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# Effect of Systems Automation on Customs Revenue Performance in Kenya

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## Abstract

Customs mandate are revenue collection, border protection, collection of international trade statistics and trade facilitation (Ayuma, 2018). Revenue collection has been used as the apex yardstick for measuring the performance of Kenya's customs and border control department. In the year 2016/2017 and 2017/2018, KRA missed its target by 18.5 billion and 15 billion respectively. This shortfall in collection created a deficit in government project's financing affecting customs revenue performance. The study had three independent variables: Scanner technology, RECTS and ICMS. This study was grounded by three theories: Technological Determinism Theory, General System theory and International Trade theory. The study adopted the explanatory research design. A population of 902 clearing and forwarding companies and customs officers were used out of which a sample of 227 respondents was selected, through Taro Yamane sampling method. The study used both primary data by use of structured questionnaires and secondary data obtained from relevant materials which represent academic research, with the selected period being 2017 to 2019. Data was analyzed into descriptive statistics and inferential statistics by use of SPSS (20) and presented in tables, pie charts and cross tabulation. Data was tested for validity and reliability using the Cronbach Alpha Score as the test for reliability. In conclusion, although systems automation comes with costs attributable to ICT infrastructure, synchronization hitches, training and security enhancements, its implementation is important in achieving revenue growth and operational efficiencies. Recommendations for further study was on effects of Business Intelligence and Customs Oil Stocks Information Systems on customs performance.

**Keywords**: Systems automation, Customs, border protection

## 1. Background

Globally, the responsibility of revenue collection has since the 1990s been hived off to semi-autonomous revenue authorities which exercise direct control over the import, export, manufacture, movement, storage or use of certain goods (Fjeldstad & Moore, 2008). The revenue authorities may be able to experience increased revenues when more taxpayers are on-boarded on to the automated systems. Similarly, avenues for tax evasion are minimized resulting in increased revenues to run government programs.

Dečman & Klun (2015) explains that governments in developing countries face great challenges in mobilizing tax

 

revenues, which result in a gap between what they could collect and what they actually collect. Technology and information systems enable e-government processes to run more effectively and efficiently, changing organizations' structure, people, processes, and regulations. Information systems (IS) are especially efficient in environments where a great amount of data is available and exact calculations are needed for many different stakeholders. Such an area in the public sector is obviously the area of taxation. These systems gather a great amount of data from different sources, they need to be reliable and, since a multitude of different users within and outside of the public sector are using them, they have to be user friendly. Technology and automation can play a crucial role in bridging these gaps argued by various scholars. For instance, Nisar (2013) argued that recent trends in public taxation stress the need of developing a system of tax assessment and collection that involves internet services. There is an increasing need by the government to collect much revenue by way of taxes to face the increasing financial expenditures budgeted by the country. Adoption of a digital tax filing system by Russia and with Spain's new digital VAT reporting system, technology has shown enormous potential for advanced analytics in tax administration. (Dobell, 2017). The adoption of e-Customs platforms to simultaneously ensure regulatory compliance and to facilitate trade is a major strategic issue for governments and customs administrations worldwide. This largely shows how systems automation and active implementation has improved customs revenue performance for developed countries.

In Kenya, most County governments have been faced with a challenging situation where the total revenues have not been adequate to cater for the budgetary requirements. The situation with respect to revenue maximization by local governments has been an area of concern since the revenue collected is inadequate to achieve the goals of self-dependence and structural transformation at the rural level. Although, there are many revenue avenues, there are some aspects of local revenue administration that has not been operationalized (Manyasi, 2012). In a baseline survey on devolution issued by the Institute of Certified Public Accountants in Kenya (ICPAK, 2014), several counties are generating less revenue than what the already existing local authorities that lay within their boundaries gathered in collectively: raising deep concerns on the capacity of the devolved units in raising own revenue. According to Amin (2013), the counties have weak revenue bases, lack internal audit, have poorly trained personnel, use manual revenue collection systems and some county revenue officers are reluctant to embrace change and this has impacted negatively on revenue collection within the counties. Having this information in mind, this study attempts to fill the knowledge gap by focusing on the automation of revenue collection process and its influence on the customs revenues collected.

*Systems Automation*

Technology has evolved over decades, originating from Greek word techne-meaning art and craft. It represented applied art. It has advanced from the Industrial Revolution era in the 18th century in Great Britain, seeing invention of machines to increase productivity. Following more inventions, trade activities have grown to global levels (Khan, 2018). The WCO Information Technology Agreement (ITA) concluded in 1996 created a great avenue encouraging information technology among member states. It did this by eliminating tariff on IT products. In 2015, at Nairobi, the expansion of the agreement was effected. The ITA covers a large number of high technology products e.g computers, telecommunication equipment, scientific instruments, software including manufacturing and testing equipment (WTO, 2011).

According to Gutierrez, (2006 and 2008), automation of tax administration is derived from the general concept of automation, a concept that describes a process of having machines to accomplish tasks previously performed wholly or partly by humans. KRA (2017) committed to technological transformation in tax administration processes. For instance, in the Financial Year 2014-2015, the Board of Directors was committed to increasing the level of automation in the Authority from 90.6% to 92.4%. Similarly, the 6th Corporate Plan seeks to promote uptake of information management systems to increase efficiency and minimize cost of doing business both to the taxpayer and the Authority (Masese, 2011).

Some of the systems that are associated with the Customs and Border Control operations are Cargo Tracking System, Cargo Manifest which reconciles between lodgements made by the shipping line and the declarants so as to assess any volume variances; Customs Oil Stocks Information System; used for stock monitoring and basis of calculation of volume for petroleum products; Manifest Management System used by shipping lines to declare items brought into the country and the Kenya Revenue Authority Valuation System, a database for creating a basis of valuation of goods and services (Okoth, 2017).

Automated systems have been proven to be capable of introducing massive efficiencies to business processes that can result in increased revenue collections. Application of technological solutions towards the strategic goals for government is a key step towards transforming government into an entity that can keep abreast of the needs, requirements and expectations of today's evolving world. Automation has created an avenue for real-time access, real time visibility of trade activities and real time analytics of global trade statistics. Tax agencies across the globe have used technology to build more effective tax functions as well as meeting the requirement of real time data as per provisions of their various

trade agreements. Tools increasingly used include Robotics Process Automation (RPA), Artificial Intelligence and Blockchain. RPA used software robots as a virtual workforce that work faster than human beings. TaxBots are in use in Europe to transform tax operations and accelerate indirect tax compliance. Blockchain ensures real time financial data is collected and stored for future use, creating transactional transparency. Artificial Intelligence is loaded with international tax laws, tax codes and globally acceptable administrative guidelines (Okoth, 2017).

Developing countries have used system automation to identify anomalies, unusual relationships and patterns using various statistical and data mining techniques. In this way, tax agencies are able to address issues of non-compliance and low revenue collection (Dobell, 2017). KRA introduced Electronic Tax Registers (ETRs) in 2005 to ensure full remittance of VAT by retailers. This was resisted openly through strikes and street demonstrations in major towns in the country. Currently, ETRs are the subject of court battles between KRA and Traders (under the United Business Association). The introduction of Simba 2005 system, an online value declaration customs system, has been strongly resisted, especially after it became evident that some imported vehicles had escaped the net following collusion between importers and customs officials. Systems automation is key in improving tax collection, increasing protection of local products and enhancing productivity of a tax system (Kamau, 2014).

*Customs Performance in Kenya*

Customs performance in Kenya has been under review form the past decade. Tariff code rationalization, reduction of the average tariffs and reduction of the number of tariff bands have formed customs duty reforms in the past. Since the 1990s, reforms have been driven partly by conditions for development aid, preferential trade arrangements and efforts to comply with the World Trade Organization (WTO) regulations. Thereafter, there has been a gradual reduction in both the tariff rates; especially on imported intermediate inputs; and tariff bands. Customs reforms were implemented alongside trade liberalization whose main objective was to enhance trade openness by moving away from the restrictive import substitution strategy towards export-oriented industrialization (Kamau, 2014).

*History of Customs Reforms*

According to the sixth corporate annual plan, KRA intends to provide consistent frameworks for achieving efficiency and effectiveness. Any organization strives to achieve the best, and nowadays pegging on technology is undertaken so as to achieve the most (Saguna, 2003). KRA has undergone the same route. In the early 80's manual processes were used in the almost all the processes. Thereafter, in 1989 the BOFFIN system was implemented which was a semi-automated system which was written in Cobol and runs of Wang Hardware. Due to lack of reliable customs system which was also cited by IMF besides other bodies, KRA sought to go forth and implement the SIMBA system in 2005, a web-based system.

Systems that were running parallel to the SIMBA system were TRADE X, ORBUX, LEUK and PAYBOX. TRADE-X is the Customs clearance management module. ORBUS module facilitates electronic contact between Customs and Customs agents, Ship agents, carriers as well as regulatory government agencies. LEUK provides an interlinking between Customs agents and Shipping line agents. Its currently replaced with the Manifest Management System (MMS). PAYBOX links the banks with the customs department which is replaced with payment gateway system. The SIMBA system came together with many other transformations and reforms from within the institution and this engulfed a whole philosophy of customs reform modernization (Waweru, 2006). After a successful implementation, SIMBA possessed yet a number of loop holes that allowed tax evaders to go away with tax payments. In the same spirit of embracing technological advancement, another set of technological reforms so as match out with newer requirement. The Electronics Container Tracking Systems (ECTS) was adopted. This was both hardware and software. The hardware included seals to be kept in every good that were to be transported on transit to neighbouring countries. This had to be done since a lot of tax evaders were using transit goods for dumping. A valuation database was also implemented in-order to ensure that under valuation of imported goods was eradicated. A strive towards the regional integration of the northern corridor in line with the ECTS that has already taken place in early 2017 and the awaiting of the implementation of the Integrated Customs Management System (ICMS) which will be an upgraded SIMBA is likely to take place by mid this year, portrays the spirit of the organisation of keeping tandem with the technological upgrades in order to meet emerging need but this study will focus on simba system (Khan, 2018).

In 1993, Kenya abolished import licensing requirements and foreign exchange controls being the two main pillars of customs reform. In addition, all current account and all capital account restrictions were lifted between 1993 and 1994. Export compensation was suspended in 1993 to save revenue to Government and forestall the prevalent abuse of the facility by corrupt local manufacturers. Export duties and export licensing were abolished to support export growth and lower bureaucratic delays for exporters. Further measures included the introduction of the manufacturing under bond facility (Moyi & Ronge 2006).

After 1991, these changes included reduction in the range of exempt goods, introducing duties on imports by parastatals, abolishing discretionary exemptions (from 1992), and eliminating exemptions on agricultural commodity aid; except under a situation of a national disaster. As from 1994, the NGOs became the focus of reforms by restricting their

exemptions, by bonding their project aid funded imports, and by insisting on their registration under Income Tax Act to be eligible for customs exemption. Both internal and external customs control programs were put in place during the reform period. These included the re-introduction of the selective examination/rapid release system and re-establishment of the intelligence and investigative functions, strengthening transit controls system, revising the pre-shipment inspection programmed; from 1994, introducing warehouse controls and strengthening cargo control at Mombasa port; from 1996.

Despite there being a zero-rating policy for agricultural sector inputs, there were reversals in 1995/96 towards protection of the agricultural sector (Karingi et al, 2005). A suspended duty of 70% was charged on imports of agricultural products. Custom revenues shrunk by 0.84% annually over 1996-2005. The fall in customs revenue can be mainly explained by the protracted trade liberalization processes under the structural adjustment programme and the regional and multilateral trade agreements. Tax revenue collection should comply with best practices of equity, ability to pay, economic efficiency, convenience and certainty. For any government to match in performance with the growth and expectations of its citizens, it needs to increase its fiscal depth without incurring costly recurring overheads. There is an increasing need by the government to collect much revenue by way of taxes to face the increasing financial expenditures budgeted by the country. This also applies to customs taxes (Karingi et al, 2005).

*Statement of Problem*

Customs mandate are revenue collection, border protection, collection of international trade statistics and trade facilitation (Ayuma, 2018). Collection of revenues has been used as the apex yardstick for measuring the performance of Kenya's customs and border control department (Morini, De'SaPorto, & Inaciao, 2017). Customs and Border Control Department in Kenya has not been performing to the expectations of the treasury. The issue is that the customs department has on several occasions missed its collection targets. For instance, in the year 2016/2017, the department collected 443.5 billion out of the targeted 462 billion. The following financial year 2017/2018, the department missed the target collecting 469.97 billion out of the targeted 484.97 billion (KRA, 2018). This problem is caused by use of conventional methods to customs operations. Missed collection target for the two years alone enough to finance a number of government projects.

