). In the past, for instance, customers placed orders, booked shipments and received the estimated time of delivery and then they were left in the dark without knowing the state of their cargo in transit. Telephone calls were the only way in which they could track the status of their shipments. Today, however, things have changed as customer experiences have changed as software and the internet advances have allowed players to access their shipping and tracking systems anytime, as and when required. This clearly, proves that technology has made changes to the industry.

The economic advances in most countries across the world have improved trade between countries. The evolution of technology is pushing the boundaries and changing how companies do business (Goldsby & Zinn, 2016). Today, companies are accustomed to almost everything being done by computers and right at their fingertips for immediate access. There are numerous types of new technologies in place today used by customs departments across the world in improving their performance. In Kenya for instance, one of such technology is the Electronic Cargo Tracking Systems (ECTS) developed by KRA in conjunction with regional revenue authorities. According to Mugambi (2017), it enables real

tracking of cargo in transit from one region to the other for the improvement of tax as well as security.

Another is the single window system, which is a trade facilitation technology that allows international businesses to submit regulatory paperwork like customs declarations and import/export permission applications all in one spot (Nizeyimana & De Wulf, 2015). This system enables countries participating in commerce and transportation to submit standardized information and documentation to meet all regulatory requirements for imports, exports, and transit through a single point of entry. Individual data elements only need to be transmitted once in the case of electronic data. Regardless of how it is described as a platform, environment or facility, a single window system is best understood through the services it is intended to provide to dealers and authorities. The third is the Load Scanner Management System (CSMS). Nwankwo and Olayinka (2019) noted that this decision plays a key role in the verification of unobtrusive export, import, and security controls. This solution has helped the customs authorities in ensuring that cargo is effectively screened booth on sea and land.

1.2 Statement of the Problem

The logistics performance index currently ranks Kenya at 68th out of 160 worldwide, down from 42nd in the previous index (World Bank, 2020). In addition, studies show that government procedures account for 31% of the main factors during stay. In addition, importers paid 3.22 billion in goods storage fees to KPA facilities in 2017-18. This is despite the widespread "increase in business costs" associated with infrastructure investment, system automation and digitization of public services, improved cargo handling, and faster cargo evacuation (East African Shippers Council [SCEA], 2019).

Logistics in terms of transportation costs accounts for 42% of the total value of imports compared to 22% in East Africa, making it one of the regions with the highest transportation costs in the world. According to the World Bank (2020), transport permits are highlighted as the biggest obstacle to efficient logistics implementation of port facilities, as 54% of permit time is spent obtaining permits. This resulted in time-consuming trade deals at ICD, which resulted in high logistics costs in Nairobi. Truck payback times remain short as the average truck logs less than 5000 km/month compared to industry practice of 9000 to 12000 km/month (World Bank, 2020). In addition, transport time at the port takes an average of 5 days, below the internationally recognized standard for a maximum stay of 3 days. As a result, logistics performance remains a challenge for ICD because logistics companies find it difficult to improve customer satisfaction, improve operational efficiency, reduce operational costs, reduce transaction times, provide competitive advantages for logistics companies, provide security and capital investment such as moving goods around the world on time. The above is clear indication that logistic performance remains a challenge in Kenya.

The government of Kenya through the revenue agency has introduced policies that have played a key role in the supply chain. Through the Kenya Revenue Authority modernization programme, Customs department has adopted new technology that is aimed at simplifying and speeding up cargo clearance process that would be key in facilitating quicker cargo evacuation from the port to the respective destination which is a key booster to logistics performance. New technology such as Single Window System, Electronic Cargo Tracking System and Cargo Scanner Management System introduced to the customs department have played key role in improving logistics performance at ICD by reducing cargo dwell time. Previous studies have investigated the connection between technology and logistic performance. For instance, (Ndonga, 2013; Miler & Bujak, 2014; Mugambi, 2017; Ahn & Han, 2017) explored the relationship between information technology and performance of logistics firms. However, these studies present contextual and conceptual gaps. Some of the studies were conducted in other countries whose logistic environment is different from Kenya. On the other hand, the local studies failed to focus on new technology adoption and performance of logistics firms in Nairobi. The current research thus intended to address the knowledge gaps by investigating the impact of new technology adoption on logistics performance in Nairobi with reference to electronic cargo tracking system, single window system and cargo scanner management system.

1.3 Objectives of the Study

The study objectives are classified into: general and specific objectives.

1.3.1 General Objective

The general objective of this research is to investigate the effect of new technology adoption on logistics performance in Nairobi, a case of transport operators at Inland Container Depot.

1.3.2 Specific Objectives

The specific objectives of this study are:

i.To determine the effect of the adoption of the single window system on logistics performance of transport operators at Inland Container Depot.

ii.To establish the effect of the adoption of electronic cargo tracking system on logistics performance of transport operators at Inland Container Depot.

iii.To determine the effect of the adoption of cargo scanner management systems on logistics performance of transport operators at Inland Container Depot.

1.4 Research Hypotheses

The research hypotheses are as follows:

Ho1: Single window system has no significant effect on logistics performance of transport operators at Inland Container Depot.

Ho2: Electronic cargo tracking system has no significant effect on logistics performance of transport operators at Inland Container Depot.

Ho3: Cargo scanner management system has no significant effect on logistics performance of transport operators at Inland Container Depot.

1.5 Significance of the Study

This research is of benefit to a number of players in the field of logistics in Nairobi County and the country as a whole. The first one is the scholars. This study is of concern to the education sector in the country because it would enrich the existing body of research and knowledge. This is because it will be an essential material for carrying out further research on the topic of logistics performance and technology, and it is also a useful resource for future reference among scholars.

The custom department under the KRA would also benefit from this research. It would be a useful research material for the customs departments since their consultants would find it as a helpful reference material in advising their investors as well as the government on some of the practical application of the new technology such as the electronic cargo tracking systems, single window system and cargo scanner management system in other counties in the country. Moreover, those businesses that would have benefitted from the customs services would be able to understand the importance of the adoption of new technology in enhancing service delivery to them.

The other crucial beneficiary of this research is the Kenyan Government. The government would benefit from this research because it will get a glimpse of some of the vital factors that customs departments consider before adopting new technology and some of the effects of new technology on logistics performance when undergoing expansion processes. This research would also provide basic blueprints in drafting of policies that will fit all the customs departments.

1.6 Scope of the Study

The study assessed the effect of adoption of new technology on logistics performance in Nairobi Inland Container Depot. The new technologies to be covered are single window system, cargo scanner management solution and electronic cargo tracking systems. The study targeted customs officers and managers in the logistics. The study was conducted during the period of June 2020 and February 2021 which involved a target population of 300 employees of customs and logistics companies and a sample size of 171 out of the total population.

LITERATURE REVIEW

2.0 Introduction

This chapter presents a review of the literature. It covers the concepts of the study, the theoretical framework that grounds the variables, literature review in line with the study variables; empirical review, research gaps and present the conceptual framework.

2.1 Concepts of the study

2.1.1 Logistics Performance

Logistics outcomes include meeting customer needs, shortening lead times, minimizing cost reductions, product/service differentiation, and managing customer or supplier relationships (Hausman, Lee & Subramanian, 2013). According to Bhagwat and Sharma (2009), one of the primary problems for firms in today's ever-changing business landscape is analyzing logistics effectiveness. Strategic relationships, customer service, logistical flow management, inventory management, cycle time reduction, adaptability, and regional coverage are all additional problems (Lin & Jung, 2006).

Fugate et al. (2010) indicated that logistics performance has various dimensions and depends on the resources employed in logistics in line with the objectives and results against other players. The author proposes that the evaluation of logistics efficiency be based on a number of aspects of the jobs that logistics performs, such as differentiation, efficiency, and effectiveness. The authors further noted that he dimension of efficiency relates to how well a resource allocated to the logistic function is put into use, effectiveness is the extent to which organization objectives are attained and differentiation relates to value created by customer service elements compared to competitors.

2.1.2 New Technology adoption

New Technology adoption refers to set of productive techniques that offer a significant improvement whether measured in terms of increased output or savings in costs over the established technology for a given process in a specific historical context (Adams, et al. 2017). In this study, the focus is on single window system, Single Window System, Cargo Scanner Management System and Electronic Cargo Tracking Systems.

Single Window System

The single window system is a facility that allows on-line lodgement of trade related information through a single electronic portal. The information is then disseminated to the various regulatory agencies and private institutions for processing. In international trade, the merchants involved

access all import or export related regulatory services through the system. Such systems can be physical structures, i.e. buildings, or electronic systems that essentially provide a central point for entering and processing data related to cross-border trade (Abeywickrama & Wickramarachchi, 2015).

The system replaces paper-based transactions and reduces physical movement and interaction between merchants and government officers, hence reducing inefficiencies in the process. The system has in-built business rules for each individual process, to enable compliance with regulatory agencies and other parties involved in cross border trade. A Single agency is entrusted with the management of the system and basically oversees the implementation of the changes from paper based business processes to electronics-based processes. This is one of the most challenging aspects of implementation of the systems and poses serious issues to do with change management. A study by the World Customs Organization (WCO, 2011) found that a single window system is a huge benefit to the trading community. It has accelerated the processing of commercial information, enabled risk management especially for relevant government agencies, improved compliance with private sector requirements and provided better business services for efficiency.

Cargo Scanner Management System

It is a shipping scanning system that allows an unobtrusive review of import, export and security controls (Föcker et al., 2015). According to Nwankwo and Olayinka (2019), cargo scanner management solutions help customs authorities ensure that cargo is effectively controlled both at sea and on land. It also helps customs authorities to facilitate the release of goods, combat fraud and smuggling, and optimize revenue collection.

Electronic Cargo Tracking Systems

ECTS is a technology solution that allows for real-time cargo tracking from the time it is loaded until the moment it is unloaded. This system was created to assist customs agencies and private shippers all over the world in remotely monitoring the movement of goods and preventing commodities in transit from being stolen or discharged via an area (Mugambi, 2017). ECTS' major goal is to enable cargo visibility by providing real-time cargo location and status; expedited release at loading and unloading locations - using technology to assure quick cargo inspection and release; and ready-to-use data for decision making: truck movements and locations are simply accessible, and bespoke reports are available (KRA, 2019).

Miler and Bujak (2014) noted that ECTS has simplified the work processes for government authorities. Not only do they get peace of mind now that they gain real time visibility of cargoes across borders but they also get to ensure security, enforce proper regulations and improve time efficiencies of tedious processes. The ECTS is undoubted expected to help save time, manpower costs, increase tax revenue and in turn, boost the economic growth for many countries especially landlocked countries.

2.2 Theoretical Framework

In the past years, there have been few studies focusing on the effects of new technology adoption by customs on logistics performance. As most customs department's performance continue to facilitate trade across the globe, researchers have developed an interest in the various aspects of new technology and how they contribute to better logistics performance. As a result, multiple scholars have come up with theories that provide a systematic understanding of new technology and its effects on logistics performance. This study is informed by the resource advantage theory of competition; task technology fit theory and the instrumental theory.

2.2.1 Resource Advantage Theory of Competition

This theory provides important information about the use of new technologies to improve logistics performance. It is a challenge for practitioners and managers to see competition as a "resource advantage" based on what develops. According to Hitt, Xu, and Carnes (2016), the resources in an organization should be seen as unique, imperfectly mobile, and diverse. Companies must create the essential competences or dynamic abilities to meet the needs and quality of consumer marketing, according to the resource advantage thesis. The theory of resource advantage, on the other hand, is the foundation on which organizational results and strategic competitive advantage can be projected, as well as the application of new technology in this study (Gakuubi, 2018).

Thus, customs departments can enhance logistics performance through the use of new technology in order to give a competitive advantage to the logistics firms over competitors through reduction in operational costs and hence enable the firms penetrate larger markets in terms of trade. The adoption of new technology is one of the ways in which the customs department has developed the required competencies or dynamic capabilities so as to address customer marketing needs and quality. For instance, the use of new technology such as the Single Window System which brings all stakeholders involved in clearance of goods together which reduces clearance time therefore enabling dispatch og goods by logistics firms within a short time. This ensures goods reach the destination in a timely manner saving the consumers funds that arise as a result of delays in

clearing goods. This gives customer satisfaction and thus giving the logistics firms a competitive edge over other competitors. As a result, the department's new technology has various advantages, including being a real application of the trade facilitation idea, lowering non-tariff barriers, and providing immediate benefits to all trading community members (Noe et al., 2017).