The Burden of Customs Procedure report by the World Bank indicates a worsened score by Kenya from 3.2 to 4.10 for the ten-year period to 2017 (World Bank, 2017). Cargo pile up witnessed at both the port of Mombasa and the Inland Container Depot in Nairobi are a clear indication that a planned strategy of advance cargo clearing that was to take off in January 2016 has not fully materialized. Importers continue to incur millions in demurrage charges as a result (Gidado, 2015). All these are against the trade facilitation initiatives that the governments of Kenya and partner states are muting. The trend in collection resonates with enforcement measures implemented since 2017 to improve customs revenue performance; this includes investment in systems.

Few studies conducted in the region and the country have explored the performance of customs and border control department although none has been conducted in relation to how system automation affects customs revenue performance in Kenya. For instance, Isaac & Lilian (2010) conducted a study on automation and customs tax administration, limiting its context primarily to Uganda while Ayuma (2018) conducted a study on the impact of emerging technology on international trade; case study of the three-dimensional printing and customs authorities in East African Community. Gitaru (2017) studied the impact of system automation on revenue collection in KRA, primarily focusing on Simba system; while assessing strategy implementation and performance of customs and border control department of KRA. Wanyama (2017) studied causes of delay in clearance of goods at the port of Mombasa while Kamau (2014) did a case study on the adoption of technology as a strategic tool in enhancing tax compliance in Kenya focusing on large taxpayers.

The KRA annual performance report showed that customs performance continued to be adversely impacted by sluggish import growth with container volumes in FY 2016/17 growing by 6.4 percent in comparison with FY2015/16. Additionally, in the FY 2016/2017 container volumes in H1 recording marginal growth of 2.8% compared to growth of 4.9% in H1 of FY 2016/17. This sluggish growth in imports greatly impact customs revenue performance showing border control issues and reduced trade activities. This study seeks to determine the effect of system automation in customs revenue performance within 2016/2017, 2017/2018, 2018/2019 financial periods. (KRA, 2018).

Targets set for the customs department have not been met as expected this despite the government's investment in tighter enforcement measures, technology being one of them. This study is meant to determine whether customs systems have been beneficial since their inception and whether customs revenue performance in Kenya has improved since government's investment in systems automation.

*1.3 Objectives of the Study*

*1.3.1 General Objective*

The general objective of the research was to establish the effect of systems automation on customs revenue performance in Kenya.

*1.3.2 Specific Objectives*

The specific objectives of the research were:

To determine the effect of scanner technology on customs revenue performance in Kenya.

To determine the effect of cargo tracking system on customs revenue performance in Kenya.

To determine the effect of Integrated Customs Management System (ICMS) on customs revenue performance in Kenya.

*1.4 Hypotheses*

A research hypothesis is a statement which describes an unknown but a tentative answer to what a researcher considers ought to be the possible outcome of an existing problem or phenomena (Kombo & Tromp, 2006).

The null hypotheses was as follows:

H01: Scanner technology has no significant effect on customs revenue performance in Kenya.

H02: Cargo tracking system has no significant effect on customs revenue performance in Kenya.

H03: Integrated Customs Management System has no significant effect on customs revenue performance in Kenya.

*1.5 Significance of the Study*

This study is beneficial to policy makers, managerial practice by customs worldwide and to scholars for theory building.

*1.5.1 Policy makers*

Local and global policy makers may be able to perform legislation on customs and general tax laws. Public revenue collection is an integral component of fiscal policy and administration in any economy because of its influence on government operations. It is the fuel of every government as it is the main instrument through which government funding is ensured. Consequentially, external data base from other government agencies are also improved. These agencies include those of the Registrar of Companies, the Deeds Office, and others.

*1.5.2 Tax Administration*

Tax managers and administrators may use this study in collection and administration of tax revenue; as a form of managerial practice. Automation of tax administration has a positive impact on the effectiveness of revenue collection. It may also be able to incorporate the potential risks to be faced in their operation if automation of revenue collection strategy is not achieved. In addition, automation of process at revenue collection points has a positive impact on the tax clearance time.

*1.5.3 Theory Building*

This study may also add to scholars' stock of knowledge for future reference as well as research. They may be able to use it to equip theories relating to this topic. Researchers may also derive areas requiring further research herein.

*1.6 Scope of the Study*

This study explained how revenue administration's systems automation impacts on effectiveness of customs revenue collection, focusing on how revenue administration's systems automation impacts on effectiveness of compliance monitoring, tax-payer audit, refunds and Filling of tax returns. Its geographical scope was the Kenya customs department and clearing and forwarding companies in Nairobi. Moreover, emphasis was on how revenue administration automation impacts on effectiveness of border management, transit management for both vehicle units and containerized cargo and interstate communication. Lastly, it underlined how customs revenue administration automation influences efficiency of export management, valuation of imports, bank payments, verification of imports and exports, goods declaration, and the general management of transit cargo. The time scope for the study was the financial year July 2017-June 2019.

## 2. Literature Review

There are several research studies that have been conducted on the effects of systems automation on customs revenue performance. This section discusses the review of concepts, theoretical review, empirical review, the conceptual framework and summary of previous studies. The review of concepts defines and briefly describes the independent and dependent variables of this study. The theoretical review explains the interrelated concepts and theories supporting this study. The empirical review discusses previous studies and the existing information on customs revenue performance and technology from the global view. The summary of previous studies discusses research papers relating to this study, the conceptual framework provides an analytical presentation of the independent and dependent variables; with the critique of the study evaluating both positive and negative ideas of previous authors of current and previous research papers.

*2.1 Review of Concepts*

Thalheim, Bernhard (2011) describes a conceptual model as a schematic description of concepts or a phenomenon of an origin that accounts for known phenomenon of the origin. It is used to create an abstract of an investigation and show the relationship between variables in a study.

*2.1.1 Concept of Systems Automation*

Gidisu (2012) defines systems automation is the use of control systems and information technologies to reduce the need for human intervention in production of goods and services. When applied correctly, systems automation facilitates for complex operational processes to be done efficiently and accurately. Three customs tax systems formed the independent variables of this study. They were Scanner Technology, ICMS and Cargo Tracking System. Scanner technology is a non-intrusive cargo verification technology used in passage scanning at the ports of entry, measured by the number of cargo cleared/scanned from import, transit and export scanning (Peterson, 2017). Cargo Tracking system is a real time monitoring system of cargo from offloading point through an E-seal fitted on outbound trucks with transit goods (Freeman, 2017); showing effectiveness of border management, containerized cargo transit management and motor vehicle transit management. ICMS is an automated

system that synchronizes all customs administration functions in control procedures over import and export of goods (Trademark East Africa, 2018); affecting valuation, verification and declaration of goods.

*2.1.2 Concept of Customs Revenue Performance*

IEA (2017) defines customs revenue performance as a financial management system used to measure customs revenue by quantifying, optimizing marketing processes and comparing estimates to targeted revenues to gain a business or economy's financial position. Montagnat-Rentier (2019) defines Customs revenue as customs duties and indirect taxes on imports such as value added tax and excise duties; collected by customs authorities within a specific customs territory. The dependent variable in this study was customs revenue performance measured by revenue collection, border control and trade facilitation prospects of the Kenyan customs department.

*2.2 Theoretical Review*

The theoretical review helps establish already existing theories and the relationship between them. The theories within which automation and technology are inclined to are General Systems Theory, Technological Determinism and International Trade Theory.

*2.2.1 General Systems Theory*

The study into systems automation was guided by the General Systems Theory. This theory was founded in 1954 by Ludwig von Bertalanffy and Kenneth Boulding in Vienna, Austria in the pre-World War II era. Ludwig Bertalanffy introduces a system as a new scientific paradigm contrasting the analytical, mechanical and classical science. It gives an abstract of reality with focus on the general properties of systems by simplifying and incorporating its multidimensionality. It deals with the most fundamental concepts, properties and aspects of systems. (Mesarovic & Takahara, 1975). The main assumption of this theory is that all systems have a similar characteristics regardless of their internal nature (Skyttner, 2001). It cuts across most disciplines while finding general principles valid for all systems; focusing on interactions. A core principle of the general systems theory is the distinction between open, isolated and closed systems. Open systems exhibit exchanges of energy, people, matter and information with the external environment, contrary to the isolated system that no such exchanges take place. Closed systems only allow exchange in energy. General systems theory has evolved into open systems theory, viable systems model and viable systems approach (Skyttner, 2001).

The Open System Theory focuses on relationships between the organizations and the environment in which they are involved. This focus reflects on the organizations' adaptability to changes in environmental conditions (Boulding, 1956). The assumption in this theory is that companies are able to process information on specific environments to show adaptability skills to shift the contextual conditions. In this case, an organization is seen as a system created by energetic input-output where the energy coming from the output reactivates the system. Skyttner (2001) further explains that organizations are socio-technical systems, emphasizing the two main components of the firm seen as a system: a social component (people), and a technical component (technology and machines).

The Viable System Model exhibits a system as an entity, adaptable for the purpose of surviving in its changing environment (Von Bertalanffy, 1972). It is described as an abstracted description applicable mostly to autonomous organizations. Further, it is the study of how actions cause changes in an environment as far as systems are concerned, allowing its adaptability to new conditions. This arises since systems and the environment have different degrees of complexities, each in its own right. Viable systems model focuses on conceptual tools that helps one understand the organization and its systems and further, their integration. This way it can redesign the former through change management, integration implementation procedures and continual evaluation of essential functions of system implementation, control, coordination, security and policy making (Kast & Rosenzweig, 1981).

Lastly, the Viable System Approach explains a new interpretation of consolidated strategic organizational and managerial models, fitting in sub-systems and supra-systems. While Sub systems focuses on the analysis of relationships among enterprises' internal components; Supra-systems focus on the connections between enterprises and other influencing systemic entities in their context. (Skyttner, 2001)

General systems theorists agree that general system theory provides a structure or framework of systems on which to lay particular principles towards a coherent body of knowledge. There are three main aspects to this theory: systems exploration, systems technology and system philosophy. (Kast & Rosenzweig, 1981). In the first aspect, explores the theory of systems in various sciences. It is commonly referred to as system sciences. Systems technology shows the problems arising in modern technology and society. Systems philosophy explains the re-orientation of thoughts and world views. Katz & Rosenweig (2017) further explains that the general systems theory provides a unified set of concepts that are applicable to most areas of science including science, finance, philosophy and economics. A distinguishing characteristic of systems theories is that they developed simultaneously across various disciplines and that scholars working from a systems theory perspective build on the knowledge and concepts developed within other disciplines.

Its relevance to the study is on customs tax systems in general, with greater focus on the KRA as an organization. This assists to further access ever evolving automation system processes with continual review and modification to incorporate local and regional requirements.

*2.2.2 Technological Determinism Theory*

Technological determinism is a reductionist theory that aims to provide a causative link between technology and a society's nature. It was introduced by a German Economist: Karl Marx. Technological determinism is manifested at various levels; initially starting with the introduction of newer technologies introduces various changes and at times these changes can also lead to a loss of existing knowledge as well. It creates a notion that technological change and development is inevitable, and that the characteristics of any given technology determine the way it is used by the society in which it is developed. The concept of technological determinism is dependent upon the premise that social changes come about as a result of the new capabilities that new technologies enable (Bimber, 1990).

Merritt (1996) also defines technological determinism as the belief in technology as a key governing force in society. An alternative weaker view of technological determinism says that technology is serving a mediating function because despite it leading to changes in culture, it is actually controlled by human beings. When control of technology slowly reduces from being in the hands of few human beings, it passes completely into the control of technology itself. In this case, it is referred to as autonomous technological determinism. Another critique of technological determinism is that technology never forces itself on members of the society. Given the proliferation of new technologies in modern capitalism, the Technological Determinism debate is continually revisited.

Mackenzie & Wajeman, (1999) dismiss the theory of Technological Determinism as mere "technological politics" that has fascinated historians, philosophers, and political scientists. Technologies always embody compromise. Political, economics available raw material all of these are thrown into the melting pot whenever an artifact is designed or built. Technologies do not, we suggest, evolve under the impetus of some necessary inner technological or scientific logic. They are not possessed of an inherent momentum. If they evolve or change, it is because they have been pressed into that shape. Additionally, William & Edge (1996) hold the same view and posit that organizational, political, economic and cultural factors do influence the design and implementation of technology. Chandler (2000) states that other than technological issue other factors have driving forces and some including economic pressures, political issues, educational background, general attitudes amongst others.

Technological determinism has evolved over the years to Diffusion Theory and Instrumentalist theory. The Diffusion of Innovation Theory was developed in 1962 by E.M Rogers. Surry. D. (1997) explains how, over time, an idea or product or service diffuses or spreads through a specific social system or population. The end result of this diffusion is that people, as part of a social system, adopt a new idea, behavior, or product. This means that technological and other advancements spread throughout societies and cultures, from introduction to wider-adoption. The diffusion of innovations theory seeks to explain how and why new ideas and practices are adopted, with timelines potentially spread out over long periods. This way, marketers and new companies know how to navigate a market and assess trends (Lamorte, 2019).

The Instrumentalist theory rejects the assumption that superior products and practices will automatically be attractive to potential users/ system adopters. They view the end user as the primary force for the technological change. Segal (1994) states the importance of adopter based theories when he writes "all structures and machines, primitive or sophisticated, exist in a social context and, unless designed for the sake of design itself, serve a social function (Surry, 1997). In the view point of Technological determinism, technology exists outside of society and follows an internal logic (Burmeister, 2017). Technological Determinism supports Scanner technology, ICMS and Cargo Tracking System showing how their implementations are made and diffused throughout a specific timeline. Its relevance to the study is that technological uptake may be embraced with the end user as the primary force to the changes. It explains further why societal values have any effect on technological implementation on customs revenue performance.

*2.2.2.1 Technological Acceptance Theory*

Technological Acceptance Theory is a specialized form of Theory of Action towards technological implementation. It describes the relationship between users' beliefs viz a vis their behavioral intentions; combining attitude to determined intention. This theory was created by Davis et al in the 1989 and was used to model user acceptance of technology. It explains that users are highly likely to use technology when they perceive it will improve job performance and is easy to use. According to Louho, Kallioja & Oittinen (2006), technology acceptance is attributed to how people accept and adopt some technology for use. User acceptance of technology has further been explained as the absolute willingness of a user group to use or implement IT for the tasks it is designed to support (Dillon, 2001). As a result, user acceptance can be viewed as a function of user involvement in technology use. Technological Acceptance can be further described as the critical factor in determining the success or failure of any technology and acceptance has been conceptualized as an outcome variable in a psychological process that users go through in making decisions about technology. According to Oye, Iahad and Ab-Rahim (2012), technology has little value, unless it is accepted and used. Suvama and Godavari (2012) also explains the importance of understanding technology acceptance it is key since access to the new technologies is the increase in the supply of information.

The Technological Acceptance theory has evolved overtime. It first started with the Cognitive Dissonance

Theory; formulated by Festinger (1957) to explain how discrepancies between one's cognition and reality change the person's subsequent cognition and behaviour (Bhattacherjee, 2001). It explains a process of an individual's behavior where a user's has a preexistent belief about technology, has experienced its usage overtime and his post usage perception. Then the Innovation Diffusion Theory (IDT) of 1995 came to describe both individual and organizational level of analysis to show how innovation moves from invention to its widespread use. (Dillon & Morris, 1996).

According to Goodhue and Thompson (1995), Task Technology Fit Model later came to add that technology has greater impact if its capabilities match the task the user ought to perform. This model consisted of eight factors: quality, locatability, authorization, compatibility, ease of use/training, production timeliness, system reliability and relationship with users. (Bhattacherjee 2001) in his explanation of the Expectation Disconfirmation Theory (EDT) shows how and why user reactions to technology changes overtime; with four main reasons: expectations, performance, disconfirmation, and satisfaction. Kriponant (2007), in the Theory of Planned Behaviour (TBH) perceived importance of one's availability of skills, resources, and opportunities to achieve outcomes.

The Theory of Reasoned Action was the first theoretical perspective to gaining user acceptance. This theory maintains that individuals would use computers if they could see that there would be positive benefits (outcomes) associated with using them. The Technological Acceptance theory was developed from the Theory of Reasoned Action. Further, the theories evolved to the Decomposed Theory of Planned Behaviour (DTPB), that suggest decomposing attitudinal belief into three factors: perceived usefulness (PU), perceived ease of use (PEOU), and compatibility; Combined TAM and TPB (C-TAM-TPB) adding the influence of social and control factors; the Technology Acceptance Model (TAM2) adding cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceived ease of use) to Technological User Acceptance Theory. Lastly The Unified Theory of Acceptance and Use of Technology (UTAUT) explains four determinants of intention and usage as: performance expectancy, effort expectancy, social influence and facilitating conditions.

Its relevance to this study is that even when technology is expected to offer efficiencies in processes, it may not be embraced to its full potential and sometimes may have resistance from users. It is therefore important to understand the influence of citizen's acceptance of e-government services has since it may affect potential cost saving and choice in investment in system. Further, Technological Acceptance theory supports border management and trade facilitation amongst all stakeholders in the region. It is key in decision making processes regarding technological implementation and future changes, for greater inclusivity of all customs stakeholders. (Bhattacherjee, 2001).

*2.2.2.2 Social Determinism Theory*

This theory is also a form of reductionism. Social determinism was first studied by Emile Durkheim (1858 - 1917), a French philosopher considered as the father of the social science. According to theory, social interactions and constructs alone determine individual behavior; as opposed to biological or objective factors. This is because technologies are continually reinterpreted by users and given new, often unexpected trajectories. It further perceives technology as a result of society within which it has been developed for, engaging that historically, technological developments were born for a social need of a political, military or economical nature. (Green, 2001).

An extreme social determinist position relating to the decoding of texts; more specifically, audience determinism; would reduce individual decoding to a direct consequence of social class position. Social determinism perceives technology as a result of the society in which it is developed. Contemporary media theorists that have provided persuasive accounts of social determinism, include Leila Green. Social determinists perceive that technological development is not only determined by the society in which it occurs, but that it is inevitably shaped by the power structures that exist in that society. Green explains that technology is always developed with a particular purpose or objective in mind, recognizing that it is developed to help those capable of making good use of its invention or creation (Green, 2001). In contrast to technological determinism, social determinism considers technology to be an integral part of society, therefore losing its autonomy (Burmeister, 2017).

An example of social determinism is in an athletic scenario where by creating a social construction of reality, societal forces directly create a hegemonic control over the future of individuals who feel like the social construct is natural and hence unchangeable. Their actions become based in the context of their society so that, even if they possess an innate talent for a sport, if the social construction implies that their race is unathletic in general, or their nation or state does not produce athletes, they do not include the possibility of athleticism in their future. Their society has successfully determined their actions. Thus social determinists perceive that technological development is not only determined by the society in which it occurs, but that it is inevitably shaped by the power structures that exist in that society. Social determinism evolved to political determinism, environmental determinism, linguistic determinism and more. In political determinism, a political party's agenda by virtue has set social rules so that the individual considers the party's agenda to be morally correct, an example being the 2010 G20 summit riots in Toronto. The media, controlled by corporations and the governments with agendas of their own, publicizes the riots as

violent and dangerous, but the goal of the rioters, to rebel against those whose position in power enables them to abuse the system for personal gain, is lost because the focus is on the violence. The individuals' views on the subject are then directly influenced by the media and their reactions are predetermined by that social form of control. (Colaguori, 2011)

The relevance of this theory is on the effect of systems automation on its users/ implementers and in their behavior towards technology and how persuasive technology is to the society. This is based on their education, social interactions and cultural expectations. This theory supports human behavior relating to customs declaration, border control and valuation of goods. This showing the self-declaration prospects, indulgence in vices such as corruption and misdeclaration while disguising goods in transit.

*2.2.3 International Trade Theory*

The study into customs revenue performance was guided by the International Trade theory. This is a microeconomic theory that deals with the structure, causes and volumes of international trade: number of exports and imports from one country to another; incorporating the gains and revenues attributable to these transactions and how both gains and revenues are distributed (Sen, 2010). It also takes into account determination of relative prices of goods in the global economy and specialization prospects for greater competitive advantage. This theory explains tariffs, quotas and other barriers to trade while also addressing factors of production and consumption. A key assumption of this theory is the existence of balance of payments (Gandolfo, 2014).

The foundations of international trade theory are summarized in 3 main models: Classical Theory, Heckscher-Ohlin theory and Neo-classical theory. The classical theory, also referred to as the Torrens-Ricardo theory, originated from David Ricardo in 1817. It affirms that the fundamental variable explaining existence and pattern of international trade is technology. They also explained that the difference in comparative costs of production reflects differences in production technique.

The Heckscher-Ohlin theory stresses the differences in factor endowments between different countries. It is a model exhibiting are two countries, two primary factors of production and two final goods (Sen, 2010). It was first examined by Heckscher in 1919 and later Ohlin in 1933 and further by Samuelson P.A from his contribution to the diffusion of this theory. The key aspect is endowment in a factor or another, specifically, that countries are endowed with factors of production different in proportions. This fact causes relative marginal cost of production, hence application of the Heckscher-Ohlin model theorem. This theorem considers that each country which uses the country's more abundant factor more intensely (Gandolfo, 2014). Unlike the Heckscher-Ohlin model, the Ricardian model isolates differences in technology between countries as the basis for trade. In the Heckscher-Ohlin theory costs of production are endogenous in the sense that they are different in the trade and economically independent situations, even when all countries have access to the same technology for producing each good (Zhang, 2008).

The neo-classical theory is the proposition that real GDP per person grows because technological change induced the level of savings and investments that makes capital per hour of labour grow (Parkin, 2005). In the neo-classical theory, the rate of technological change influences the rate of economic growth, and in the context of this study, customs revenue performance. (Toney, 2014)

Toney (2014) also explains that the international trade aligns the key features of export, import and transit costs incorporating comparative advantages experienced by different countries that allows there cost of production and overall revenue performance to grow (Anderson, 2016). It addresses the key subsets of the dependent variable (customs revenue performance): revenue collection, border control and trade facilitation by factoring in trade barriers, tariffs like revenue and protective tariffs and import quotas.

*2.3 Empirical Review*

In the customs field, studies by different researchers have been conducted on scanner technology, Cargo Tracking System and ICMS and their influence on customs revenue performance. All the studies aimed at improving customs revenue collections especially in developing countries, facilitating trade while ensuring border control is maintained.

*2.3.1 Systems Automation and Customs Revenue Performance*

Automation is the use of control systems and information technologies to reduce the need for human intervention in production of goods and services (Gidisu, 2012). It aids the conduct of complex processes accurately, efficiently and effectively (Hollingum, 2006, 2007) and Gutierrez (2008) emphasize the appropriate application of automation to tax administration. Automation of tax administration allows tax data entry, automated processing, computation and analysis as well as automatic production of tax reports and feedback required for control and risk management purposes Additionally, Holniker (2005) explains automation of tax administration includes developing powered computer programmes to carry out tax assessments and computations; and to determine tax dues at high levels of speed and accuracy.

According to Katsuya-Takii (2003), automation is a catalyst and stimulus for customs modernization. Customs automation has been part of the overall tax administration reform (Rao, 2000) and modernization programme (Greenwood et al., 2008 & Gutierrez, 2006). The main functions of automation of customs administration include: controlling crossborder flow of goods, ensuring compliance with government rules and regulations, collecting of the duties and taxes due according to the national customs tariff and tax code, and protecting a country against the importation of

goods and materials intended for illegal purposes (Booze et al., 2007). Customs automation makes extensive use of computer systems consisting of comprehensive and integrated software packages that Greenwood et al. (2008) describes as cargo control, to monitor all movements of importation, transit and exportation, and ensure that all goods are duly cleared before release; and declaration processing, to capture and process data for duty and revenue collection. Swindley (2007) adds payment and accounting, to register and account for payments by importers and exporters; and risk management, to select those consignments bearing higher risks, concealing duty and tax noncompliance, illegal importation of drugs or materials aimed for terrorist activities.

The European Commission is working more actively to implement IT in the field of customs control. The European Parliament and Council decision of 2008 to create a Pan-European electronic customs system that provides an efficient paperless environment for customs and trade—a CIS—is the response to this challenge. The CIS is meat to boost communication within the EU customs union and its stakeholders- with its aim being to increase the competitiveness of economic operators acting in the EU member states, to a reduction in the costs of compliance with the legal requirements, and to an increase in security at the borders of the Union. (Antov, 2017).