Therefore, the resources advantage theory of competition urges firms and customs department to adopt new technology that could give the much-needed competencies that could give competitive advantage. Also, it is important to note that new technology helps in the utilization of the crucial resources to the advantage of an organization due to its efficiency, economy, and effectiveness. In this study, the theory thus supports new technology aspects including single window system, cargo scanner management system and electronic cargo tracking systems which have brought about efficiency in cargo clearance which has led to cost effective logistics and thus improving its performance in moving cargo to its end users.

2.2.2 Task Technology Fit theory

Task technology adaptation theory explains how new technologies can be incorporated into tasks to increase efficiency and increase efficiency. According to Goodhue and Thompson (1995), new technologies are likely to improve employee performance and can be deployed when the technology's capabilities meet the tasks that the user must do. Performance, quality, compatibility, resolution, ease of use and training, on-time output, system reliability, and customer relations are all variables that Goodhue and Thompson (1995) created as a technological compliance measure for a task. Seven-point scale questions were used to rate each aspect, ranging from strongly agree to entirely disagree. According to Goodhue and Thompson (1995), the degree of task technology appropriateness, as well as its use, is a key predictor of user reports of increased efficiency and effectiveness as a result of using the system under study.

New technology is designed for asset organizations or users to perform tasks in a more effective and efficient manner. Companies spend fortunes on new technologies to improve their performances and this is no exception to the customs departments. Lai (2017) states that within customs departments, new technology has been put in place to ensure that individual and organization performance is improved. However, the key challenge emerges when the technology deployed does not fit into the task or to the skills of the employees. Therefore, customs services should be in accordance with the duties of different people to improve the efficiency of transportation logistics. The capabilities of the new technology must be compatible with the tasks the user has to perform or be compatible to increase productivity.

The theory is important in this study in that, the new technology that has been adopted by customs is aimed at carrying out tasks that were initially carried out by people in facilitating cargo clearance, by making the processes simple, fast and efficient on order to improve the performance of moving goods to various users. For instance, cargo was verified physically which took long to have the goods cleared. But with the cargo scanner management system put in place to fit into the task of verification of goods, the process of cargo clearance is fastened and as a result logistics performance in terms of service delivery and reduced turnaround time of trucks is achieved. Therefore, new technology adopted has fit into the tasks undertaken by customs which has foreseen improvement in the performance of the transport logistics.

2.2.3 Instrumental Theory of Technology

Andrew Feenberg of Oxford University proposed this idea in 2002. The approach focuses on how people in an organization use technology to their advantage rather than the technology itself. The most frequently held view of technology is instrumental theory. It is founded on the common sense notion that technology is a "tool" that may be used to fulfill the needs of its users. The technology is regarded as "neutral," as it contains no evaluative material. But, exactly, what does the term "technological neutrality" imply? At least four points are normally used to build a concept. The first technology, as a tool, is unconcerned about the multiple uses it might be put to (Feenberg, 2002). Second, technology, at least in the modern world, and notably in capitalist and socialist civilizations, appears to be unconcerned about politics (Feenberg, 2002). Third, technology's sociopolitical neutrality is frequently associated with its "rational" nature and the universality of the knowledge it contains. To put it another way, technology is founded on provable causal statements (Feenberg, 2002). Finally, the technology's universality means that the same measurement standard can be utilized in a variety of settings (Rvik, 2016).

Instrumental theory, therefore, helps in understanding how technology affects how people use it in an organization (Feenberg, 2002). This could be useful in understanding how technology used by customs department as a tool performs the intended purpose of its users in cargo clearance and consequently the logistics firms in improving their performance.

The principle is important in this study because it explains how the new technology for instance electronic cargo

tracking system is used by customs as a tool to ensure security and real time information with regard to cargo. As a result, logistics firms involved in moving the cargo are able to locate the cargo and as such be able to plan on evacuating the cargo as fast as possible to reach the consumer on time without incurring extra costs resulting from excess dwell time of cargo at the port. Thus, improvement in performance of transport logistics is achieved. So it is said that technology increases labor productivity in different countries, different eras and different civilizations. Technology is neutral because it falls under the same level of effectiveness in any context.

2.3 Empirical Review

Technology has caused a major paradigm shift in habits around the world. Studies by Bhandari (2014) have shown that new business processes and major innovations have changed the flow of goods from manufacturers, retailers or wholesalers to customers. Saidi and Hammami (2011), on the other hand, stated that improvements in communication technology, information technology, and the change of identification technology from manual to automatic have all had a significant impact on the face of logistics. Increased efficiency, reduced costs, increased competitiveness, and changes in strategy have all changed in today's business world. Another study by Mathauer and Hofmann (2019) found that technology has significantly improved logistics through innovation. The introduction and development of new technologies has led to the introduction of new technologies such as cargo scanner management systems, single window systems, and regional cargo tracking systems (RECTS) (Olah et al., 2018).

This technology offers useful opportunities for customs service's looking to improve their yields. Bolatan et al. (2016) conducted a study on the impact of new technologies on logistics performance. According to their study, new technologies improve customer relationships by removing barriers to entry, speeding up transactions and shortening order cycles. Gunasekaran, Subramanian and Papadopoulos (2017) also show that new technologies lead to real-time interactions so that customers and car companies can quickly find delivery positions. This new technology also eliminates some human warehouse operations, which lowers costs and increases the efficiency and reliability of logistics systems (Gunasekaran, Subramanian & Papadopoulos, 2017; Mathauer & Hofmann, 2019). In addition, Aziz et al. (2016) said it has improved supply chain management through increased accuracy, increased efficiency, and reliability of logistics systems.

2.3.1 Electronic Cargo Tracking System and Logistics Performance

According to the Kenya Revenue Authority, the Electronic Freight Tracking System (ECTS) is a joint KRA initiative with the financial administrations of Rwanda, Uganda, Kenya and Tanzania. According to Kabiru et al. (2016), this technology allows for real-time cargo tracking via a digital internet platform from Mombasa port to final destination. Mugambi (2017) observed that the rationale for building this system was to establish a security and cargo tracking system that is in line with the interests of the governments of the four nations, in order to boost tax collection. In addition, Miller and Bujak (2014) point out that this system also aims to improve the implementation of cargo handling regulations and to keep Kenya as the preferred trade route for goods in East Africa. This initiative is very important to support national programs to promote trade between East African countries. The Mugambi study (2017) also found that another reason for creating this system was to replace the private sector managed electronic cargo tracking (ECTS) system that failed to achieve the stated goals.

The Electronic Cargo Tracking System encompasses the use of satellites, special electronic seals fitted into cargo containers and a monitoring center (Kenya Revenue Authority, 2016). According to Mugambi (2017), ECTS encompasses trade channels spanning from the port of Mombasa to the Kenyan free zone, as well as from the port to adjacent landlocked countries such as Uganda and Rwanda via Kenya's primary transport trade routes. Ross (2017), on the other hand, claims that the implementation of ECTS is opportune, given the prevalence of unlawful dumping. Dumping happens when commodities are delivered to separate customs regions and are unloaded while in transit (Mugambi, 2017). This not only leads to unfair trade practices, but also high tariffs and tax shortages. This system has brought major results to the customs departments in the region. Kithiia (2015) found out that the implementation of ECTS has led to the closing of prevalent loopholes of tax loss and it has increased the flow of cargo through the e-monitoring system. Juma (2016) also found out that ECTS has eliminated cargo diversions into the local market as well as creating alert and responses during the trailer stop-over that take more than the allowed time. This has greatly led to reduced time for goods on transit to reach the end destination, and as such saved importers and exporters of funds that occur due to delayed deliveries. Thus, ECTS has led to improved logistics performance as security of goods is guaranteed. Therefore, it is clear that its implementation has brought major trade boosts in Kenya and the entire East African region.

Kilonzi and Kanai (2020) developed an electronic delivery tracking system and its impact on revenue generation in East African countries. This research is guided by two theories, namely; Transaction Cost Theory and Institutional Theory. This study uses an explanatory research design. Data were analyzed using descriptive statistics and additional statistics, including correlation and regression analysis. The results showed a positive correlation between operational efficiency and revenue efficiency. The relationship is significant, so that operating results have a significant effect on sales efficiency. There is a positive correlation between profitability and sales. The correlation is significant as to why tax avoidance affects income results. The study concludes that electronic cargo tracking systems do not completely reduce the time it takes to release cargo. Since the introduction of electronic tracking systems, personnel costs at border crossings in East African member states have remained a challenge. Even after the introduction of electronic tracking systems, there have been cases of loss of income at border crossings.

Zephania (2019) examined the effects of information technology on the efficiency of logistics firms in Tanzania. The study evaluates how system quality affects logistics company efficiency, assesses how information quality affects logistics company efficiency and determines how service quality affects logistics company efficiency. This study uses a quantitative approach because it aims to measure the impact of IT on the performance of logistics companies in Tanzania. This study uses a cross-sectional research method to assess the impact of information technology on the efficiency of logistics companies in Tanzania. The results of this study indicate that the three independent variables (system quality, information quality and service quality) have a positive effect on the efficiency of logistics companies in Tanzania. The quality of the system affects the performance of logistics companies by 23.4%, the quality of information affects the performance of logistics companies by 28.3%, and service quality affects the performance of logistics companies by 32.8%. Therefore, all factors are important for logistics companies in Tanzania, while these three factors contribute about 84% of the influence of information technology on the efficiency of logistics companies in Tanzania. The results also show statistically significant differences in annual earnings after the introduction of electronic tracking and security systems between companies with low, medium and very large numbers of employees using electronic delivery tracking systems.

2.3.2 Cargo Scanner Management System and Logistics Performance

Supply chain security has never been more critical in a global economy where unlawful cross-border trading thrives. Customs must keep illegal narcotics, firearms, other illicit commodities, and migrants out of the country. In a research of cargo scanner management systems, Nwankwo, Olayinka, and Benson (2019) discovered that cargo scanning plays a vital role in unobtrusive import, export, and security controls. Inconspicuous scanners combined with effective profiling methods, according to Focker et al. (2015), can greatly improve customs and security functions by verifying the flow of products at sea and land borders. Nwankwo, Olayinka, and Benson (2019) also articulated that the cargo scanner management system do not only scan containers, but provides container loading inspections services that guarantee control by the customs departments of the entire loading process. This ensures that the goods being imported or exported to a customer are the right goods in terms of quality and safety standards. This guarantees the safety of the consumer from harmful goods and also ensures the integrity of the transport logistics firms is not compromised as this would greatly affect its performance.

The Cargo Scanner Management System is an inconspicuous inspection method (NII) for inspection and identification of goods in the transportation system without an intensive loading and unloading process (Bendahan, 2015). This ensures that goods are transported quickly from the point of loading and scanning to the port. It is believed that this will shorten truck execution time, which ensures timely delivery of cargo to customers. It is widely used for scanning intermodal freight containers. Cutmore, Liu and Tickner (2013) note that container content verification is carried out by scanning to enable customs officials to verify the accuracy of the information provided by the shipper about the container contents and the effectiveness of the container integrity. container. . In addition, Föcker et al. (2015) point out that scanning is important because it helps identify dangerous goods when the shipper or party responsible for filling and sealing a container appears legitimate but is actually infiltrated by criminal groups. In this case, another level of security can convey a false sense of security, because the broadcast appears “legitimate” on the outside, even though it is actually illegal (Cutmore, Liu & Tickner, 2013).

Abbas (2016) analyzed the impact of cellular technology on the logistics outcomes of clearing and delivery companies in Mombasa Regency. This study adapts the descriptive design of the research section, which is like research, to obtain qualitative information. The target audience is 535 clearing agents registered in Mombasa District. Questionnaires are the preferred survey instrument. Researchers distributed 269 questionnaires and received 180 for analysis, giving a response rate of 67%, which was

deemed appropriate. The results showed that the mobile technology variables studied in this study, namely information flow, logistics integration, fleet management systems and warehouse and inventory management, showed a positive correlation with logistics outcomes.

Oduma and Shale (2019) analyzed the effects of logistics automation on supply chain efficiency. Research uses a descriptive research design, research design refers to whatever method the researcher chooses to investigate a particular set of questions or hypotheses, and the framework for collecting and analyzing data relevant to the research question. The survey used a census approach to collect data from 91 respondents who work for the AS group and are mainly involved in the management of the procurement process, especially in the management of the logistics process, therefore the sampling procedure was not used. Primary survey data were collected using a questionnaire. The study found that the entire logistics and warehouse automation system drastically reduced the need for KEMSA's manpower for the operation of the facility, with human intervention only required for some tasks, such as: B. selection of individual products from bulk packages. Assistance is provided with devices such as the light selection module. Only smaller equipment is required to handle this part of the process.