According to Subidey Togan (2012); In Turkey, the first phase and pilot implementation of the BILGE system started in 1998 at Istanbul. In August 1999, traders at Atatürk Airport began using electronic data interchange (EDI) software supporting BİLGE. To date, almost all of the customs offices have been automated, and a very large percentage of all customs transactions are carried out electronically. In 2001 the project GÜMSİS (Security Systems for Customs Checkpoints) was launched with the objective of establishing watch and evaluation systems in customs collection district in order to prevent effectively illegal trafficking of goods, vehicles and people; to prevent false declaration of quantity and values of goods; and to facilitate legal trade. Under this project, X-ray scanners and nuclear radiation detectors have been installed at several locations within the country. (Dramod, 2004).

In 2003 a security system for customs borders was started with the aim of improving transit traffic based on a vehicle tracking system using license plate scanning. During subsequent years Turkey increased its use of X-ray devices, Closed Circuit TV systems, License Plate Scanners and Vehicle Tracking Systems, considerably helping to detect more drugs and smuggled goods over time. In 2004 a new project started on customs information technology (IT) systems the objective of which is the establishment of connection of BILGE with the Common Communication Network and Common System Interface (CCN/CSI) systems, National Customs Transit System (NCTS), Integrated Tariff of the European Communities (TARIC) and other related tariff systems with a view to harmonising the IT systems of TCA with the EU systems. (Togan, S. 2012). The South African Revenue Services (SARS) has implemented Mobisite, a mobile version for filing returns on mobile phones. A second initiative is the Help-You-eFile facility that provides taxpayers calling the Contact Centre with live assistance. This enables a SARS agent to view the same screen as the taxpayer to assist in identifying the problems they are experiencing. This is an example of a flagship initiative by The South African Revenue Authority that has increased its tax base from taking advantage of technology. (Antov, 2017).

(Teera, 2002) examined the tax system and tax structure of Uganda to investigate the factors affecting revenue collection in the country. He used the time series data of the period 1970 to 2000 and estimated a model. His results showed that agriculture ratio, population density and tax evasion affect all type of taxes. GDP per capita showed the surprising negative sign. Tax evasion and openness (as measured by import ratio) showed the significant negative impact. Aid variable showed positive sign since aid in Uganda always supported imports especially raw material so not surprisingly. Modern logistics have increasingly vouched for technological based clearance processes; including use of Radio Frequency Identification Technology. Since the need for a logistics-customs clearance services platform worldwide, Kenya has since embraced this measure to provide efficiencies in the harmonization and simplification of customs processes along with increasing revenue collection (Deng. et al., 2010). According to Parliamentary Budget Office (PBO) Policy paper (Series No. 2/2010) on revenue potential in Kenya, there is need to put more efforts to ensure that there is adequate and sustainable exploitation of the available opportunities to raise resources domestically. Despite the country having a large potential and opportunities to raise resources, the low compliance levels and tax evasion creates a narrow tax base and high enforcement costs. Taxes are collected from easy-to-tax sectors as public wage earners while enforcement of collection among small business enterprises is difficult. Tapping into this group of taxpayers can significantly increase revenue collection (Masese, 2011).

Customs systems automation have resulted in increased transparency in duties assessment and valuation, reduced clearance time and data sharing amongst regional bodies. Both revenue authorities and the trading community have attained direct and indirect saving from systems automation including synchronization of procedures, faster electronic lodgment of declarations using Direct Trade Input (DTI) and reduced physical examination of shipments. More revenue has been collected from customs duties from the automated calculation of duties and the uniform application of regional and global customs laws. Systems automation has allowed timely data sharing for foreign trade statistics. Cost implications vary

from country to country based on the initial reforms programmes, ICT systems and technological applications used in their customs administration units. These vary from hardware, software, training requirements and ICT infrastructure in the country. Countries with efficient goods markets are well positioned to produce the right mix of products and services given their particular supply-and-demand conditions, as well as to ensure that these goods can be most effectively traded in the economy. Healthy market competition, both domestic and foreign, is important in driving market efficiency, and thus business productivity, by ensuring that the most efficient firms, producing goods demanded by the market, are those that thrive (Maree, 2018).

*2.3.2 Scanner Technology and Customs Revenue Performance*

Scanner technology uses a non-intrusive and non-destructive mode of inspection in a bid to identify goods in transportation systems. They use an x-ray imaging of goods in a container or tanker (Dobell, 2017). Port-of-entry delays due to clearance procedures are directly related to trade policy as well as customs and port infrastructure (Lewis, Erera, Nowak, & White-III, 2013). This shows that any shortfall on this affects big and small companies alike, not forgetting the regional blocks goal of intra and inter-regional trade facilitation.

In Korea, the Korean Customs Service provides a swift clearance process for e-commerce goods. For example, according to data extracted from the automated e-clearance system (UNIPASS), on average it takes only 4 hours to complete the Customs clearance of expedited cargo under the list clearance procedure. At present, X-ray inspections of expedited cargo and international mail are conducted by the KCS on a 100% basis. Postal operators and couriers are obliged to send information requested for clearance electronically, in order to permit the preadvice and possible pre-clearance of items. To do so, postal operators use the electronic version of the CN 22 and CN 23 forms developed by the WCO and the Universal Postal Union (UPU). All information on the packages selected for inspection, such as the X-ray image and the data contained in the form used for clearance, is loaded on the computer screen of the Customs officer handling the inspection. Technology is constantly being revolutionized. In 2017, Singapore embraced a new advanced scanning system: Passport System; that goes from human inspection of a projected image to materials identification. Passport System identifies guns, drugs and other contraband based on their atomic number - a measure of their density. But it still uses high-energy X-rays in its scanning process. (Freeman, 2017). Chalfin (2004) also explained the role of border scanning technology on the sovereignty of customs service in Ghana, providing opportunity for surveillance of state agents and authorities in execution of their duties. In case study of Nigeria, Durban, the Suez Canal and Mombasa, Gidado (2015) studied the implications congestion in ports as a phenomena associated with delays, queuing and extra time of voyage and dwell of ships and cargo at the port, which always occur with unpleasant consequences on logistics and supply chain. This creates extra costs, loss of trade and disruption of trade and transport agreements.

Wanyama (2017), in the study on Kenyan customs, points that lack of smooth flow of documentation process and operational inefficiencies were found to be contributing factors to the delay in the clearance of goods with corruption as a major cause. Number of officers deployed at the verification section would not match the demand of the work as volume of goods had increased and therefore, the laid down number of containers that every officer is supposed to verify, cannot reduce congestion at the port.

Use of scanner technology affects revenue collection from identification and proper classification of goods under correct duty payable. It ensures border security is maintained by detecting contrabands and prohibited goods. It significantly reduces cargo clearance time. (MRA, 2018). The real bottleneck in the existing systems, is if you find an anomaly, your only option without materials identification is to unload the entire trailer, costing a lot of time and money to do so (KRA, 2018).

*2.3.3 Cargo Tracking System and Customs Revenue Performance*

Cargo Tracking System involves fitting of an e-seal with a 60-day power capacity, monitored under the GPRS platform, on outbound trucks with transit goods. The cargo is expected to move along the gazette geo-fenced route, failure to which real time detection is done from the control room and a rapid response team deployed, are prompted to intervene. This real time monitoring of cargo from offloading point is made possible by Radio Frequency Identification (RFID) and GPS/GPRS technology (Freeman, 2017). The World Trade Organization attributed that the old Electronic tracking system used multiple vendors to install the tracking and which can only be trace up to the border point.

Gidisu (2012), in his case study of Ghanaian Customs department explains that the management of customs has implemented an electronic tracking and monitoring system in its transit operations to reduce delays and prevent revenue leakages associated with Transit operations; this initiative undertaken in collaboration with the private sector stakeholders. In Uganda, the Regional E-cargo tracking system project was initiated in 2013 through to 2016 at the value of $US 3,600,000. It was introduced to curb major delays arising from physical escorts, which are considered a major non-tariff barrier in the region. URA further indicates that physical escorts in Uganda have the effect of increasing the transit period from 1 day to 3 - 4 days, effectively resulting into an estimated increase in transport costs of about $400 -

$500, the additional cost paid as a result of the increase in transit period (Okoth, 2017).

In 2017, Kenya joined the East African community in embracing the Regional Cargo tracking system which allowed three countries to monitor the cargo in real time hence limiting the opportunity for any collusion to evade tax. went a long way to safeguard Kenya as a major transit point for cargo in this region (Okoth, 2017). Regional Electronic Cargo Tracking System or RECTS as it is commonly referred to, as an initiative of the Kenya Revenue Authority in partnership with the revenue administrations of the partner states of Uganda and Rwanda and seeks in the mid-term, to rope in all EAC states and outlying countries in the region. The system enables real time tracking of transit cargo from the port of Mombasa to its final destination through an online digital platform (KRA, 2018). In April 2018, the Transit Business Module was at its acceptance testing stage with KENTRADE, Shipping agents, the Kenya Ports Authority and container freight stations (Hollaway, 2008).

*2.3.4 ICMS and Customs Revenue Performance*

This system automates all functions of customs administration, including the entire series of activities carried out by customs officers in the control procedures on the import and export of goods. Its main aim is connecting the internal and external systems to hasten cargo clearance. This is facilitated by pre-arrival processing of cargo as well as use of Authorized Economic Operators. According to Sani (2009), systems automation helps to improve revenue collection. This is because they are based on the electronic payment system through applications such as toll revenue collection, automatic fare collection, bus revenue system and parking system. Additionally, service providers have better audit trail since all transactions captured can be detailed by time, whom and where. This prevents revenue loss through abuses as all moves are recorded electronically. Automation also allows huge transactions to be handled efficiently.

Customs automation makes extensive use of computer systems consisting of comprehensive and integrated software packages which Greenwood et al. (2008) describes as cargo control, to monitor all movements of importation, transit and exportation, and ensure that all goods are duly cleared before release; and declaration processing, to capture and process data for duty and revenue collection. Swindley (2007) adds payment and accounting, to register and account for payments by importers and exporters; and risk management, to select those consignments bearing higher risks, concealing duty and tax noncompliance, illegal importation of drugs or materials aimed for terrorist activities; statistics and reporting, to extract data for dissemination of foreign trade statistics and to generate management reports for customs for efficient communication between customs, traders, and other government agencies. The overarching benefit is the direct and indirect reduction in administration cost and increased effectiveness in collection of customs revenue, this since customs administration leads to increased collection of duties and taxes due to the uniform application of laws and regulations through the automated calculation of tax due; and built-in security. According to Ward and Dietmar (2007) automation brings about benefits such as faster release of cargo passing through customs clearance; simpler procedures and documents, based on international standards; reduced physical examination of goods; separation of payment of duties and taxes from physical clearance of goods and faster electronic lodgement of customs declarations, using Direct Trader Input or other on-line connections. Holniker (2005) highlighted other advantages as: reduced customs auditing of documents.

This efficiency was not applicable in the previous system; Simba system. Simba system ran from 2005 to 2014, under sub-systems and required multiple points of authentication for users. This took more time for a transaction to take place. ICMS was envisioned to change this fact by reducing imports and exports clearance by at least 60 per cent (KRA, 2018). ICMS is regarded as an important component of internal control in Kenya as is the Bulgarian Integrated Customs Information System. Its access is authorised on the basis of specific competences of customs officers with respect to its separate modules, and records are kept about which actions have been performed, when they were performed, and by which employee. All EAC member states, except Kenya, have; for a long time; been using the Automated System for Customs Data (Asycuda). The ICMS is now able to exchange Customs declaration information with Asycuda (TradeMark East Africa, 2018).

ICMS has created an opportunity for expanded tax payment channels reducing the costs of doing so. It has spearheaded reengineered customs processes to align and harmonize them through such actions as enhancing AEO programmes and creating documents management systems. Its implementation is in phases (KRA, 2018). The ICMS solution comes with best practice features including auto-upload of cargo import data from shipping manifest to prevent import falsification, auto-exchange of information with Itax to counter non-compliant traders and a virtual electronic auction platform to make Customs cargo auctions accessible to all (Kenya Revenue Authority, 2018). The ICMS Implementation Roadmap shows it has achieved several milestones since its inception. They include accompanied baggage clearance at baggage hall module, Air Manifest, Single Window, Document Management system and continuous training of internal and external users.

*2.4 Critique of the Study*

Automation of customs processes and generally trade procedures comes with criticism and ultimate favour for the conventional approach to tax operations. Systems automation creates a risk of replacing human capital for tools such as

TaxBots and other machines. Nationalism along with rigid political and trade policies subjects Kenya to unsynchronized trade activities with its trade partners. Moreover, systems automation requires a large capital allocation by the states and their respective counties to initiate and sustain it (Dobell, 2017). The empirical studies cover Scanner technology, ICMS, Cargo tracking systems individually making the scope to be limited. Policy development requires a wider consideration of factors affecting the very policy area which renders the studies limited in scope.

The report on WCO Private Sector Consultative Groups (2018) discusses why technology in excess though good, cannot change many trading environments. It can only boost existing positively steered states. Moreover, though technology helps with data sharing, countries still regulate information for fear of unfair international competition (Maree, 2018).

*2.5 Summary of Previous Studies and Research Gaps*

A similar study in Bulgaria; on the role on technologies in the development of customs control in the Republic of Bulgaria explains that European Commission is increasingly and actively working to implement information technology in customs control. A Pan-European electronic customs system was launched to build a robust communication system between customs offices in the union and other stakeholders (Antov, 2017). Rehman, Esichaikul, & Kamal (2012) in their case study of Pakistan explained three variables: awareness, trust in the internet and trust in the government caused adoption of e-government in Pakistan, this showing conceptual gaps. The methodological gap is exhibited in Ghana's case study by Gidisu (2012) who used descriptive research design.

According to Antov (2017), Bulgaria employed various systems to this effect: New Computerized Transit System, Customs Information Systems for Exports, Bulgarian Integrated Customs Systems and Import Control System. The European Commission have set high standards that Bulgaria have to follow to qualify for preferential treatment as part of its customs union, guided by the Customs Code. (Antov. 2017). Gidisu (2012) did a case study on automation system procedure of the Ghana Revenue Authority's customs division on the effectiveness of revenue collection. The contextual gap in these studies were their concentration on Bulgaria, Pakistan and Ghana. Dobell (2017) explains the use of scanner technology as improving border security, depicting a contextual gap in his premise from its non-practicability to Kenya owing to differing variables to customs operations. These formed the basis for this study.

*2.6 Conceptual Framework*

A conceptual framework is an interconnected set of ideas or theories about how a particular phenomenon functions or is related to its parts (Svinicki, 2010). This schematic description, in form of a diagram, helps one visualize the theorized relationships. (Sekeran & Bougie, 2011). It serves as the basis for understanding the causal or correlational patterns of interconnections across the observations and their interpretations. The study conducted a multiple regression analysis in measuring the correlations between different aspects of scanner technology, ICMS and cargo tracking system and the performance of customs department in Kenya.

Figure 2.1 identifies four major systems which are employed by revenue authorities in their operations with the view of aiding in revenue collection. They include: ICMS, Cargo Tracking System and Scanner Technology. Customs revenue performance will be measured through the actual amount of money collected, effectiveness of border controls by time taken to clear cargo and the transit system efficiencies with regard to trade facilitation.

**3. Research Methodology**

This section deals with the designs and methods of the study. Research methods describe tools and techniques used in data collection. It comprises of research design, target population, sampling technique, data collection, data analysis, presentation and data reliability.

*3.2 Research Design*

A research design is a plan or structure which gives a solution to a problem by answering research questions (Cooper & Schindler, 2010). This study used explanatory research design. Yousaf (2018) explains explanatory research design as one that uses causal relationship between variables to study the effect between one variable and another. Explanatory research design allows a researcher to understand a certain subject while allowing them find out how and why things happen. It accounts for descriptive information, building on descriptive research and goes beyond description by explaining reasons for a phenomenon that a descriptive study only observed (Yousaf, 2018). The researcher therefore uses theories or hypotheses to represent forces that caused occurrence of a certain phenomenon. Further, a researcher focuses on analysis of a certain problem to explain patterns of relationships between variables. Explanatory research design is instrumental in identifying reasons behind a wide range of processes while showing the impact of the changes on existing processes, norms and cultures (Boru, 2018).

This study required the careful analysis of the current systems automation processes in the customs department under the Kenya Revenue Authority while showing the impact of systems automation in customs revenue performance. It required accurate and systematic description of facts and characteristics of the population of interest with an aim of discovering associations and relationships among selected variables (Boru, 2018). It will use structured questionnaires, interviews and surveys.

*3.3 Target Population*

A population is a group of objects or individuals that have the same form of characteristics (Mugenda & Mugenda, 2003).

The target population of this study was composed of registered clearing and forwarding companies officials and customs officers in Nairobi. According to KRA and KIFWA, there are 892 registered and licensed clearing and forwarding firms in Kenya. The size of the target population was 902 with 892 clearing and forwarding agents and 10 customs officials located in JKIA and ICD, where ICMS has been fully rolled out. Stratified sampling technique was used to arrive at the target population above.

*3.4 Sample Size*

A sample is a part of the target population, carefully selected to represent that population (Dell, Holleran, & Ramakrishnan, 2002). This study assumed a 95% confidence interval and error level of 0.05. The sample size (n) was calculated by using the Yamane formula:

n=N/((1+Ne^2))

Where,

n = Sample size, N = population size, and e = Margin of error (MoE), e = 0.05

The sample was divided into three specific strata; n1, n2 and n3 using proportional strata allocation to obtain proportional representation, which formed the focus of the study. The sample size was therefore calculated as elaborated below.

n=902/((1+902〖(0.05)〗^2))

n=227

The study thus reached a total of 227 respondents proportionately drawn from Nairobi. This sampling frame was derived through stratified sampling technique. Out of 227, 10 were from customs office at JKIA and ICD while 207 were picked from the 892 clearing and forwarding firms based in Nairobi.

*3.5 Pilot Test*

The term pilot study is as a small-scale test of the methods and procedures to be used on a large scale. The importance of the pilot study lies in improving the effectiveness and efficiency of research. Kothari (2004) argues that pilot study results can inform on feasibility and identify modifications needed in the main study of a given research. A pilot study was conducted on some clearing and forwarding companies and customs officials to evaluate research instruments so as to ensure that they are concise, clear, comprehensive and reliable. The Questionnaire was piloted to help identify any possible weaknesses and adjustments Were made to make the test reliable, appropriate and comprehensible.

*3.6 Data Analysis and Presentation*

The data was analyzed using descriptive and inferential statistics analysis techniques. Descriptive statistical technique allows use of graphical presentations to describe data. The data for the dependent and independent variables was analyzed and presented in tables and pie chart. The purpose was to show the behaviour of the variables after the various systems were implemented. The pie chart showed the response rates. Inferential statistics allows one to make predictions from that data by taking data from samples and make generalizations about a population. It uses statistical models to help you compare your sample data to previous research through use of estimating parameters for instance; population mean or hypothesis testing.

In the context of this study, data was demarcated into segments within it. Each segment was labeled with a "code" to include short phrase that suggests how the associated data segments inform the research objectives (Grbich, 2013). The data that is coded was inputted into Statistical Package for the Social Sciences (SPSS) version 20. SPSS software automatically generated descriptive statistics such as means, modes, median, frequency, percentages and range which was used to describe the respondent's opinions on factors affecting revenue performance of Customs in Kenya. The data collected was documented and analyzed using essential statistical measures like measures of central tendency, standard deviations, totals and percentages along with regression analysis. The mean, for example was used to measure the general response to a question by the respondents. The standard deviation was applied in instances of measuring variability regarding responses to questionnaire. The percentages were used to measure the shares of respondent in each category.

To investigate the relationship between the independent variables and dependent variable, the study used linear multiple regression analysis. This is because the study sought to establish the degree of dependence of revenue performance of customs on scanner technology, Cargo Tracking System and ICMS in Kenya. Linear multiple regression is a useful means of representing decision outcomes, makes relatively few statistical assumptions and is robust to the statistical assumptions that are made.

Data collection instrument used was structured questionnaire. They were administered electronically. The questionnaire was divided into three sections. In Section I the respondents provided general information about the business operations in terms of period of active operation, the industry of operation, profitability, and nature of management. Section II outlined the effects of systems automation on revenue performance of customs department. Section III was a prompt for probable solutions to the identified challenges. The Likert Scale was used in measurement throughout the questionnaire except for part I.

Table 3.1: Test of Reliability of Questionnaire

*3.7 Reliability and Validity of the Research Instruments*

Reliability of data refers to the consistency with which results occur while validity of data refers to how well the data measures what they ought to measure (Triola, 2011).

*3.7.1 Reliability of the Research Instrument*

Saunders et al., (2009) and Triola (2011) describe reliability as the measure of degree to which an instrument yields consistent measurement across time and across items in the instrument. A reliable study is trustworthy if the appraises yield the same results on other occasions, if similar observations be reached by other observers and if there is transparency in the sense made is from the raw data (Sekaran, 2012).

Table 3.1 shows the results of Cronbach Alpha Score to test reliability of data, showing reliability alpha was 0.819 which is above 0.7; this implied that all instruments of the study were reliable for measurement. Sekaran (2012) describes coefficient is high when its absolute value is greater than or equal to 0.7. Additionally, Cooper and Schindler (2010) argue that a Cronbach's alpha coefficient value equal or great than 0.5 is regarded to be an indication of reliability. This study adopted a coefficient of 0.5 as the benchmark for reliability. Results of items deleted are shown in Appendix 3.

*3.7.2 Validity of the Research Instrument*

Validity refers to how well the results of a study measure what they are intended to measure (Sauro, 2014). It arises due to the fact that measurements in social science are indirect. It is the extent to which the indicators devised to measure a concept really measures that concept (Cooper & Schindler, 2010). Validity is therefore, the accuracy of a measure or the extent to which a score fruitfully represents a concept. There are four conventional ways of establishing validity namely, content validity, face validity, criterion validity and construct validity. Creswell (2013) defines content validity as the extent to which all possible questions about the content are represented by the questions on the instrument and the scores that are obtained from these questions. It ensures that the questionnaire includes adequate set of items that tap the concept. Cook & Lawless (2006) describes face validity as validity without empirical testing hence its weakest (Robertson & Kandola, 1982). Anastasi & Urbina (1997) describe construct validity as the extent to which a test may be said to measure a theoretical trait. It is verified by comparing the test to other tests that measure similar qualities to see how highly correlated the two measures are. Criterion-related validity is one which correlates test results with another criterion of interest (Pallant, 2011).

This study therefore adopted content validity for the purpose of assessing the accuracy of the data. This enabled one assess validity of instrument including clarity, relevance, interpretation of questions and time spent and improves where necessary. Supervisors and Scholars at the School of Business were consulted to examine and review the instrument for content validity to avoid Type I error and Type II error. Any ambiguous questions were identified and rectified.

*3.8 Data Analysis and Presentation*

Cooper and Schindler (2010) explains data analysis as the process of edition and also the reduction accumulated data to manageable size, developing summaries, looking for patterns and applying statistical techniques. Data was demarcated into segments within it. Each segment was labeled with a "code" to include short phrase that suggests how the associated data segments inform the research objectives (Grbich, 2013). The process for data collected being edited, cleaned and coded was for completeness. Cleaned data was then analyzed using descriptive and inferential statistics. The coded data was entered into Statistical Package for the Social Sciences (SPSS) version 20, that automatically generated descriptive statistics such as means, median, modes, percentages, frequency and range which was used to describe the respondent's opinions on factors affecting revenue performance of Customs in Kenya. The results were represented in form of charts and tables. Inferential statistics was used to evaluate the hypotheses presented in the study. To investigate the relationship between the independent variables and dependent variable, the study used linear multiple regression analysis. By using linear multiple regression analysis, the study sought to establish the degree of dependence of customs revenue performance on scanner technology, ICMS and cargo tracking system in Kenya.

*3.8.1 Regression Model*

The three key elements of systems automation on customs revenue performance formed a multiple linear regression

$Y=\beta_0+\beta_1X\_1+\beta_2X\_2+\beta_3X\_3+\cdots\varepsilon$

Where,

Y= Revenue Performance (Dependent variable)

X_(1,) X_2,X_3 = Independent variables

X_1= cargo tracking system

X_2=integrated customs management system

X_3= scanner technology

$\beta_n$ = beta coefficient

$\varepsilon$ = Error term

Multiple regression analyses was used to test hypotheses 〖 H〗_(0_1 ),H_(0_2 ) and H_(0_3 )respectively. The results from this model was presented in tables where analysis of variance (ANOVA) table was also presented by Correlation analysis. The most common indices used in correlation analysis is Pearson Correlation co efficient.

3.9 Diagnostic Tests

In scientific research, diagnostic tests are usually carried out to empirically determine the quantitative effect of study design shortcomings of more quantitative loading of diagnostic accuracy (Lijmer et al., 1999). In this study, two diagnostic tests were done before data analysis to authenticate the research findings. The tests included normality which used

Shapiro-Wilk tests to check for normality and Multicollinearity test, In order to test for multicollinearity, variance inflation factor (VIF) was computed using statistical packages for social science (SPSS).