2.3.3 Single-Window System and Logistics Performance

International and local trade has been a vital economic development for ages among nations, individuals and groups. For governments to increase trade through efficient flow of goods across markets, various systems have been put in place. One of these systems is the single-window system. Ndonga (2013) argues that a single window system is a complex government computer implementation to facilitate international trade by sending regulatory documents to a single entity or location. In addition, Ann and Hahn (2017) define it as an instrument that enables shareholders in international transportation and trade to transmit uniform official documents and information to a single point of entry, which then fulfills all requirements for export, import and transit. Ndonga (2013) adds that's if the documents are submitted through the internet, in most cases, the person performing the transaction has to submit the documents only once. Some of the common documentations that go through this system include certificates of origin, commercial invoices; customs manifest declaration, and imports/exports trade declarations.

Nizeyimana and De Wulf 2015) provided an overview of the implementation of the Electronic Single Window in Rwanda (ReSW) and its impact on trade facilitation since its introduction in 2012. To increase cross-border trade, the Rwanda Business Committee plans to make ReSW as soon as possible and the Rwanda Revenue Authority (RRA)) was appointed as the main agent. The ReSW Steering Committee and Project Implementation Team were formed, involving all stakeholders, to ensure that the project meets the most comprehensive requirements to achieve its objectives. The use of ReSW has resulted in reduced release times and direct and indirect costs associated with international trade. This document offers suggestions on how delays can be further reduced, for example by critically reviewing the need for physical inspection of most cargo currently being inspected.

Single window system of trade is helpful as many countries across the globe have adopted it in facilitating trade. According to McMaster and Nowak (2016), an automated single window trading environment (ACE) system intends to facilitate the import and export of commodities in countries such as the United States. Because having a single point of contact for electronic data sharing between regulatory agencies and dealers makes things easier, faster, and more efficient. Freight forwarders, brokers, and shippers, for example, only have to enter information once rather than many times, reducing the possibility of errors and redundancy. Therefore, the single window system is the main tool for logistics results, because transportation logistics companies can track shipments and monitor their time. Thus, customer satisfaction is enhanced as the customer is able to know when to receive the consignment. Customer service delivery is key in logistics performance. The single window system enables fast clearance process as all parties involved in the process are located in the same entity and this improves the logistics performance by reducing warehousing costs that occur as a result of delays in clearance of goods and thus increasing cargo dwell time at the port facility. The figure below illustrates how a single-window system of trade works.

See annex figure 2.1

2.4 Summary of Literature review and Research Gaps

The concept of a new technology and its influence on the main logistics figures are discussed in detail both in the literature and in empirical research in the subject area. It is clear that the regional Cargo Scanner Management System, Singe Window System and Electronic Cargo Tracking System (ECTS) have a positive effect on customs and logistics results. This new technology is used as a financial and non-financial measure and is currently in a competitive business environment as a competitive tool.

According to Aman et al. (2017), a single window approach is being used in countries such as South Africa and Nigeria to increase customer satisfaction in logistics, as passing customs processes can take a long time, resulting in delivery delays and disgruntled customers. Finally, Ndonga (2013) finds that

in a market characterized by low margins and high costs, using SW as an ACE helps shippers and freight forwarders speed up the release of goods so that items can be delivered to customers rapidly.

Kenya is no exception when it comes to using a single window trading system. In a study by Ndonga (2013), he found that Kenyan customs authorities have introduced the use of a one-window system to increase revenues and track local and international trade in the country. Pugliatti (2011) points out that the government introduced a one-window system in order to set up one window, as companies have direct costs associated with borders, such as the costs of providing information and documents to the competent authorities, as well as indirect costs, such as those resulting from procedural delays, lost business opportunities, and unpredictable regulation. Tosevska-Trpcevska (2014) clarifies this statement by pointing out that the studies used to calculate these costs show that they are between two percent and 15 percent of the value of goods traded in developed countries and 30-42 percent of production costs in developing countries like Kenya. As a result, establishing a single window system, also known as the Kenyan trade network system, will aid international trade in Kenya by reducing the time and costs associated with releasing goods at the border, while also providing the necessary controls and well-maintained Tax collection, fees, duties, and taxes, if any, on import and export.

Based on published studies over the last 8 years, new technology in relation to logistics showed that research done to assess the use of new technology to support logistics performance are very few. This makes the study relatively important because of its contribution to knowledge and economics; it is also important with regard to the customs department in Kenya. Grawe (2019) indicates that successful innovation creates a unique competitive position which gives a business competitive advantage and good performance.

The innovation in software and microelectronics has brought about universal technologies which have come to form a cluster of information and communication technologies (Grawe, 2019). Whereas the link between technology use and logistics performance is theoretically justified, no empirical evidence related to the link has been identified in Kenya especially within customs department. Thus, this study sought to show that logistics performance improvement relies on new technology.

2.5 Conceptual Framework

There are two types of variables in this study, which include independent variables and dependent variables. The independent variable is the variable that affects the dependent variable. Seuring and Müller (2018) stated that the value of one independent variable does not represent a problem in the analysis that requires explanation and its variation does not depend on other variables. The independent variable in this study was new technology which encompasses the Cargo Scanner Management System, Single Window System and Cargo Tracking System. With regard to the dependent variable, Seuring and Müller (2018) define it as a variable that is measured in the experiment and is influenced during the experiment, because it reacts to the independent variable and in this study is logistical performance.

See annex Figure 2.2

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology for conducting research. This chapter describes the research design, target population, sample frame describing sample size and selection, data collection and management tools, data analysis techniques and tools.

3.2 Research Design

Kothari (2004) defines research design as "the process of establishing settings for data collection and processing with the goal of incorporating relevance for research purposes." Research design, according to Cooper and Schindler (2008), is the plan and structure of an investigation to answer research questions. This study follows an explanatory research design. The study's explanatory design focuses on the relationship between cause and effect and concerns about how one variable affects or is responsible for another variable. Explanatory research projects go beyond description and try to explain the causes of the phenomenon. This study aims to determine the impact of the introduction of new technology by customs on logistics performance.

3.3 Target Population

A population, according to Cooper and Schindler (2008), is a well-defined set of persons, events, or records that contain the needed data and can answer measurement questions. The target population in this study comprised of 300 custom officers and logistics managers in logistics firms in Nairobi operating from the Inland Container Depot Nairobi (ICD). The population of customs officers was obtained from customs department Human resource office at the Times Tower. Logistics managers under study were picked from four registered logistics companies in Nairobi. The choice of custom officers and logistic managers was justified as they had adequate information with regard to adoption of new technology and its effect on logistics performance.

See annex Table 3.1

3.4 Sample size and Sampling Techniques

A sampling frame was obtained from KRA customs senior management and senior managers in logistic firms. Stratified random sampling was employed due to heterogeneity of the population and to stratify the sample of participants into categories. The choice of stratified sampling was justified because the target population was categorized into two groups (strata), that is, customs officers and logistics managers. Further, proportionate random sampling was further used to select the sample from the customs officers. The design was justified since customs officers share similar characteristics and therefore, any of the customs officers can be chosen to represent the rest. It gives each target respondent equal chance of being chosen. In addition, convenient sampling was used to select logistics managers. The design was appropriate since managers are known and therefore, it was easy to locate them. The sample size was calculated by the formula advanced by Yamane (1967).

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n= sample size

N = Target population

e= level of significance (5%) implying that the Confidence level is (95%)

Therefore;

$$n = \frac{300}{1+ 300(0.05)^2}$$

n =171

The study sample size was 171.

See annex Table 3.2.

3.5 Data Collection Instrument

The study involved the collection of primary data from the customs officers and logistics companies conducting business within the ICD. In this study, primary data was collected because this study collected feedback from those in charge of logistics in the company. These were collected through a structured questionnaire addressed to experienced managers and/or employees with more than three years of experience in the quantitative data generation industry. The questionnaire was measured on a Likert scale from 1-5, where 5) to a greater extent; 4) high grade; 3) Moderate; 2) low grade; 1) Very low grade. The structure of the questionnaire is a profile of respondents, questions about the introduction of new technologies and logistics results.

3.6 Data Collection Procedure

In order to collect data and generate meaningful data for analysis, the data collecting procedure is critical (Groves, 2009). The drop-and-pick approach was used to administer the questionnaire. By keeping a list of issued and received questionnaires, it was possible to assure that all questionnaires sent to respondents were collected. With the assistance of three helpers, the questionnaire was administered independently.

3.7 Pilot Testing

The questionnaire must be tested before it can be used to collect data (Dikko, 2016). The goal is to make the questionnaire better so that responders have no difficulty answering the questions. Furthermore, a preliminary analysis of the questionnaire aids in determining the validity and reliability of the data. In this study, questionnaires were distributed at random to up to 10% of the sample size. William et al. (2011) observed that 5 to 10% of the sample is adequate for piloting the research instrument. The respondents for the pilot study included customs officers at KRA in Nairobi.

3.7.1 Validity of Research Instrument

The amount to which an instrument measures what needs to be measured is referred to as validity (Remenyi, 2015). This study looked at the content and design validity. The supervisor reviewed the questionnaire for content validity and, if appropriate, provided suggestions for improvement. For construct validity, factor analysis was utilized. A threshold of 0.4 and above was used.

3.7.2 Reliability of Research Instrument

Each test is trustworthy if it accurately measures what it claims to measure. The research instruments are dependable because of their precision, consistency, and correctness. It assesses the consistency with which research tools produce data after many retests (Meyers, Gamst & Guarino, 2006). The Cronbach test was used to check the reliability of the data collection tool. Cronbach's alpha ranges from r = 0 to 1, with r = 0.7 or more considered quite reliable (Nunnally & Bernstein, 2014).

3.8 Measurement of Study Variables

This section presents the measurement of study variables. Logistic performance was measured in terms of cost, quality service and turnaround time. Single Window System was measured in terms of goods release, cargo manifest and gate departure procedures. Electronic Cargo Tracking System was measured in terms of real time location of cargo, real time response and security improvement. Cargo Scanner Management System was measured in terms of verification, monitoring and detection of contraband.

See annex table 3.3

3.9 Data Analysis and Presentation

Data were obtained through a questionnaire prepared for analysis by editing, processing blank answers, coding, categorizing and entering into the SPSS software for analysis. Descriptive and inference techniques were used for statistical analysis in this study. Correlation analysis and multiple regression were used to test the relationship between the independent variable and the dependent variable. Correlation analysis determines the strength of the linear relationship between variables. On the other hand, the multiple linear regression model examines the significance of the effect of the independent variable on the dependent variable. Apart from SPSS, Microsoft Excel is mainly used to create charts and tables. The results of descriptive statistics are summarized in the form and tables with frequency and percentage.

The following model was used:

$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \varepsilon$

Where;

Y = Logistics Performance

X1 = Single Window System

X2 = Electronic Cargo Tracking System

X3 = Cargo Scanner Management Solutions

$\beta 0$ = Constant

$\beta 1$ $\beta 2$ and $\beta 3$= regression coefficients

ε = error term

3.10 Regression Assumptions

Several assumptions were made about the variable data prior to the regression analysis. This is done to ensure that the results of the analysis are correct and unbiased (Field, 2009). Tests include normality, linearity, multicollinearity, heteroscedasticity, and autocorrelation.

3.10.1 Normality Test

The normality test improves the regression model by ensuring that the data is normally distributed. The normality of the data was tested using the Shapiro-Wilk test. The criterion is that the probability value must be greater than 0.05 so that the data is normally distributed (Thornhill, Saunders & Lewis, 2009).

3.10.2 Linearity Test

Linearity is tested with a scatter plot, which is used to show whether there is a linear relationship between two continuous variables. The relationship between variables is expected to be quite linear before the regression model is applied (Jain et al., 2017). The test criterion is that the line of best fit in the scatter plot should be a straight line either upward or downward sloping.

3.10.3 Multicollinearity Test

Multicollinearity occurs when there is a high correlation between independent variables, which affects the significance of each variable. The inflation coefficient of variation (VIF) was used to examine multicollinearity (Thompson, Kim, Aloe & Becker, 2017). A VIF value greater than 10 implies a multicollinearity problem, while a VIF value less than 10 does not indicate a multicollinearity problem. In addition, a tolerance value greater than 0.2 indicates that the independent variables are not strongly correlated.

3.10.4 Heteroscedasticity Test

If the error variation is not constant, there is evidence of heteroscedasticity. Applying a regression model without considering heteroscedasticity will cause biased parameter estimates.) Scatterplot is used to test heteroscedasticity. The null hypothesis states that the variance of the error term is constant. A probability value > 0.05 leads to the assumption of a null hypothesis, which indicates a constant variance of the error term and vice versa.

3.10.5 Test of Autocorrelation

Using the Durbin-Watson autocorrelation test, we were able to establish whether the residues were serially correlated or not. The Durbin Watson test produced test statistics with values ranging from 0 to 4, with 2 denoting no autocorrelation, 0 to 2 denoting positive autocorrelation, and > 2 denoting negative autocorrelation. Test statistic results in the 1.5-2.5 range are generally considered normal. Values outside of this range can be problematic (Field, 2009).

3.11 Ethical Considerations

Ethical considerations refer to ethical norms that researchers should consider in all research strategies at all stages of research design (Fellows & Liu, 2015).

Approval from the university was obtained to conduct the research. In addition, research permits were obtained from NACOSTI prior to the commencement of data collection. The strictly confidential treatment of information collected from interviewees ensures high ethical standards. The target people were informed about the purpose of the study.Data collected from respondents is reported without bias or bias.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter presents the findings from the field which were analyzed using SPSS and Excel and presented in form of tables and diagrams. The findings in this chapter represent the findings of the response rate, pilot testing, factor analysis, demographics, descriptive statistics, diagnostic results, correlation analysis, regression analysis and the summary of the findings. The sections are described as follows.

4.2 Response rate

This is the result determined by the cooperation of the respondents in expressing their opinion on the given question, which is reflected in different topics.

See annex table 4.1

Since the questionnaires given were 171, 139 were properly filled and returned. It turned out that the response rate of 81.29% of the questionnaires was filled out correctly, which is a fairly high response rate. According to Allen (2016) and Rindfuss (2015), a response rate of more than 50% is sufficient for analysis.

4.3 Pilot Testing

This section presents pilot results. Seventeen (17) questionnaires were issued to customs officers at KRA in Nairobi. This corresponds to 10% of the sample size. The reliability of the questionnaire was checked from the pilot data using Cronbach's alpha test.

4.3.1 Reliability Results

Reliability analysis was done to evaluate survey construct using Cronbach's alpha. Table 4.2 shows the reliability results for the statements.

See annex table 4.2

The test results indicate that the statement of variables were reliable, because the results are 0.719, 0.757, 0.820 and 0.759 for single window systems, electronic cargo tracking systems, cargo scanner controls, and logistics performance respectively. The variable items were considered to be reliable as they met the 0.7 threshold.

4.4 Factor Analysis (Test for Construct Validity)

The design validity test for this study was the Kaiser-Meyer-Olkin (KMO) design validity test, which, according to Kaiser Field (2005), establishes the following overall value/degree of variation in KMO: 0.00 to 0.49 unacceptable, 0, 50 to 0.59 is poor, 0.60 to 0.69 is average, 0.70 to 0.79 is average, 0.80 to 0.89 is obtained and 0.90 to 1.00 is excellent.

See annex table 4.3

The significance of the KMO coefficient was assessed using the chi-square test and the critical probability value (p-value) was 0.05. The chi-square ratio of 13,541 to 25,176 and a p value of less than 0.05 means the probability is significant. The results show that statements describing single window systems, electronic cargo tracking management systems, cargo scanner management solutions, and logistics have a significant sample adequacy.

4.5 Demographic Information

This section provides results on the demographic information of the respondents. This includes: gender, age and length of uninterrupted service.

4.5.1 Gender

The results shown in the Table 4.4 indicate that most of the respondents (66.2%) were male while 33.8% of them were female. The results imply that the customs department has adhered to the 1/3 gender rule by the constitution of Kenya

See annex table 4.4

Figure 4.1: Age of the respondents

The results indicate that 49.0% of the respondents in the customs department are between the age of 21 and 30 years. In addition, 43.0% of them are between 31 and 40 years, 24% of them being between 41 and 50 years while 23% of them are over 50 years. This implies that majority of the customs department staff are of youthful age, that is between 20 years and 40 years.

See annex figure 4.1

4.5.3 Length of continuous service

The participants were asked to indicate for how long they have been in the construction industry. The results are as shown in Table 4.5.

The findings in table 4.5 indicate that 33.1% of the respondents in the customs department have served between 2 and 5 years. Furthermore, 31.7% of them have been in service in the customs department between six and ten years, 25.2% of them serving for less than 2 years while 10.1% of them have served for over 10 years. This implies that majority of the customs department staffs (64.8%) have been in service between 2 and 10 years

See annex table 4.5

4.6 Descriptive statistics

Descriptive statistics are used to show a summary of the results, including the mean and standard deviation.

4.6.1 Single Window System

The respondents were asked to indicate the extent to which the following uses of single window system have been implemented in the customs department. This was done

using the 5-point scale of 5) Greater extent; 4) Great extent; 3) Moderate extent; 2) Low extent; 1) Very low extent. The results are as shown in the Table 4.6.

The results in the Table 4.6 revealed that majority of the respondents (70.50%) agreed that routing of information to target recipients have been implemented in the customs department to a greater extent. The results further show that, 65.46% of the respondents agreed that goods release has been implemented in the customs department to a greater extent. Moreover, 64.75% of the respondents also agreed that submission of regulatory documents have been implemented in the customs department to a greater extent. In addition, 55.40% of the respondents agreed that gate departure procedures have been implemented in the customs department to a greater extent. The results likewise showed that 61.87% of the respondents also agreed that cargo manifest has been implemented in the customs department. The results further show that, 65.46% of the respondents agreed that B/L manifest has been implemented in the customs department to a greater extent.

In summary, the mean response was 3.67 with a standard deviation of 1.31. On a five-point scale, this means that the majority of respondents agree that the use of a one-window system is applied in the customs area. These results confirm the results reported by Aman et al. (2017), who showed that in many countries single-window systems were adapted to improve customer satisfaction in logistics, as reducing customs procedures could take time, leading to delivery delays and dissatisfied customers. Ndonga (2013) concluded that in a market characterized by low margins and high costs, the use of SW as an ACE helps speed up the release of goods so that carriers and freight forwarders can deliver goods to customers quickly.

See annex table 4.6

4.6.2 Electronic Cargo Tracking Systems

The respondents were asked to indicate the extent to which the following uses of electronic cargo tracking system have been implemented in the customs department. This was done using the 5-point scale of 5) Greater extent; 4) Great extent; 3) Moderate extent; 2) Low extent; 1) Very low extent. The results in Table 4.7 shows that majority of the respondents (76.26%) agreed that real-time tracking of transit cargo has been implemented in the customs department to a greater extent. Majority of the respondents (71.94%) also agreed that improvement of security has been implemented in the customs department to a greater extent. Moreover, 73.38% of the respondents agreed that tax collection has improved tax collection in the customs department to a greater extent. Majority of the respondents (55.39%) also ag agreed that enforcement of cargo handling regulations has been enhanced in the customs department to a greater extent. Additionally, 62.59% respondents thought that reduction of rampant illegal dumping of goods has improved tax collection in the customs department to a greater extent. Majority of the respondents (58.27%) also agreed that improvement of transit time has been implemented in the customs department to a greater extent. Given a choice, 56.83% of the respondents indicated that real-time response to clients has been implemented in the customs department to a greater extent.

In summary, the mean response rate was 3.74 on a five-point scale with a standard deviation of 1.24. Thus, the majority of respondents agree with the use of an electronic goods tracking system in the customs area. This result is in line with Mugambi (2017) who conducted a study on the impact of regional electronic cargo tracking systems and found that the reason for developing this system was to implement a security and cargo tracking system in response to the interests of the governments of four countries to increase tax collection.

See annex table 4.7

4.6.3 Cargo Scanner Management System

The respondents were asked to indicate the extent to which the following uses of cargo scanner management system have been implemented in the customs department. This was done using the 5-point scale of 5) Greater extent; 4) Great extent; 3) Moderate extent; 2) Low extent; 1) Very low extent. The results are as shown in the table 4.8.

The results in table 4.8 revealed that majority of the respondents (88.52%) agreed that verification of goods has been implemented in the customs department to a greater extent. The results also exposed that majority of the respondents (90.37%) agreed that monitoring of goods has been implemented in the customs department to a greater extent. Additionally, 84.44% of the respondents agreed that strengthening of customs protection of consumers from harmful goods has been implemented in the customs department to a greater extent. The results also showed that 91.85% of the respondents agreed that detection of contraband has been implemented in the customs department to a greater extent. Moreover, majority of the respondents (90.37%) agreed that reduction of physical examination of good has been implemented in the customs department to a greater extent. The results also showed that 90.00% of the respondents agreed that utilization of resources has been implemented in the customs department to a greater extent.

In short, the average answer when viewed on a 5-point scale is 3.56, which translates to a standard deviation of 1.29. This means that the majority of respondents agree that the use of a cargo scanner management system has been implemented in the customs area. The results are in

agreement with Nwankwo, Olayinka, and Benson (2019), who found that cargo scanning plays an important role in unobtrusive import, export and security control inspections. Focker et al. (2015) added that inconspicuous scanners combined with effective profiling methods can significantly improve customs and security functions by checking the flow of goods at sea and land borders.

See annex table 4.8

4.6.4 Logistics Performance

The respondents were asked to indicate the extent to which the following logistics performance aspects have improved as a result of adoption of new technology in the customs department. This was done using the 5-point scale of 5) Greater extent; 4) Great extent; 3) Moderate extent; 2) Low extent; 1) Very low extent. The results of Table 4.9 show that most of the respondents (88.52%) agree with the statement that the efficiency of the customs process in the customs area has increased through the introduction of new technologies. The results also show that the majority of respondents (90.37%) agree that the quality of trade-related infrastructure related to the use of information technology has improved with the introduction of new technologies in the customs area. In addition, 84.44% of respondents agree that the introduction of new technologies has improved access to information to facilitate customs operations. The results also show that 91.85% of respondents agree that the competence and quality of logistics services such as transportation companies and customs brokers have improved with the introduction of new technologies. The majority of respondents (90.37%) agree that the ability to track and trace shipments without physical intervention in the ICD has improved with the introduction of new technology by Customs. The results also show that 90.00% of respondents agree that the timeliness of delivery to reach the destination within the planned or expected delivery time has improved with the introduction of new technologies.

In short, the average answer is 3.70 when viewed on a 5-point scale with a standard deviation of 1.26. In other words, the majority of respondents agree that logistics metrics have improved due to the introduction of new technologies in the customs area. This finding is consistent with Ojala and Celebi (2015) that the supply chain is seen as the weakest link in the chain and continuous improvement requires complex changes in a number of policy dimensions, including facilitating trade, services, and infrastructure. This effort requires persistence and focus; the combination of several countries has been achieved according to a study by the World Bank for Retail Logistics. Therefore, the effectiveness of customs clearance in regard to logistics performance of a country leads to trade facilitation which is quite pivotal to its development. Efficient logistics fosters a country's competitiveness as it allows it to trade services and goods on a timely basis and at lower costs of transaction (Martí, Martín & Puertas, 2017).

See annex table 4.9

4.7 Diagnostic Results

This section presents the diagnostic results. The tests include normality test, multicollinearity linearity test, heteroscedasticity test, and autocorrelation test.

4.7.1 Normality Test

Normalization is important in determining whether the data given by the dependent variable is normally distributed. The normality of the data was tested using the Shapiro-Wilk test. The criterion is that the probability value must be greater than 0.05 so that the data is normally distributed (Thornhill, Saunders & Lewis, 2009).

The null hypothesis states that the data is normally distributed. From the study it was noted that all the variables indicated the absence of abnormality of data points. Thus, the null hypothesis was accepted implying that the data was normally distributed.

See annex table 4.10

4.7.2 Linearity Test

Scatterplots, which are used to indicate if two continuous variables have a linear relationship, were employed to assess linearity. Before using regression models, it is believed that the relationship between variables will be largely linear (Jain et al., 2017).

The results indicated that the relationship between the independents and dependent variable were linear. This was evidenced by positive r values and an illustration of fit regression line in each of the plots.

See annex figure 4.2,4.3,4.4

4.7.3 Multicollinearity Test

Multicollinearity was assessed in this study by using the inflation variance factor. According to Field (2009) a VIF value above 10 is an indication of multicollinearity.