*3.10 Ethical Consideration*

Ethics concerns are moral principles and how people should conduct themselves in social affairs (Graham and Benett, 2005). Before data collection, introductory letters were issued from Moi University and research permit sought from National Commission for Science, Technology and Innovation. The researcher incorporated integrity, honesty and also maintained more of the confidentiality level of data provided by individuals or identifiable participants and their anonymity, all major statements in the study was cited to avoid plagiarism.

*3.11 Operationalization and Measurement of Variables*

This explains the variables and how they were each be measured.

Table 3.2: Operationalization of study variables

*3.12 Limitation of the Study*

This study had its limitations just like any other research study. A total of 227 questionnaires were prepared and distributed to registered clearing and forwarding agents and KRA customs officers. Due to the prevailing Covid-19 pandemic, issue and collection of questionnaire were a challenge. To mitigate the issue of non-response, questionnaires were shared electronically while follow-up was done by phone calls and emails. 90% were filled and returned while 10% were not returned; hence the latter did not form part of the study.

**4. Data analysis, Presentation and Interpretation**

This chapter discusses the interpretation and presentation of the findings obtained from the field. Descriptive and inferential statistics were used in this study.

*4.2 Response Rate*

The study targeted a sample size of 227 clearing and forwarding agents & customs officers. 22 questionnaires were partially filled and not returned while 205 filled and returned the questionnaires making a response rate of 90%, satisfactory enough to complete this study. According to Mugenda & Mugenda (2008), a response rate of 50% is adequate for analysis and reporting, 60% is good while that of 70% and above is excellent. This is summarized below:

Table 4.1: Response Rate

Figure 4.1: Response Rate

*4.2.1 Demographic Information*

The respondents' social and demographic information included their age, highest level of education and length of service in their respective businesses. The respondents' age was disaggregated base on uniform intervals where 18 years (legally mature age) was taken as the minimum and 56 & above as the maximum. The findings below show that majority 32.2% of the respondents were aged between 36-45 years, followed by 25.3% who were aged 26–35 years, 22.4% were aged above 56years, 11.2% were aged between 46–55 years and 8.78% were below 25 years. From these findings, most of the respondents belong to an age category of 46-55years. This is the middle age group hence they are actively involved clearing and forwarding. From these statistics it can be deduced that majority of the people are involved in customs activities in Kenya.

The respondents were also asked about their highest level of education as a critical indicator of their understanding of customs in Kenya. The findings indicated that majority of them were diploma holders 42.9%, followed by those who had bachelor degree stood at 31.7%, form four certificate 14.2%, any others at 6.3% and primary school holder 4.8%, respectively. The respondents were asked about their level of service in their respective industry as a critical indicator of their understanding of import/export and other customs processes. The findings indicated that 38.5% of them had served for 5-10 years, followed by 26.3% who had 3-5 years of experience, 23.4% had 10 years and above and 11.7% of them 0-3 years of experience in field of business. This also shows that majority of the respondents had 5-10 years of experience showing more experience in the regional customs operations and that they appreciate the importance of the study. These findings are summarized in table 4.2.

Table 4.2: Demographic Information

*4.3 Assumptions of Regression*

Prior to performing the inferential analyses, statistical assumptions were tested to establish if the data met the normality, linearity, collinearity and homogeneity of variance assumptions; and it was on the basis of these results, that tests of associations and prediction were performed.

*4.3.1 Test of Normality*

The Shapiro-Wilk test was employed to test for normality. This test establishes the extent of normality of the data by detecting existence of skewness or kurtosis or both. For Shapiro-Wilk test, data is assumed to be normally distributed if the P-value is greater than 0.05. Normality was tested using the Shapiro-Wilk test and the results showed that Standardized and Unstandardized Residual above 0.05 ($p=0.180p > 0.05$) hence confirming data normality. Normality assumes that the sampling distribution of the mean is normal.

Table 4.3: Tests of Normality

*4.3.2 Linearity Test*

The linearity test is a requirement in the correlation and linear regression analysis. Good research in the regression model there should be a linear relationship between the independent variable and dependent variable. Linearity implies the degree level to which a change in the dependent variable is related to a change in the independent variables. The relationship between each of the predictor for the independent variable and dependent variable could be linear.

Linearity was tested using Pearson correlation to check the correlation among the variables of this study.

*4.3.3 Multicollinearity Test*

Multicollinearity is a phenomenon whereby high correlation exists between the independent variables. It occurs in a multiple regression model when high correlation exists between these predictor variables leading to unreliable estimates of regression coefficients. This leads to strange results when attempts are made to determine the extent to which individual independent variables contribute to the understanding of dependent variable (Creswell, 2014).

The consequences of multicollinearity are increased standard error of estimates of the Betas, meaning decreased reliability and often confusing and misleading results. Multicollinearity test was conducted to assess whether high correlation existed between one or more variables in the study with one or more of the other independent variables. Variable Inflation Factor (VIF) measured correlation level between the predictor variables and estimated the inflated variances due to linear dependence with other explanatory variables. It was tested by computing the Variance Inflation Factors (VIF) and its reciprocal, the tolerance.

In the current study tolerance ranged from 0.536 to 0.674 and therefore its reciprocal, the VIF was between one and two, which is below the maximum threshold value. A common rule of thumb is that VIFs of 10 or higher (conservatively over 5) points to severe multi-collinearity that affects the study. A tolerance threshold value of below 0.2 indicates that collinearity is present (Ary, Jacobs & Sorensen, 2015). The results revealed no problem with multicollinearity. The variables of the study indicated VIF values of between 1.483 to 1.865 which is less than 10. This indicated that the data set displayed no multicollinearity.

Table 4.4: Multicollinearity Test

*4.3.4 Heteroscedasticity*

Pallant, 2011 describes hheteroscedasticity as a term used to describe the situation when the variance of the residuals from a model is not constant. Heteroscedasticity is a violation of the multiple regression analysis. It was examined by visualizing scatter plots and partial regression plots for individual variables. This means the dependent variable scores have the same dispersion/variability around the regression line through them, to mean they have equal spread. Outliers defined as cases that have a standardized residual value of more than 3.3 Or less than -3.3 was checked (Tabachnick & Fidell, 2007). This assumption was checked by visual examination of a plot of the standardized residuals (the errors) by the regression standardized predicted value.

*4.4 Descriptive Statistics*

The study sought to establish the effects of systems automation on customs revenue performance in Kenya. The respondents were asked to rate how they feel about the different variables related to system automation in a 5 point likert scale. The range was from Strongly Agree (5), to strongly disagree (1) with 1 representing strongly disagree, 2 representing disagree, 3 representing neutral, 4 as agree and 5 as strongly agree.

*4.4.1 Scanner Technology*

Table 4.5 illustrate scanner technology on implementation on customs revenue performance. Scanners affect accountability and efficiency of customs officers and cargo owners with a (mean=4.26). Exposure of goods to high energy X ray affects full implementation (mean=3.87). Access controls affected the quality of service and clearance time at the border posts (mean=4.15). Costs implications affect revenue authorities' investment in Scanner Technology (mean=4.77) while Human labour will soon be rendered obsolete from use of scanners had a (mean=4.05).

Table 4.5: Scanner Technology

Table 4.6 illustrate cargo tracking system on implementation on customs revenue performance. There has been training and capacity building on Cargo Tracking Systems with a (mean=3.87). Cargo Tracking systems are costly to implement with (mean=4.93). Containerized cargo theft has reduced since incorporation of cargo tracking system (mean=4.32). Use of physical escorts during transit is more preferable (mean=4.82) while this tool affects the volumes of trade and accountability had a (mean=4.70).

Table 4.6: Cargo tracking system

Table 4.7 illustrate Integrated customs management system on implementation on customs revenue performance. ICMS Training is available to all stakeholders with a (mean=4.88). Self-declaration of goods and import data sharing has affected compliance with (mean=3.32). Using estimates during customs valuation is more favourable with a (mean=3.14) while using ICMS decentralizes customs operations affecting time costs (mean=4.19). Using ICMS Lastly, ICMS is critical in streamlining customs procedures had a (mean=3.69).

Table 4.7: Integrated customs management system

The study sought to establish the effect of revenue performance. Results in Table 4.8, shows systems automation affect customs compliance and revenue collection had a (mean =4.75), respondent agreed that Customs valuation has grown in accuracy since ICMS, Scanners inception and Cargo Tracking systems. mean = 4.27), Demographical gaps affect border control customs operations (mean 3.58). Access controls affects the quality of service at the border posts (mean 3.53), while agreement of Customs operations methods affect regional trading activities with a (mean =4.46).

Table 4.8: Customs Revenue Performance

The data is transformed to mean of the input variables to form one index.

Table 4.9: Systems Automation Impact on Customs Revenue Performance.

The KRA Annual Revenue Performance for the years 2017/2018, 2018/2019 and 2019/2020 show ICMS, Scanners

and RECTs have affected revenue growth. In 2019/2020 financial year, Customs recorded overall growth of 7.7%, with non-oil collections, which accounted for 70% of revenue growing at 8.1%. Improved performance is largely attributed to tighter enforcement through among others benchmarking of cargo values to address undervaluation, greater use of scanners and stricter application of cargo auction processes. This has resulted in average daily collection for non-oil revenue increasing from Sh 1.126 billion in H1 of FY 2016/17 to Sh 1.257 billion in H1 of FY 2017/18, an increase of Sh 131 million per day. (KRA, 2018)

In 2018/2019 financial year: KRA collected a total revenue of 525.3billion against Ksh. 522.8bn as targeted revenue. Customs and Border Control growth also exceeded the 3-year (2015/16 to 2017/18) trend growth of 9.5% with an average daily revenue collection growth of 7.9%: this from Ksh.1313 million in 2017/2018 financial year vs 1418 million in 2018/2019 financial year. KRA also collected Kshs 525.3 billion in Customs revenue during the 2018/19 financial year, growing by 11.8% from last year. Table 2.1 above shows the revenue CIF value for non-containerized cargo grew by 22.3% from 0.151mn to 0.184mn. Revenues from scanner technology was 2.2bn as per tale 4.9 above. Revenues from RECTS were 0.67mn in 2018/2019 financial year with 1.84bn saved from E- sealed trucks. (Kenya Revenue Authority, 2019) Customs revenue collections have dropped in 2019/2020 fin year by 2.8% due to COVID- 19 implications on global trade. Collections of 510. 63 billion were reported by the Kenya Revenue Authority (KRA, 2020).

*4.5 Correlation Analysis*

The Table 4.10 presents the results of the correlation analysis showing that Scanner technology and revenue performance are positively and significantly associated with revenue as shown as r=0.713. The results also show that cargo tracking system and revenue performance are positively and significantly associated with revenue performance as shown r=0.663. Further, results show that integrated customs management system and revenue performance are positively and significantly associated with revenue performance as shown r=0.635.

Table 4.10: Correlation Matrix

*4.6 Regression Analysis*

The broad objective of the study was to investigate the effects of systems automation of customs revenue performance in Kenya. To achieve this objective, three specific objectives and three corresponding questions were set and formulated respectively. To achieve the set objectives and to answer the questions, the study used various inferential statistical tools and multiple regression analyses was used.

*4.7 Model Summary*

Table 4.11: Model Summary

Results in Table 4.11 show that scanner technology, cargo tracking system and integrated customs management system were considered satisfactory in explaining customs revenue performance. Scanner technology, cargo tracking system and integrated customs management system had a positive correlation with revenue performance up to 80.8% or (R= 0.808). The results reveals that scanner technology, cargo tracking system and integrated customs management system caused a variation of 64.7% or (R2=0.652 and adjusted R2 =0.647) on revenue performance. This implies that the remaining 35.3% of the change was caused by other factors not included in the Table 4.12: ANOVA

Further, ANOVA tests were conducted to determine whether the model works in explaining the relationship among variables as postulated in the conceptual model.

From the Analysis of Variance, the F-value was (F= 125.615, p=0.000 p<0.05). Hence establishing the model is statistically significant. The implication is that each independent variable (scanner technology, cargo tracking system and integrated customs management system) contributes significantly to changes in the dependent variable (customs revenue performance).

Table 4.13: Coefficients

Y= 0.692 + 0.451X1 +0.303X2 + 0.204X3 +e

The regression equation shows that the independent variables and dependent variable were statistically significant. A unit change in scanner technology, cargo tracking system and integrated customs management system increase customs revenue performance by 0.451, 0.303 and 0.204 respectively keeping all other factors constant.