Table 4.11 presents the VIF results indicating that all the variables had values less than 10. Therefore, the independent variables were not highly correlated. This means that there was no problem of multicollinearity.

See annex table 4.11

4.7.4 Heteroscedasticity Test

The null hypothesis of this study indicates that the error variation is homoscedastic, and therefore the null hypothesis is rejected if the error term is found to be variable. If the error variation is not constant, there is evidence of heteroscedasticity. Applying the regression model without considering heteroscedasticity will cause the parameter

estimation to be biased. Graphical dispersion method was used to test heteroscedasticity.

Since the null hypothesis of this study indicates that the error variation is homoscedasticity, the results show that there is no heteroscedasticity with simple least squares regression. This is shown by a graphical scatter diagram that oscillates along the standard regression line.

See annex figure 4.5

4.7.5 Autocorrelation Test

The Durbin Watson test was used to determine the autocorrelation. The findings are shown in Table 4.12.

The results in Table 4.12 indicate that there was no autocorrelation, since the Durbin-Watson statistic of 1.71 was within the 1.5 and 2.5 limits.

See annex table 4.12

4.8 Correlation Analysis

Pearson correlation coefficient is used to determine the relationship between variables and is denoted r using a threshold of +1 to -1. If r is above 0, the value of other variables increases linearly compared to positive values, if r is below 0, it indicates that there is a negative relationship and a decreasing linear relationship on the same line and r = 0, we cannot claim that there is no correlation (Taylor, 1990).

The results in Table 4.13 show that there is a positive and significant relationship between the single window system and the logistics performance of transportation companies at ICD in Nairobi. This is evidenced by the positive r value and the p value less than 0.05 (r = 0.622 **, p = 0.002). These results are consistent with McMaster and Nowak (2016), who stated that in countries such as the United States they introduced a one-window system in the form of an automated trading environment (ACE) and facilitated the import and export of goods. Because the central point of contact for electronic information exchange between regulatory authorities and dealers is easier, faster and more efficient.

It further shows that shows that electronic cargo tracking management systems and logistics performance of transport operators at ICD in Nairobi have a positive and significant relationship. This is evidenced by a positive r value and a p value of less than 0.05 (r=0.544**, p=0.001). These findings are in agreement with Mugambi (2017) who conducted a study on the effects of the Regional Electronic Cargo Tracking System found out that the reason for the development of this system was to implement cargo security and tracking system as a response to the interest of the governments of the four countries to improve tax collection. Kithiia (2015) further, found out that the implementation of ECTS has led to the closing of prevalent loopholes of tax loss and it has increased the flow of cargo through the e-monitoring system.

The results also show that there is a positive and significant relationship between the cargo scanner management system and the logistics performance of transportation companies at ICDE in Nairobi. This is evidenced by the positive r value and p value less than 0.05 (r = 0.588 **, p = 0.000). These findings are consistent with Nwankwo, Olayinka, and Benson (2019) who indicated that the cargo scanner management system do not only scan containers, but provides container loading inspections services that guarantee control by the customs departments of the entire loading process. Cutmore, Liu, and Tickner (2013) discovered that scanning of a container's contents is done to allow Customs officers to verify the veracity of information provided by shippers about the contents of the container and the effectiveness of container integrity measures. Scanning is also crucial, according to Föcker et al. (2015), because it can help identify risky cargo when the originating shipper, or the party responsible for stuffing and closing the container, looks to be legal but has been infiltrated by a criminal gang.

See annex 4.13

4.9 Regression Analysis

This section presents regression results on the relationship between new technology and logistics performance. The findings on model of fitness, ANOVA and regression of coefficients are presented below.

Table 4.14 shows the results of the fitness of regression model which is used to explain the study phenomena. The results indicate that single window system, electronic cargo tracking systems and cargo scanner management system were significant explanatory variables of logistics performance of transport operators at ICD, as supported by adjusted R squared of 0.573. This implied that the variables jointly explained 57.3% of total variations in logistics performance of transport operators at ICD. The adjusted R-square was preferred because the constant value in Table 4.16 is insignificant.

The regression model was statistically significant, according to the results in Table 4.15. The F statistic of 62.756 and the reported p value of 0.000, which was less than the standard probability of 5% significance level, backed up this claim. Where F critical = 2.680 and F statistic = 62.756.

All independent variables have identical (Likert) scales, but the constant values in the model are not significant and hence the use of standard beta coefficients as opposed to non-standard B coefficients. The results of the regression coefficients in Table 4.16 show that the one-window system and logistics indicators of transportation companies in ICD are positively and significantly related (β = 0.389, p = 0.000) at a significance level of 5%. This shows that an increase in the aspect of 1 unit related to the one window system

increases the logistics performance of transportation companies in the ICD by 0.389 units.

These results agree with Aman et al. (2017), who showed that in many countries single-window systems were adapted to improve customer satisfaction in logistics, as reducing customs procedures could take time, leading to delivery delays and dissatisfied customers. Ndonga (2013) concluded that in a market characterized by low margins and high costs, the use of SW as an ACE helps speed up the release of goods so that carriers and freight forwarders can deliver goods to customers quickly.

In addition, the results show that the electronic cargo tracking system and the logistics performance of transportation companies in the ICD are positively and significantly related (β = 0.268, p = 0.000). This means that an increase in aspects related to the electronic cargo tracking system by 1 unit increases the logistics performance of carriers in the ICD by 0.268 units.

These findings are consistent with Kithiia (2015) who found out that the implementation of ECTS has led to the closing of prevalent loopholes of tax loss and it has increased the flow of cargo through the e-monitoring system. Juma (2016) also found out that ECTS has eliminated cargo diversions into the local market as well as creating alert and responses during the trailer stop-over that take more than the allowed time. Therefore, it is clear that its implementation has brought major trade boosts in Kenya and the entire East African region.

Furthermore, cargo scanner management system and logistics performance of transport operators at ICD were found to be positive and statistically related (β=0.330, p=0.000). This implies that an increase in 1 unit of aspects related to cargo scanner management system improves logistics performance of transport operators at ICD by 0.330 units.

These findings are consistent with Nwankwo, Olayinka, and Benson (2019) who indicated that the cargo scanner management solutions do not only scan containers, but provides container loading inspections services that guarantee control by the customs departments of the entire loading process. Cutmore, Liu, and Tickner (2013) discovered that scanning of a container's contents is done to allow Customs officers to verify the veracity of information provided by shippers about the contents of the container and the effectiveness of container integrity measures. Scanning is also crucial, according to Föcker et al. (2015), because it can help identify risky cargo when the originating shipper, or the party responsible for stuffing and closing the container, looks to be legal but has been infiltrated by a criminal gang.

From the hypothesized model ($Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e$), the following model was estimated:

$Y = 0.300 + 0.389X_1 + 0.268X_2 + 0.330X_3$

Where:

Y = Logistics Performance

X1 =Single Window System,

X2 =Electronic Cargo Tracking System

X3 =Cargo Scanner Management System

See annex tables 4.14,4.15,4.16

4.10 Test of Hypotheses

The first hypothesis (Ho1) was that single window system has no significant effect on logistics performance of transport operators at ICD. The regression results in Table 4.16 show a p-value of 0.000 <0.05 which leads to the rejection of the null hypothesis. Therefore, the single window system has a significant impact on the logistics performance of transportation companies in ICD.

The second hypothesis (Ho2) was that cargo electronic tracking system has no significant effect on logistics performance of transport operators at ICD. The regression results show a p-value of 0.000 <0.05 which leads to the rejection of the null hypothesis. Therefore, the electronic goods tracking system has a significant impact on the logistics performance of transportation companies in ICD.

The third hypothesis (Ho3) was that cargo scanner management system has no significant effect on logistics performance of transport operators at ICD. The regression results show a p-value of 0.000 <0.05 which leads to the rejection of the null hypothesis. Therefore, the cargo scanner management system does not have a significant effect on the logistics performance of transportation companies in ICD.

4.11 Discussion of the key Findings

The correlation results indicated that single window system (r=0.622**, p=0.002), electronic cargo tracking systems (r=0.544**, p=0.001) and cargo scanner management system (r=0.588**, p=0.000) have a positive and significant association with logistics performance of transport operators at ICD. This implies that adoption and implementation of single window system, electronic cargo tracking systems and cargo scanner management system would be accompanied by an improvement in logistics performance.

Further, the regression results revealed that single window system and (β=0.389, p=0.000), electronic cargo tracking systems (β=0.268, p=0.000) and cargo scanner management system (β=0.330, p=0.000) have a significant and positive effect on the logistics performance of transport operators at ICD. As a result of the high coefficient of the single window system, it was discovered that the variable has the greatest impact on logistics performance. The cargo

scanner management system came next, followed by computerized cargo tracking systems.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the main results of the study and provides conclusions and recommendations relevant to the research objectives. The summary is based on the results of descriptive and inferential statistical analysis. This chapter also provides areas for further research.

5.2 Summary of Findings

5.2.1 Single Window System and Logistics Performance

The results showed that there was a positive and significant relationship between the one window system and the logistics performance of transportation companies at ICD in Nairobi. In addition, the results are supported by statements in the questionnaire, which most of the respondents agree. This indicates that the uses of single window system have been implemented in the customs department. The regression of coefficient results further corroborated the findings by indicating that single window system and logistics performance of transport operators at ICD are positively and significantly related.

These results are consistent with McMaster and Nowak (2016), who found that countries such as the United States have implemented a single window system in the form of an automated trading environment (ACE) and have positively facilitated the import and export of goods. Because the central point of contact for electronic information exchange between regulatory authorities and dealers is easier, faster and more efficient. Similarly, Aman et al. (2017) show that in countries such as South Africa and Nigeria, a one-window system is being adapted to improve customer satisfaction in logistics, as reducing customs procedures can take time, leading to delivery delays and dissatisfied customers.

5.2.2 Electronic Cargo Tracking Systems and Logistics Performance

The findings revealed that electronic cargo tracking management systems and logistics performance of transport operators at ICD in Nairobi have a positive and significant relationship. The findings were also backed up by remarks in the questionnaire that the majority of respondents agreed with regarding computerized freight tracking management systems. The results further indicate that electronic cargo tracking management systems and logistics performance of transport operators at ICD are positively and significantly related.

These findings are consistent with Kithiia (2015) who found out that the implementation of ECTS has led to the closing of prevalent loopholes of tax loss and it has increased the flow of cargo through the e-monitoring system. Juma (2016) also found out that ECTS has eliminated cargo diversions into the local market as well as creating alert and responses during the trailer stop-over that take more than the allowed time. Therefore, it is clear that its implementation has brought major trade boosts in Kenya and the entire East African region.

5.2.3 Cargo Scanner Management System and Logistics Performance

The findings further indicated that there is a positive and significant association between cargo scanner management system and logistics performance of transport operators at ICD in Nairobi. These findings were in agreement with the statements from the respondents. Majority of the respondents agreed with all the questionnaire questions regarding cargo scanner management system. Furthermore, cargo scanner management system and logistics performance of transport operators at ICD were found to be positive and statistically related.

These findings are consistent with Nwankwo, Olayinka, and Benson (2019) who indicated that the cargo scanner management system does not only scan containers, but provides container loading inspections services that guarantee control by the customs departments of the entire loading process. According to Cutmore, Liu, and Tickner (2013), scanning of a container's contents is done to allow Customs officers to check the correctness of information provided by shippers about the contents of the container and the effectiveness of container integrity measures. Scanning is also crucial, according to Föcker et al. (2015), because it can help identify risky cargo when the originating shipper or the entity in charge of packing and closing the container, looks to be legal but has been infiltrated by a criminal gang.

5.3 Conclusion

The first objective of the study was to determine the effect of adoption of Single Window System on logistics performance of transport operators at ICD. The study indicated that the single window system has a good and significant impact on the logistics performance of transport operators at ICD in Nairobi based on the findings. In particular, the study identified routing of information to target recipients, goods release, submission of regulatory documents, gate departure procedures and cargo manifest are critical aspects of single window system. From the regression results, the null hypothesis that single window system has no significant effect on logistics performance of transport operators at ICD was rejected. The implication is that improvement of single window system is likely to enhance logistics performance of transport operators at ICD.