*4.8 Hypothesis Testing*

The first hypothesis 〖Ho〗_1 stated that the use of scanner technology has no significant effect on customs revenue performance in Kenya. The scanner technology has a positive relationship impact on customs revenue performance. The results on Table 4.16 revealed that P value was below 0.05, ρ=0.000 which implies that relationship was statistically significant therefore null hypotheses was rejected.

The second hypothesis 〖Ho〗_2 stated that the cargo tracking system has no significant effect on customs revenue performance in Kenya. Cargo tracking system has a positive relationship effect on the revenue performance. The results on Table 4.16 revealed that p value was less than 0.05, ρ=0.000 which implies that relationship was statistically significant and therefore null hypotheses was rejected.

The third hypothesis 〖Ho〗_3 stated that the use of Integrated Customs Management System has no significant effect on customs revenue performance in Kenya. Integrated Customs Management System has a positive relationship impact on the revenue performance. The results on Table 4.13 revealed that p value was less than 0.05, ρ=0.000 which implies that relationship was statistically significant and therefore null hypotheses was rejected.

Table 4.14: Summary of Hypothesis Testing

*4.9 Discussion of the Findings*

This chapter presents discussion of the results of various tests carried out on the study. The results of each of the questions in this study will be discussed.

*4.9.1 Effect of Scanner Technology on Revenue Performance*

The first objective of the study was to find out the effect of scanner technology on customs revenue performance in Kenya which showed a positive relationship (R=.713). The coefficient of 0.713 shows that a unit increase in scanner technology would lead to an increase in revenue performance in Kenya.

The objective had a corresponding hypothesis which stated that the use of scanner technology has no significant effect on customs revenue performance in Kenya. From the results of the research they indicate that scanner technology positively influenced customs revenue performance (ρ=0.000) therefore the hypothesis was rejected.

*4.9.2 Effect of Cargo Tracking System on Revenue Performance*

The second objective of the study was to find out the effect of cargo tracking system on customs revenue performance in Kenya which showed a positive relationship (R=.663). The coefficient of 0.663 shows that a unit increase in cargo tracking system would lead to an increase in customs revenue performance in Kenya.

The objective had a corresponding hypothesis which stated that the use of cargo tracking system has no significant effect on customs revenue performance in Kenya. From the results of the research they indicate that cargo tracking system positively influenced customs revenue performance (ρ=0.000) therefore the hypothesis was rejected.

*4.9.3 Effect of Integrated Custom Management System on Revenue Performance*

The third objective of the study was to find out the effect of Integrated Custom Management System on customs revenue performance in Kenya which showed a positive relationship (R=.635). The coefficient of 0.635 shows that a unit increase in Integrated Custom Management System would lead to an increase in customs revenue performance in Kenya.

The objective had a corresponding hypothesis which stated that the use of Integrated Custom Management System has no significant effect on customs revenue performance in Kenya. From the results of the research they indicate that Integrated Custom Management System positively influenced customs revenue performance (ρ=0.000) therefore the hypothesis was rejected.

*4.10 Discussion of the Findings*

This section presents as per objective discussion of the findings and collaborates them to other studies.

*4.10.1 Scanner technology and customs revenue performance*.

The study established that scanner technology has a positive and statistically significant effect on the customs revenue performance in Kenya with B=0.451 and Sig = 0.000 which is less than the threshold level of 0.05. The means that a unit increases in the use of scanner technology would result in a statistically significant increase customs revenue performance. The findings concur with Chalfin (2004), who found out the use of scanner technology enhances revenue collection from identification and proper classification of goods under correct duty payable. It ensures border security is maintained by detecting contrabands and prohibited goods.

*4.10.2 Cargo tracking System and Customs Revenue Performance*.

The study established that cargo tracking system has a positive and statistically significant effect on the customs revenue performance in Kenya with B=0.303 and Sig = 0.000 which is less than the threshold level of 0.05. The means that a unit increase in cargo tracking system would result in a statistically significant increase in customs revenue performance. The finding of this study concurs with Freeman (2017) as enabling real time tracking of transit cargo from the ports of entry to its final destination through a synchronised online digital platform.

*4.10.3 Integrated Customs Management System and Customs Revenue Performance*

The study established that integrated customs management system has a positive and statistically significant effect on the customs revenue performance in Kenya with B=0.204 and Sig = 0.000 which is less than the threshold level of 0.05. The means that a unit increase in the use of integrated customs management system would result in a statistically significant increase in customs revenue performance. The finding of this study concur with Moyi & Ronge (2016) and Antov (2017) regarding ICMS as an important component of internal control in Kenya as is the Bulgarian Integrated Customs Information System. Its access is authorized on the basis of specific competences of customs officers with respect to its separate modules, and records are kept about which actions have been performed, when they were performed, and by which employee. All EAC member states, except Kenya, have; for a long time; been using the Automated System for Customs Data (Asycuda).

## 5.Summary of Findings, Conclusion And Recommendations

This chapter presents a summary of the findings in line with the specific objectives of the study, conclusions drawn and recommendations made for the study including suggested areas of further study to enrich relevant knowledge under the study.

*5.2 Summary of the Findings*

The general objective of this study was to establish the effect of systems automation on customs revenue performance in Kenya. The specific objectives were to determine the effect of scanner technology on customs revenue performance in Kenya, to investigate the effect of cargo tracking system on customs revenue performance in Kenya and to determine the

effect of integrated custom management system on customs revenue performance in Kenya.

*5.2.1 Effect of Scanner Technology on Customs Revenue Performance*

The first objective was determining the effect of scanner technology on customs revenue performance in Kenya. Correlation analysis showed that scanner technology and custom revenue performance are positively and significantly associated. Also the Regression analysis shown there was a positive significant linear relationship between scanner technology and custom revenue performance evidence of $p=0.000$, $\rho<0.05$. Scanner technology was found to be satisfactory in explaining customs revenue performance in Kenya.

*5.2.2 Effect of Cargo Tracking System on Customs Revenue Performance*

The second objective was to investigate the effect of cargo tracking system on customs revenue performance in Kenya. Correlation analysis showed that cargo tracking system and custom revenue performance are positively and significantly associated. Also the Regression analysis shown there was a positive significant linear relationship between cargo tracking system and custom revenue performance evidence of $p=0.000$, $\rho<0.05$. Cargo tracking system was found to be satisfactory in explaining customs revenue performance in Kenya.

*5.2.3 Effect of Integrated Custom Management System on Customs Revenue Performance*

The second objective was to investigate the effect of integrated custom management system on customs revenue performance in Kenya. Correlation analysis showed that integrated custom management system and custom revenue performance are positively and significantly associated. Also the Regression analysis shown there was a positive significant linear relationship between integrated custom management system and custom revenue performance evidence of $p=0.000$, $\rho<0.05$. Integrated custom management system was found to be satisfactory in explaining customs revenue performance in Kenya.

*5.3 Conclusions*

The purpose of this study was to investigate the effect of systems automation on customs revenue performance in Kenya. The conclusions were formed based on the findings of the study. Each objective was reviewed and a conclusion provided. Based on research finding it can be concluded that Scanner Technology, Cargo Tracking System and Integrated Customs Management System have effects on customs revenue performance. KRA has achieved their objectives to systems automation of customs processes by sealing revenue leakage points, improving efficiencies, enhancing accuracy of cargo declarations, widening taxpayer base and reducing perceived and actual corruption. Intensified stakeholders training on use of the Scanner Technology, ICMS and Cargo Tracking System can help bridge the knowledge gap amongst all stakeholders to improve customs revenue performance in Kenya.

*5.4 Recommendations*

The findings revealed a statistically significant relationship between scanner technology, Cargo Tracking systems and integrated customs management system on customs revenue performance in Kenya. The study recommends that KRA should pay attention to periodic stakeholder training on operational and prospective system automation processes. KRA should put more emphasis on self-declaration of goods and import data sharing which affects compliance. Further, Cargo Tracking Systems and E-seals ought to be subsidized to allow greater inclusion of all stakeholders.

*5.5 Suggestions for Further Research*

Fundamental insights were gained from empirical data showing continuous automation reforms at customs, a probabilistic technique engaging a large sample size would increase the statistical estimates reliability. Additionally, since the study focused only on three specific objectives scanner technology, Cargo Tracking systems and integrated customs management system, similar study can be conducted extensively addressing on the impact of ICMS on the Single Window and regional trade in EAC and on effects of Customs Oil Stocks Information Systems on customs performance.

**6. References**

[1.] Amin, M. A. (2013). Is there an African Resource Curse? Global Human Rights, And International Organizations. (Serial No. 113-91).

[2.] Anastasi, A., & Urbina, S. (1997). Validity: basic concepts. Psychological testing, 7, 113-139.

[3.] Anderson, J.E (2008) International Trade Theory. The New Palgave Dictionary of Economics. Palgave Macmillan. London.

[4.] Ary, D., Jacobs, L. C., & Cheser, R. (2015). an Sorensen, CK 2010. Introduction to Research in Education (8th ed). Belmot, CA: Wadsworth/Thomson Learning.

[5.] Antov, Momchil. (2017).The role of information technologies in the development of customs control in the Republic of Bulgaria. World Customs Journal. 11. 101.

[6.] Ayuma, I. (2018). The Impact of Emerging Technology On International Trade: A Case Study of The Three-Dimensional (3D) Printing And Customs Authorities In The East African Community (Doctoral dissertation, University of Nairobi).

[7.] Bhattacherjee, A. (2001). Understanding information systems continuance: an expectation-confirmation model. MIS quarterly, 351-370.

[8.] Bimber, B. (1990). Karl Marx and the Three Faces of Technological Determinism. Social Studies of Science, 20(2), 333-351. Retrieved from http://www.jstor.org/stable/285094

[9.] Booze, R., Allen, J., Hamilton, E. (2007), Customs Automation in Sub Saharan Africa.

[10.] Boru, Tesfaye. (2018). Chapter Five Research Design and Methodology 5.1. Introduction. 10.13140/RG.2.2.21467.62242.

[11.] Boulding, K.E. (1956). General Systems Theory- the skeleton of science. Management Science, 2(3), 197-208.

[12.] Brenda Chalfin (2004) Border Scans: Sovereignty, Surveillance and the Customs Service in Ghana, Identities, 11:3, 397-416, DOI: 10.1080/10702890490493554

[13.] Buckley, W. (1967). Sociology and modern systems theory. Prentice-Hall.

[14.] Burmeister, S. (2017). Innovation as a Possibility. Technological and Social Determinism in Their Dialectical Resolution.

[15.] Casey P., & Castro P (2015) Electronic Fiscal Devices, IMF Working Paper (WP/15/73: pg 10-12).

[16.] Chandler, D. (2000). Technological or Media Determinism. Aberystwyth: Aberystwyth University.

[17.] Chalfin, B. (2004). Border scans: Sovereignty, surveillance and the customs service in Ghana. Identities: Global Studies in Culture and Power, 11(3), 397-416.

[18.] Colaguori, C. (2011). Power and Society: Critical issues in Social Science. Tronto: York University

[19.] Cooper, D.R., & Schindler, P.S. (2010). Business Research Methods (8th Edn) McGraw- Hill: New York.

[20.] Creswell, J. W. (2013). Research Design_ Qualitative, Quantitative, and Mixed Methods Approaches. Califonia: SAGE Publications, Inc.

[21.] CSC Scholarship Council. (2020). Explanatory Research Definition. Retrieved from Chinese Scholarship Council: https://www.chinesescholarshipcouncil.com/explanatory-research.html

[22.] Dečman, M., & Klun, M. (2015). The Impact of Information Systems

[23.] Deng, H. F., Deng, W., Li, H., & Yang, H. J. (2010). Authentication and access control in RFID based logistics-customs clearance service platform. International Journal of Automation and Computing, 7(2), 180-189.

[24.] De Wulf, L., & Sokol, J. B. (2005). Customs modernization Handbook. Washington: World Bank.

[25.] Dillon, A., & Morris, M. G. (1996). User acceptance of new information technology: theories and models. Medford, NJ: Information Today.

[26.] Dulock, H. L. (1993). Research Design: Descriptive Research. Journal of Pediatric Oncology Nursing, 10(4), 154–157.

[27.] Dobell, J. (2017). The Future of Tax Technology is Now. International Tax Review.

[28.] Dramod, K.R. (2004). The Challenges of Tax Collection in Developing Economies. University of Georgia: Georgia.

[29.] Dulock, H. (1993). Research Design: Descriptive Research. Sage Journals, 154.