The second objective of the study was to establish the effect of Electronic Cargo Tracking System on logistics performance of transport operators at ICD. The study indicated that electronic cargo monitoring has a good and significant impact on the logistics performance of transport operators at ICD in Nairobi based on the findings. In particular, the study concluded that electronic cargo tracking system facilitates real-time tracking of transit cargo, improvement of security, reduction of rampant illegal dumping of goods and real-time response to clients. From the regression results, the null hypothesis that cargo electronic tracking system has no significant effect on logistics performance of transport operators at ICD was rejected. The implication is that improvement of cargo electronic tracking system is expected to increase logistics performance of transport operators at ICD.

The study's third objective was to determine the effect of Cargo Scanner Management System on logistics performance of transport operators at ICD. The study indicated that the cargo scanner management system has a good and significant effect on the logistics performance of transport operators at ICD in Nairobi based on the data. In particular, the study concluded that cargo scanner management system facilitates verification of goods, monitoring of goods, detection of contraband, reduction of physical examination of good and utilization of resources. From the regression results, the null hypothesis that cargo scanner management system has no significant effect on logistics performance of transport operators at ICD was rejected. The implication is that improvement of cargo scanner management system is expected to increase logistics performance of transport operators at ICD.

5.4 Recommendations

Based on the study findings, the study recommends that Kenya Revenue Authority through the customs department needs to strengthen the use of these new technologies across all its ports and borders to ensure increased trade by efficient movement of goods across markets.Also,KRA through the IT department should constantly update its ICT infrastructure to incorporate the latest software which would enhance efficient flow of processes in clearance of goods so as to improve flow of goods into and out of port. This helps in speeding up the tracking systems and providing real time and reliable information. The report also suggests that e-government standards, particularly standardized e-customs solutions, be adopted, as well as the political and societal implications of e-customs policy. The customs department officials, logistics companies, and technological providers need to scale up their collaborative activities in advancing the application of single window system, electronic cargo tracking systems and cargo scanner management system in supply chains for better performance of logistics.

5.5 Areas for Further Studies

The study sought to establish the effect of new technology adoption by customs on logistics performance in Nairobi, case of transport operators at ICD. Future scholars can conduct further research to incorporate a moderating or a mediating variable to assess increase in the robustness of the study findings. In addition, further studies can be conducted in other contexts other than the case of transport operators in Nairobi County. This can offer basis of comparison where the studies can provide a more holistic approach to addressing the problems experienced in the customs department in Kenya. Further, the study variables (single window system, cargo scanner management system and electronic cargo tracking systems) accounted for 58% of the changes in logistic performance. Other characteristics of new technology could be considered in future studies to explain the remaining 42%.

References

[1.] Abbas, A. W. (2016). *The effects of mobile phone technology on logistics performance of clearing and forwarding firms in Mombasa county* (Doctoral dissertation, University of Nairobi).

[2.] Abeywickrama, M. H., & Wickramaarachchi, W. A. D. N. (2015). Study on the Challenges of Implementing Single Window Concept to Facilitate Trade in Sri Lanka: A Freight Forwarder Perspective. *Journal of Economics, Business and Management*, *3*(9), 883-888.

[3.] Adams, E., Goodale, W., Burns, S., Dorr, C., Duron, M., Gilbert, A., ... & Robinson, M. (2017). *Stereo-Optic High-Definition Imaging: A New Technology to Understand Bird and Bat Avoidance of Wind Turbines* (No. DOE-BRI-072117). Biodiversity Research Institute.

[4.] Ahn, B. S., & Han, M. C. (2017). A comparative study on the single window between Korea and Singapore. *Journal of Korea Trade*, *11*(3), 279-303.

[5.] Aman, A., Al-Shabil, T., Mohamed, Z., & Auzair, S. (2017). E-Single window implementation: a case of Jordan customs department. *International Journal of West Asian Studies*, *8*(1), 7-17.

[6.] Arvis, J. F., Saslavsky, D., Ojala, L., Shepherd, B., Busch, C., Raj, A., & Naula, T. (2016). *Connecting to Compete 2016: Trade Logistics in the Global Economy--The Logistics Performance Index and Its Indicators*. World Bank.

[7.] Aziz, Z. A., Razak, R. C., Yaacob, M. R., Hussin, N. S. N., & Razmin, N. H. M. (2016). Does technological and organizational innovation have significant influences on

logistics performance?. *International Journal of Business and Management Invention*, *5*(11), 55-62.

[8.] Bendahan, J. (2015). *U.S. Patent No. 9,086,497*. Washington, DC: U.S. Patent and Trademark Office.

[9.] Bhagwat, R., & Sharma, M. K. (2009). An application of the integrated AHP-PGP model for performance measurement of supply chain management. *Production Planning & Control*, *20*(8), 678-690.

[10.] Bhandari, R. (2014). Impact of technology on logistics and supply chain management. *IOSR Journal of Business and Management*, *2*(1), 9-19.

[11.] Bolatan, G. I. S., Gozlu, S., Alpkan, L., & Zaim, S. (2016). The impact of technology transfer performance on total quality management and quality performance. *Procedia-Social and Behavioral Sciences*, *235*, 746-755.

[12.] Bolatan, G. I. S., Gozlu, S., Alpkan, L., & Zaim, S. (2016). The impact of technology transfer performance on total quality management and quality performance. *Procedia-Social and Behavioral Sciences*, *235* (8), 746-755.

[13.] Bowersox, D. J., & Daugherty, P. J. (2015). Logistics paradigms: the impact of information technology. *Journal of Business Logistics*, *16*(1), 65-77.

[14.] Christopher, M. (2016). *Logistics & supply chain management*. Pearson UK.

[15.] Cooper, D., & Schindler, P. (2008). *Business Research Methods* (10th ed.). New York, NY: McGraw Hill

[16.] Cutmore, N. G., Liu, Y., & Tickner, J. R. (2013, November). Development and commercialization of a fast-neutron/x-ray Cargo Scanner. In *2010 IEEE International Conference on Technologies for Homeland Security (HST)* (pp. 330-336). IEEE.

[17.] Dikko, M. (2016). Establishing Construct Validity and Reliability: Pilot Testing of a Qualitative Interview for Research in Takaful (Islamic Insurance). *Qualitative Report*, *21*(3).

[18.] Feenberg, A. (2002). *Transforming technology: A critical theory revisited*. Oxford University Press.

[19.] Fellows, R. F., & Liu, A. M. (2015). *Research methods for construction*. John Wiley & Sons.

[20.] Field, A. (2009). Discovering statistics using SPSS. Sage publications

[21.] Föcker, F., Neubauer, A., Metzger, A., Gröner, G., & Pohl, K. (2015, April). Real-time cargo volume recognition using internet-connected 3D scanners. In *2015 International Conference on Evaluation of Novel Approaches to Software Engineering (ENASE)* (pp. 323-330). IEEE.

[22.] Fugate, B. S., Mentzer, J. T., & Stank, T. P. (2010). Logistics performance: efficiency, effectiveness, and differentiation. *Journal of business logistics*, *31*(1), 43-62.

[23.] Gakuubi, D. K. (2018). *The Impact Of Information Communication Technology On Organizational Performance: A Case of Nairobi Bottlers Logistics Operation's* (Doctoral dissertation, United States International University-Africa).

[24.] Gani, A. (2017). The logistics performance effect in international trade. *The Asian Journal of Shipping and Logistics*, *33*(4), 279-288.

[25.] Gao, Y., Chang, D., Fang, T., & Luo, T. (2018). The correlation between logistics industry and other industries: an evaluation of the empirical evidence from China. *The Asian Journal of Shipping and Logistics*, *34*(1), 27-32.

[26.] Goldsby, T. J., & Zinn, W. (2016). Technology innovation and new business models: can logistics and supply chain research accelerate the evolution?.

[27.] Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *MIS quarterly*, 213-236.

[28.] Groves, G. L. R. (2009). *Now it can be told: The story of the Manhattan Project*. Da Capo Press.

[29.] Gunasekaran, A., Subramanian, N., & Papadopoulos, T. (2017). Information technology for competitive advantage within logistics and supply chains: A review. *Transportation Research Part E: Logistics and Transportation Review*, *99*, 14-33.

[30.] Hausman, W. H., Lee, H. L., & Subramanian, U. (2013). The impact of logistics performance on trade. *Production and Operations Management*, *22*(2), 236-252.

[31.] Hitt, M. A., Xu, K., & Carnes, C. M. (2016). Resource based theory in operations management research. *Journal of Operations Management*, *41*, 77-94.

[32.] Jain, N., Agarwal, N., Thinakaran, R., & Parekhji, R. (2017). Low cost dynamic error detection in linearity testing of SAR ADCs. In *2017 IEEE International Test Conference (ITC)* (pp. 1-8). IEEE

[33.] Jiang, Z. (2017). Trade facilitation and customs compliance for cost-saving and efficiency: Policies, practices and proposals–A China case study. *Global Trade and Customs Journal*, *12*(11/12).

[34.] Kabiru, V. N. (2016). *Electronic cargo tracking system and operational peformance at kenya revenue authority and on transporters* (Doctoral dissertation, University of Nairobi).

[35.] Kalinicheva, V., Dmitriev, S., Drigo, M., Shadoba, E., Ozherelieva, M., & Matyushkina, I. (2016). Innovation,

economic growth and inequality. *International Review of Management and Marketing*, *6*(1S).

[36.] Kilonzi, F., & Kanai, C. K. (2020). Electronic Cargo Tracking System and Its Effects On Revenue Realization in East Africa Member Countries.

[37.] Kithiia, A. K. (2015). Effects of Electronic Logistics on the Logistical Performance of Logistics Firms in Kenya: A Case Study of Maersk Kenya Limited. *The International Journal of Business & Management*, *3*(12), 68.

[38.] Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International.

[39.] Lai, P. C. (2017). The literature review of technology adoption models and theories for the novelty technology. *JISTEM-Journal of Information Systems and Technology Management*, *14*(1), 21-38.

[40.] Lin, C. Y., & Jung, C. (2006). Influencing factors on the innovation in logistics technologies for logistics service providers in Taiwan. *Journal of American Academy of Business*, *9*(2), 257-264.

[41.] Martí, L., Martín, J. C., & Puertas, R. (2017). A DEA-logistics performance index. *Journal of applied economics*, *20*(1), 169-192.

[42.] Mathauer, M., & Hofmann, E. (2019). Technology adoption by logistics service providers. *International Journal of Physical Distribution & Logistics Management*.

[43.] McMaster, J., & Nowak, J. (2016). The Evolution of Electronic Trade Facilitation: Towards a Global Single Window Trade Portal. The Electronic Journal of Information, 1-19.

[44.] Meyers, L. S., Gamst, G., & Guarino, A. J. (2006). *Applied multivariate research: Design and interpretation*. Sage publications.

[45.] Miler, R., & Bujak, A. (2014). Electronic cargo tracking systems as a part of the intelligent freight technologies. Their impact on the global integrated supply chain security and effectiveness based on the Avante system. *Archives of Transport System Telematics*, *7*(3), 31-36.

[46.] Mugambi, N. (2017). *Effect of Cargo Tracking System On Cross-Border Trade Between Kenya and Uganda* (Doctoral dissertation, University of Nairobi).

[47.] Mutula, E. O. (2018). *Strategic Change Management at Kenya Revenue Authority: a Case of Customs and Border Control Department* (Doctoral dissertation, university of Nairobi).

[48.] Mwangangi, P. W. (2016). *Influence of logistics management on performance of manufacturing firms in Kenya* (Doctoral dissertation, COHred, supply chain managent, JKuat).

[49.] Nandagopal, S. (2018). Customs Studies at the Cross Roads. *Available at SSRN 3156221*.

[50.] Ndonga, D. (2013). Managing the risk of corruption in Customs through single window systems. *World Customs Journal*, *7*(2), 23-37.

[51.] Nizeyimana, C., & De Wulf, L. (2015). Rwanda electronic single window supports trade facilitation. *World Customs Journal*, *73*.

[52.] Nizeyimana, C., & De Wulf, L. (2015). Rwanda electronic single window supports trade facilitation. *World Customs Journal*, *73*.

[53.] Noe, R. A., Hollenbeck, J. R., Gerhart, B., & Wright, P. M. (2017). *Human resource management: Gaining a competitive advantage*. New York, NY: McGraw-Hill Education.

[54.] Nwankwo, W., & Olayinka, A. S. (2019). Implementing a risk management and X-Ray cargo scanning document management prototype. *International Journal of Scientific and Technology Research*, *8*(9), 93-105.

[55.] Oduma, R. O., & Shale, N. (2019). Effect of Logistics Automation on Supply Chain Performance in Kenya Medical Supplies Authority.

[56.] Ojala, L., & Celebi, D. (2015). The World Bank's Logistics Performance Index (LPI) and drivers of logistics performance. *Proceeding of MAC-EMM, OECD*.

[57.] Oláh, J., Karmazin, G., Pető, K., & Popp, J. (2018). Information technology developments of logistics service providers in Hungary. *International Journal of Logistics Research and Applications*, *21*(3), 332-344.

[58.] Parra-Frutos, I. (2013). Testing homogeneity of variances with unequal sample sizes. *Computational Statistics*, *28*(3), 1269-1297.

[59.] Pugliatti, L. (2011). Cloud single window: legal implications of a new model of cross-border single window. *World Customs Journal*, *5*(2), 3-20.

[60.] Pugliese, E., Patelli, A., Cimini, G.,& Gabrielli, A. (2017). The scientific influence of nations on global scientific and technological development. *Journal of Informetrics*, *11*(4), 1229-1237.

[61.] Ross, H. (2017). Tracking and tracing tobacco products in Kenya. *Preventive medicine*, *105*, S15-S18.

[62.] Rotolo, D., Hicks, D., & Martin, B. R. (2015). What is an emerging technology?. *Research policy*, *44*(10), 1827-1843.

[63.] Røvik, K. A. (2016). Knowledge transfer as translation: Review and elements of an instrumental theory. *International Journal of Management Reviews*, *18*(3), 290-310.

[64.] Ruto, W. K., & Datche, E. (2015). Logistical factors influencing port performance a case of kenya ports

authority (KPA). *International Journal of Current Research and Review*, *7*(12), 52.

[65.] Saidi, S., & Hammami, S. (2011, May). The role of transport and logistics to attract foreign direct investment in the developing countries. In *2011 4th International Conference on Logistics* (pp. 484-489). IEEE.

[66.] Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students*. Pearson education.

[67.] Thompson, C. G., Kim, R. S., Aloe, A. M., & Becker, B. J. (2017). Extracting the variance inflation factor and other multicollinearity diagnostics from typical regression results. *Basic and Applied Social Psychology*, *39*(2), 81-90.

[68.] Tosevska-Trpcevska, K. (2014). Effects of the implementation of single window and simplified customs procedures in the Republic of Macedonia. *World customs journal*, *8*(1), 51-62.

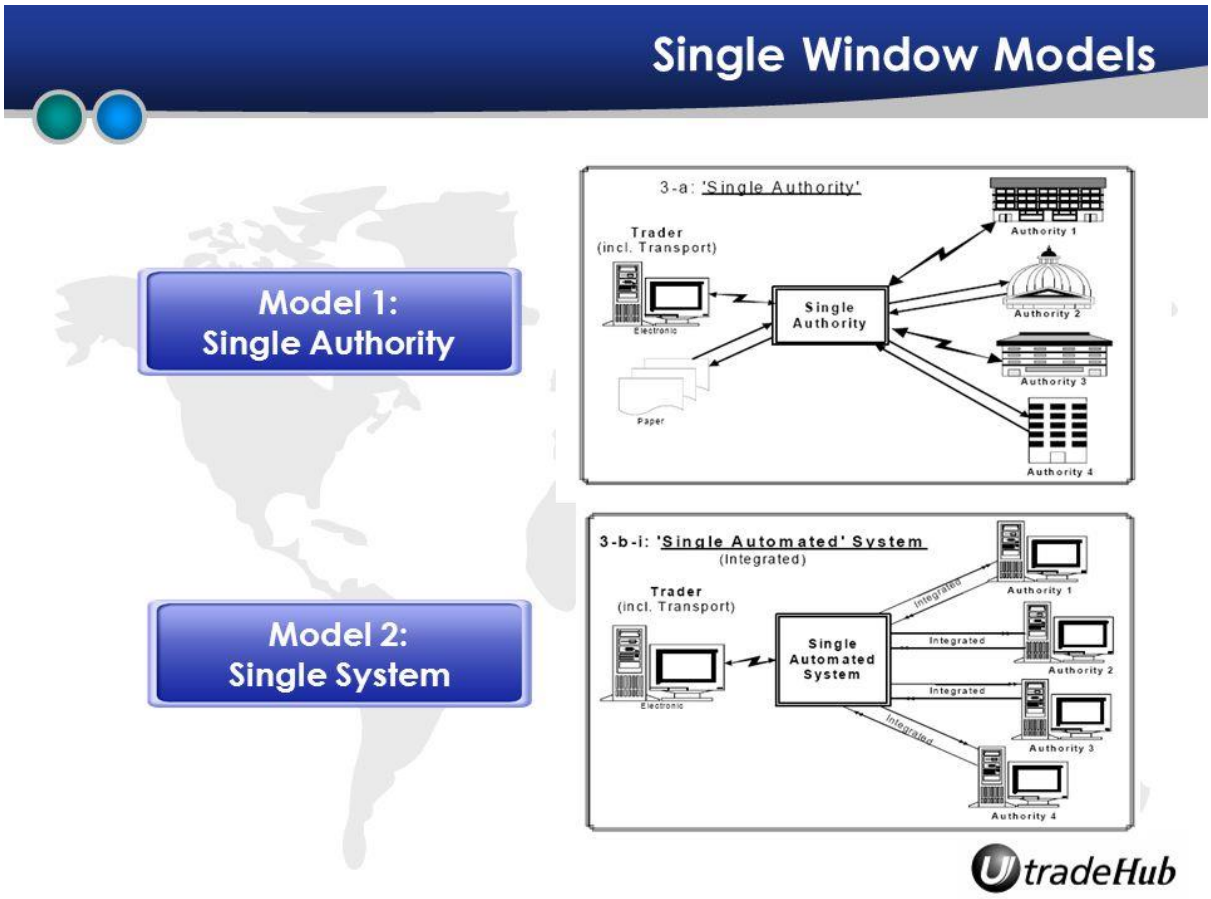
[69.] World Customs Organization (2011), How to build a Single Window environment; Key Factor in Establishing Single Windows for Handling Import/Export Procedures and Formalities. United Nations Publication E//ESCWA/EDGD/2011/5, 11-0286-December 2011 – 472.

[70.] Yamane, T. (1967). Elementary sampling theory.

[71.] Zephania, J. (2019). *Influence of information technology on performance of logistics firms in Tanzania: A case of Dar es salaam city in Tanzania* (Doctoral dissertation, Mzumbe University).

Annex

Figure 2.1: Single Window System of Model of Trade



Source: Pugliatti (2011)

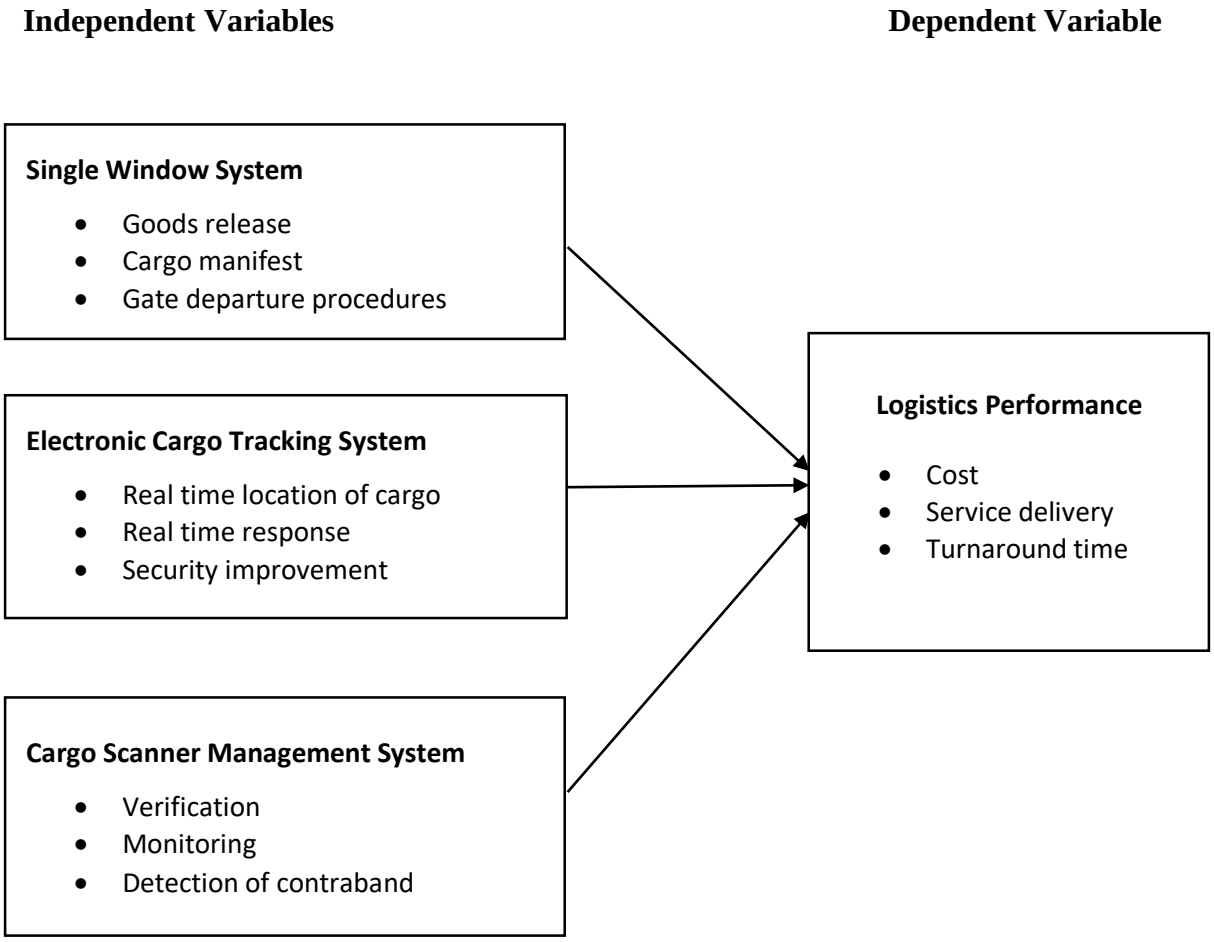


Figure 2.2: The Conceptual Framework

Source: (Researcher, 2019)

Table 3.1: Target Population

Categories	Number
Custom Officers	270
Logistics managers	30
Total	**300**

Table 3.2: Sample Size

Categories	Target Population	Sample Size
Custom Officers	270	154
Logistics managers	30	17
Total	**300**	**171**

Table 3.3: Measurement of Study Variables

Variable	Type of variable	Indicators	Measurement scale
Logistics Performance	Dependent	·Cost ·Service delivery ·Turnaround time	5 Likert scale
Single Window System	Independent	· Goods release · Cargo manifest · Gate departure procedures	5 Likert scale
Electronic Cargo Tracking System	Independent	· Real time location of cargo ·Real time response · Security improvement	5 Likert scale
Cargo Scanner Management System	Independent	· Verification · Monitoring · Detection of contraband	5 Likert scale

Table 4.1: Response Rate

Response	Frequency	Percentage
Returned	139	81.29%
Unreturned	32	18.71%
Total	**171**	**100%**

Table 4.2: Reliability Results

Variables	Cronbach's Alpha	Number of Items	Conclusion
Single Window System	0.719	6	Reliable
Electronic Cargo Tracking Systems	0.757	7	Reliable
Cargo Scanner Management System	0.820	6	Reliable
Logistics Performance	0.759	6	Reliable

Table 4.3: Factorial Test Results for Construct Validity

	KMO	Bartlett's Test of Sphericity			Conclusion	Validity
Variable		Approx. Chi-Square	df	Sig.		
Single Window System	0.624	25.176	15	0.000	Acceptable	Valid
Electronic Cargo Tracking Systems	0.756	26.410	21	0.002	Acceptable	Valid
Cargo Scanner Management System	0.670	13.541	15	0.003	Acceptable	Valid
Logistics Performance	0.507	19.229	15	0.000	Acceptable	Valid

Table 4.4: Gender

Category	Frequency	Percent
Female	47	33.8
Male	92	66.2
Total	**139**	**100**

4.5.2 Age bracket of the respondents

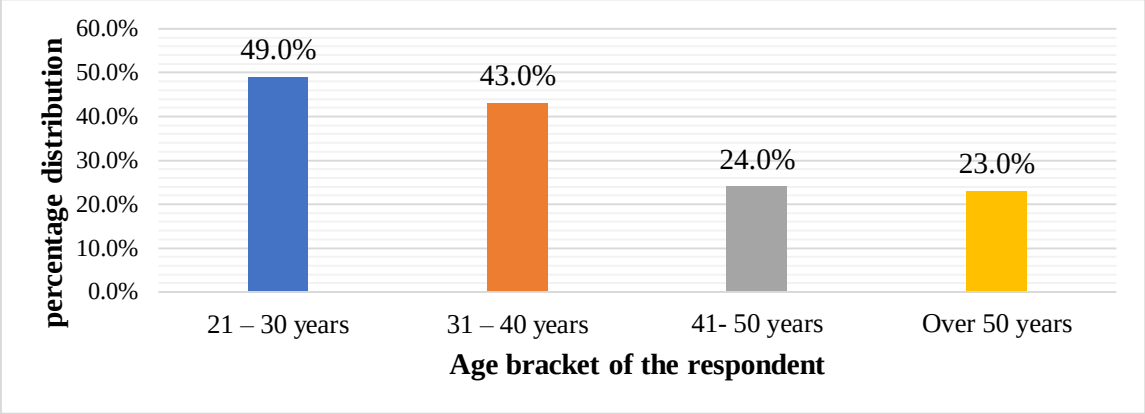


Table 4.5: Length of continuous service

Category	Frequency	Percent
Less than two years	35	25.2
2-5 years	46	33.1
6- 10 years	44	31.7
Over 10 years	14	10.1
Total	**139**	**100**

Table 4.6: Single Window System

Statements	1	2	3	4	5	Mean	S. D
Routing of information to target recipients	5.0%	9.3%	15.1%	33.8%	36.7%	3.88	1.16
Goods release	7.9%	10.1%	16.6%	33.8%	31.7%	3.71	1.24
Submission of regulatory documents	12.9%	4.3%	18%	25.9%	38.9%	3.73	1.36
Gate departure procedures	7.9%	18%	18.7%	25.9%	29.5%	3.51	1.30
Cargo manifest	10.1%	9.4%	19.4%	24.5%	36.7%	3.68	1.32
B/L manifest	16.6%	10.1%	11.5%	29.5%	32.4%	3.51	1.45
Average						**3.67**	**1.31**

M = Mean, S.D =Standard Deviation

Table 4.7: Electronic Cargo Tracking Systems

Statements	1	2	3	4	5	Mean	S. D
Real-time tracking of transit cargo	2.9%	5.8%	15.1%	38.1%	38.1%	4.03	1.01
Improvement of security	6.5%	7.9%	13.7%	36.7%	35.3%	3.86	1.17
Improving tax collection	8.6%	5.0%	12.9%	38.1%	35.3%	3.86	1.21
Enhancing enforcement of cargo handling regulations	8.6%	15.8%	20.1%	23.0%	32.4%	3.55	1.32
Reduction of rampant illegal dumping of goods	7.9%	9.4%	20.1%	24.5%	38.1%	3.76	1.27
Improvement of transit time	15.8%	13.7%	12.2%	26.6%	31.7%	3.45	1.46
Real-time response to clients	7.2%	7.9%	28.1%	23.7%	33.1%	3.68	1.22
Average						**3.74**	**1.24**

Table 4.8: Cargo Scanner Management System

Statements	1	2	3	4	5	Mean	S. D
Verification of goods	6.5%	16.6%	19.4%	29.5%	28.1%	3.56	1.24
Monitoring of goods	8.6%	7.2%	17.3%	42.5%	24.5%	3.67	1.18
Consumer protection from harmful goods	14.4%	4.3%	17.9%	25.9%	37.4%	3.68	1.39
Detection of contraband	5.0%	17.9%	20.1%	25.9%	30.9%	3.6	1.24
Reduction of physical examination of good	8.6%	9.4%	22.3%	35.9%	23.7%	3.57	1.2
Utilization of resources	17.9%	16.6%	14.4%	23.7%	27.3%	3.26	1.47
Average						**3.56**	**1.29**

Table 4.9: Logistics Performance

Statements	1	2	3	4	5	Mean	S. D
Efficiency of the clearance processes.	5.0%	10.8%	16.6%	35.3%	32.4%	3.79	1.16
Quality of trade-related infrastructure in respect to information technology usage.	5.0%	10.8%	14.4%	40.3%	29.5%	3.78	1.13
Ease of access to information to facilitate action from the customs department	11.5%	4.3%	17.9%	27.3%	38.9%	3.78	1.32
Competence and quality of logistics services such as transport operators and customs brokers.	4.3%	17.9%	18.7%	27.3%	31.7%	3.64	1.22
Ability to track and trace consignments	7.9%	9.4%	20.1%	24.5%	38.1%	3.76	1.27
Timeliness of shipments in reaching the destination within the scheduled or expected delivery time.	15.8%	13.7%	12.2%	26.6%	31.7%	3.45	1.46
Average						**3.70**	**1.26**

Table 4.10: Normality Results

	Shapiro-Wilk		
Variables	**Statistic**	**Df**	**Sig.**
Single Window System	0.977	139	0.122
Electronic Cargo Tracking System	0.986	139	0.164
Cargo Scanner Management System	0.979	139	0.130
Logistics Performance	0.984	139	0.109

a Lilliefors Significance Correction

Figure 4.2: Linearity Test for Single Window System

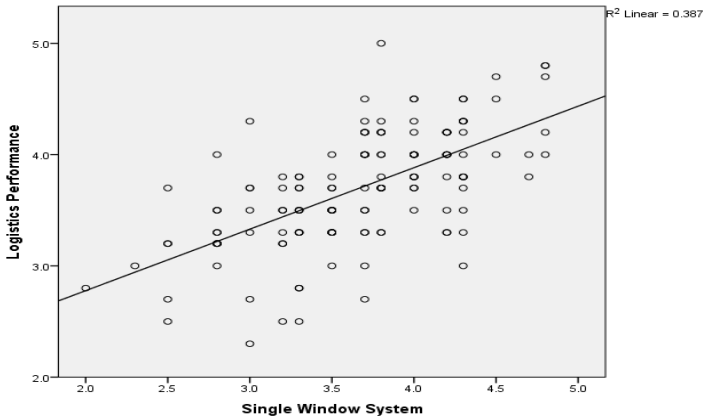
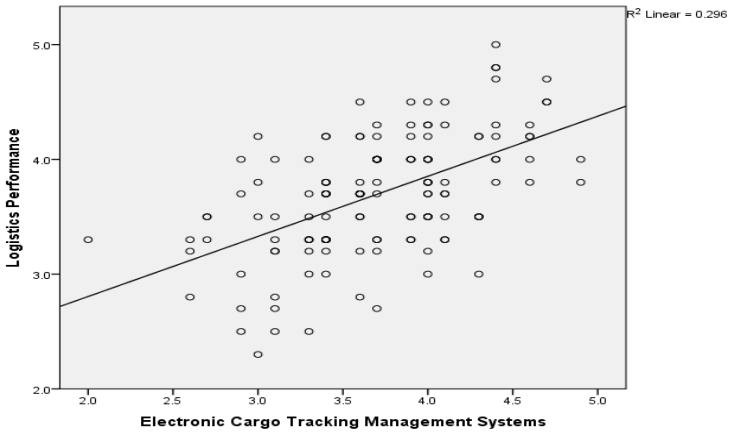


Figure 4.3: Linearity Test for Electronic Cargo Tracking Systems



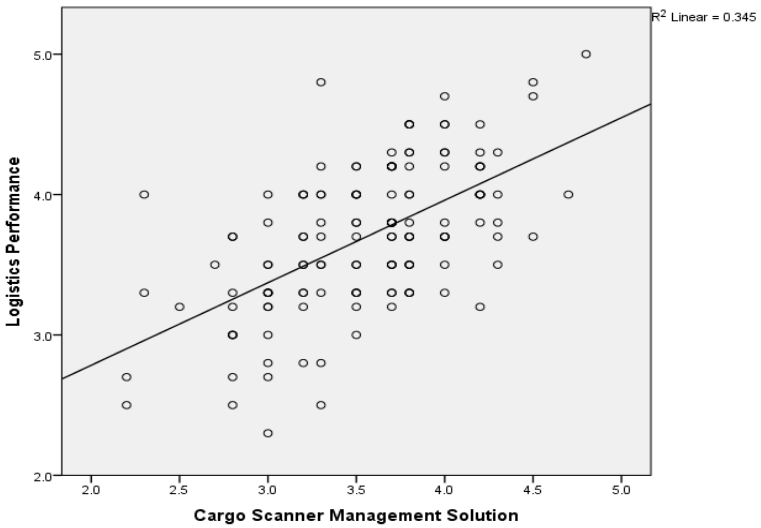


Figure 4.4: Linearity Test for Cargo Scanner Management System

Table 4.11: Collinearity Test

Variable	Tolerance	VIF
Single Window System	0.781	1.280
Electronic Cargo Tracking System	0.789	1.267
Cargo Scanner Management System	0.779	1.284
Mean VIF		**1.277**

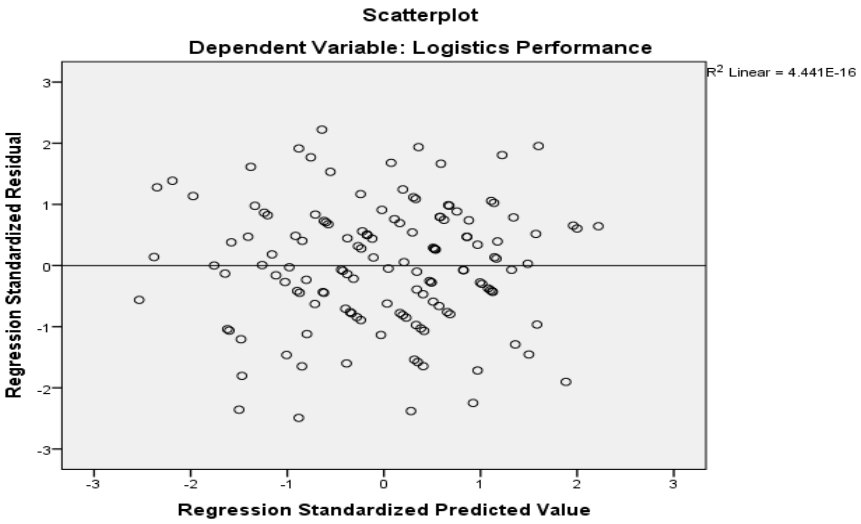


Figure 4.5: Error variance of the residuals

Table 4.12: Durbin-Watson Test for Autocorrelation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.763a	0.582	0.573	0.3404	1.71

a Predictors: (Constant), Cargo Scanner Management System, Electronic Cargo Tracking Systems, Single Window System

b Dependent Variable: Logistics Performance

Table 4.13: Correlation Analysis

Correlations		Logistics Performance	Single Window System	Electronic Cargo Tracking Systems	Cargo Scanner Management System
Logistics Performance	Pearson Correlation	1.000			
	Sig. (2-tailed)				
	N	139			
Single Window System	Pearson Correlation	.622**	1.000		
	Sig. (2-tailed)	0.002			
	N	139	139		
Electronic Cargo Tracking Systems	Pearson Correlation	.544**	.382**	1.000	
	Sig. (2-tailed)	0.001	0.000		
	N	139	139	139	
Cargo Scanner Management System	Pearson Correlation	.588**	.396**	.386**	1.000
	Sig. (2-tailed)	0.000	0.000	0.000	
	N	139	139	139	139

** Correlation is significant at the 0.01 level (2-tailed).

Table 4.14: Model of Fitness

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.763a	0.582	0.573	0.3404

a Predictors: (Constant), Cargo Scanner Management System, Electronic Cargo Tracking Systems, Single Window System
b Dependent Variable: Logistics Performance

Table 4.15: Analysis of Variance (ANOVA)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	21.816	3	7.272	62.756	.000b
	Residual	15.644	135	0.116		
	Total	37.46	138			

a Predictors: (Constant), Cargo Scanner Management System, Electronic Cargo Tracking Systems, Single Window System
b Dependent Variable: Logistics Performance

Table 4.16: Regression of Coefficients

Variables	β	Std. Error	Beta	t	Sig.
(Constant)	0.300	0.252		1.190	0.236
Single Window System	0.346	0.056	0.389	6.186	0.000
Electronic Cargo Tracking System	0.258	0.060	0.268	4.287	0.000
Cargo Scanner Management System	0.330	0.063	0.330	5.238	0.000

a Dependent Variable: Logistics Performance