[30.] Eunsook Koh, W. O. (2000). Descriptive Research and Qualitative Research. Springer Link, 221.

[31.] Festinger, L. A. (1957). Theory of cognitive dissonance. Row and Peterson, Evanston, IL

[32.] Fjeldstad, O. H., & Moore, M. (2008) Revenue Authorities and State Capacity in Anglophone Africa, CMI: Bergen.

[33.] Freeman, M. (2017). This Company's Scanning Technology is a Smugglers' Nightmare. The San-Diego Union.

[34.] Gidado, U. (2015). Consequences of port congestion on logistics and supply chain in African ports. Developing Country Studies, 5(6), 160-167.

[35.]

[36.] Gidisu, T. E. (2012). Automation System Procedure of the Ghana Revenue Authority on the Effectiveness of Revenue Collection: A Case Study of Customs Division, Unpublished MBA Thesis, Kwame Nkrumah University of Science and Technology.

[37.] Given, L. M. (2008). The SAGE encyclopedia of qualitative research methods (Vols. 1-0). Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9781412963909

[38.] Gitaru, K. (2017). The Impact of System Automation on Revenue Collection in Kenya Revenue Authority (A case study of SIMBA).

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

[40.] Grbich, C. (2013). Content analysis of texts. C. Grbich, Qualitative data analysis, 189-199.

[41.] Gregory Mankiw, M. W. (2010). Optimal Taxation in Theory and Practice. Havard University, 4-8.

[42.] Green, V. (2001). Race on the line: gender, labor, and technology in the Bell system, 1880–1980. Duke University Press.

[43.] Greenwood CL, Jr, Thapan A, Ahmed J, Kertzman D, Kelly B, Balbosa J, (2008). Enhancing Revenue Collection and Strengthening the Criminal Prosecution of Tax Evasion Cases.

[44.] Gutierrez N (2006). Issues in Revenue Administration, Tax Compliance, and Combating Corruption.

[45.] Gutierrez N (2008). Information Technology in Support of the Tax Administration Functions and Taxpayer Assistance.

[46.] Haughton, M., & Desmeules, R. (2001), Recent Reforms in Customs Administrations, The International Journal of Logistics Management, 12 (1): 65-82.

[47.] Hollaway, S. (2008). The Transition from eCustoms to eBorder Management. World Customs Journal. UNCTAD. New York, USA

[48.] Hollingum J (2006). Looking to Automation to Enhance Productivity, J. Comput.15 (2): 655-689.

[49.] Hollingum J (2007). Optimizing the Benefits of Automation through Design, J. Comput., 15 (2): 755-789.

[50.] Holniker, D. (2005). Computerization of commercial tax system. A Review of Some Efficiency and Macroeconomic Aspects, 231-263.

[51.] Isaac, N. N., & Lilian, L. (2010). Automation and customs tax administration: Empirical evidence from Uganda. African Journal of Business Management, 4(11), 2241-2246.

[52.] Jimenez, G., Sionnaigh, N., & Kamenov, A. (2013). Information Technology for Tax Administration: USAID Leadership in Public Financial Management (LPFM). USAID/Mission

[53.] Kamau, S. K. (2014) The Adoption of Technology as Strategic Tool in Enhancing Tax Compliance in Kenya: A Case Study of Large Taxpayers of Kenya Revenue Authority. Unpublished MBA Project Report Submitted to the Chandaria School of Business, United States International University. Nairobi, Kenya

[54.] Karingi, S. N. & Wanjala, B. (2005). The tax reform experience of Kenya (No. 2005/67). WIDER Research Paper.

[55.] Katsuya-Takii J (2003). Prediction Ability of Customs Automation, Rev.Econ. Dynam., 6: 80-98.

[56.] Kendrick, M. (1939). The Ability-to-Pay Theory of Taxation. The American Economic Review, 29(1), 92-101. Retrieved from http://www.jstor.org/stable/1806989

[57.] Kenya Revenue Authority (2015). ICT Strategy 2014/2018: Using IT as a Business Enabler: Nairobi, Kenya. Saina, E. K. Deputy Commissioner, Information and Communication Technology. Available at http://www.kra.go.ke/notices/pdf2017/The KRA Second ICT Strategy.pdf.

[58.] Kenya Revenue Authority. (2018). Annual Revenue Performance FY 2017/2018. KRA.

[59.] Kenya Revenue Authority. (2019). Annual Revenue Performance FY 2018/2019. KRA.

[60.] Kenya Revenue Authority. (2020). Annual Revenue Performance FY 2019/2020. KRA.

[61.] Kenya Revenue Authority. (2018, August 30). ICMS: A Milestone to Trade Facilitation. Retrieved from www.kra.go.ke.

[62.] Kenya Revenue Authority. (2018, June 20). Integrated Customs System, a Game Changer in Clearance of Goods. Retrieved from Kenya Revenue Authority.

[63.] Kast, F.E & Rosenzweig, J. E. (1981). General Systems Theory: Applications for organization and management. JONA: The Journal of Nursing Administration, 11(7), 32-41.

[64.] Khan, N. (2018). History and Evolution of Technology. The Nation.

[65.] Kombo, D. K., & Tromp, D. L. (2006). Proposal and thesis writing: An introduction. Nairobi: Paulines Publications Africa, 5, 814-30.

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

[67.] Kripanont, N. (2007). Using technology acceptance model of Internet usage by academics within Thai Business Schools. PhD thesis submitted to the Victoria University.

[68.] LaMorte, W. W. (2018). Diffusion of innovation. Behavioral Change Models.

[69.] Lind, D. A., Marchal, W. A., & Samuel, A. W. (2010). Business statistics. Mc Graw Hill.

[70.] Louho, R., Kallioja, M. & Oittinen, P. (2006). Factors affecting the use of Hybrid media applications. Graphic arts in Finland, 35 (3), pp. 11-21.

[71.] Lewis, B. M., Erera, A. L., Nowak, M. A., & Chelsea C III, W. (2013). Managing inventory in global supply chains facing port-of-entry disruption risks. Transportation Science, 47(2), 162-180.

[72.] MacKenzie D., & Wajcman J. (1999). The social shaping of technology, 2nd ed., Open University Press, Buckingham, UK. ISBN 9780335199136.

[73.] Malawi Revenue Authority. (2018). What are Cargo Scanners? Retrieved from https://www.mra.mw/custom-and-excise/what-are-cargo-scanners

[74.] Manyasi, J. M. (2012). The effect of strategic alignment as a source of performance at Kenya Revenue Authority (Doctoral dissertation).

[75.] Maree, J. (2018). Report on WCO Private Sector Consultative Groups. Brussels: WCO.

[76.] Masese, W. (2011, January 15). Daily Nation. Retrieved January 28, 2017, from KRA Automation: http://www.nation.co.ke/business/Automation-has-boostedKRA-/996-1090288-gf3uwfz/index.html

[77.] Mesarovic, M. D & Takahara, Y. (1975). General Systems Theory: Mathematical foundations. Academic press.

[78.] Montagnat-Rentier, G. (2019). Revenue Administration: Short-Term Measures to Increase Customs Revenue in Low –Income and Fragile Countries. IMF.

[79.] Moyi, E. & Ronge, E. (2006). Taxation and tax modernisation in Kenya: A diagnosis of performance and options for further reform.

[80.] Mukoyama, Toshihiko. (2003). A Theory of Technology Diffusion.

[81.] Mugenda, O. M., & Mugenda, A. G. (2003). Research methods: Quantitative and qualitative

Approaches. Nairobi: African Centre for Technology Studies.

[82.] Mwai, C. (2017). Strategy Implementation and Performance of Customs and Border Control Department of Kenya Revenue Authority, University Of Nairobi.

[83.] Okoth, E. (2017). Kenya joins Uganda, Rwanda in E-Cargo tracking system. The East African.

[84.] Oye, N. D., Iahad, N.A. and Ab.Rahim, N. (2012).The history of UTAUT model and its impact on ICT acceptance and usage by academicians. Educational Information Technology, DOI 10.1007/s10639- 012-9189-9.

[85.] Pallant, J. (2011). SPSS survival manual: A step by step guide to data analysis using the SPSS program. 4th Edition. Berkshire: Allen & Unwin.

[86.] Parkin, M. (2005). Macroeconomics. University of Ontario. Pearsons, 443-450

[87.] Peterson, J. (2017). An Overview of Customs Reforms to Facilitate Trade . Journal of International Commerce and Economics, 1-30.

[88.] Rehman, M., Esichaikul, V. and Kamal, M. (2012), "Factors influencing e-government adoption in Pakistan", Transforming Government: People, Process and Policy, Vol. 6 No. 3, pp. 258-282.

[89.] Ronge, E. M. (2006). Taxation and Tax Modernisation in Kenya. Institute of Economic Affairs, 27-39.

[90.] Saguna, D. D. (2003). Financial Law and Tax. Bucharest: All Beck Publishing House.

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

[92.] Segal. H. (1994). Technology and ciation.

[93.] Sekaran, U., & Bougie, R. (2016). Research methods for business: A skill building approach. John Wiley & Sons.

[94.] Sekaran, U., & Bougie, R. (2012). Research methods for business: A skill-building approach. Chichester: Wiley.

[95.] Sen, S. (2010). International Trade Theory & Policy. A Review of the Literature. Levy Economics Institute of Bard College.

[96.] Skyttner, L. (2001). General Systems Theory: Ideas & Applications. World Scientific.

[97.] Smith, Merritt Roe; Marx, Leo, eds. (1994). Does Technology Drive History? The Dilemma of Technological Determinism. Cambridge: MIT Press. ISBN 9780262691673.

[98.] Svinicki, M. D. (2010). Guidebook On Conceptual Frameworks for Research In Engineering Education. Texas: University of Texas.

[99.] Surry, D.W. (1997) Diffusion Theory and Instructional Technology. Journal of Instructional Science and Technology, 2, 24-36.

[100.] Swindley, D. G. (2007). Computerization of Tax Administration. Int. J. Fis. Manage, 21(3), 199-233.

[101.] Tabachnick, B. G., & Fidell, L. S. (2007). Using multivariate statistics. https://psycnet.apa.org/record/2006-03883-000

[102.] Teera, J. (2002). Tax Performance: A Comparative Study. Working Paper 01-02, Center for Public of Economics.

[103.] Thalheim, Bernhard. (2011). The Theory of Conceptual Models, the Theory of Conceptual Modelling and Foundations of Conceptual Modelling. 10.1007/978-3-642-15865-0_17.

[104.] Togan, S. (2012). The EU-Turkey Customs Union: A Model for Future Euro-Med Integration. MedPro Technical Report, 4.

[105.] Toney, S. (2014) Principles of Economics. Savanna State University. Mc Graw-Hill.

[106.] TradeMark East Africa. (2018). Support to the Kenya Revenue Authority: ICMS. Retrieved from https://www.trademarkea.com/projects/support-kenya-revenue-authority-icms/

[107.] Triola, M. (2011). Essentials of Statistics. Pearson. 4th Ed.

[108.] Utz, S. (2002). Ability to Pay. Faculty Articles and Papers, 27-50.

[109.] Von Bertalanffy, L (1972) The History and status of General Systems Theory. Academy of Management Journal, 15(4), 407-426.

[110.] Von Bertalanffy, L & Sutherland, J.W. (1974) General Systems Theory: Foundations, Developments, Applications in IEEE Transactions on Systems, Man, and Cybernetics. Vol. SMC-4, no.6, pp.592-592, doi: 10.1109/TSMC.1974.4309376.

[111.] Walsh, J. (2006, March). New Customs. Finance & Development, p. Vol 43.

[112.] Wanyama, T. (2017). Causes of delay in clearance of goods at the port of Mombasa. International Journal of Supply Chain and Logistics, 39-41.

[113.] Ward, N., & Dietmar, J. (2007). CAREC Customs Automation. In Technical Paper presented at a Conference held at Beijing on the (pp. 23-25).

[114.] WEF. (2014). The Global Competitiveness Report 2014-2015. World Economic Forum, 105-150.

[115.] WEF. (2015). The Global Competitiveness Report 2015-2016. World Economic Forum, 106-375.

[116.] WEF. (2016). The Global Competitiveness Report 2016-2017. World Economic Forum, 106-372.

[117.] Williams, R. & Edge, D. (1996). The Social Shaping of Technology. Research Policy. 25. 865-899. 10.1016/0048-7333(96)00885-2.

[118.] WTO. (n.d.). Information Technology Agreement- An Explanation. World Trade Organization.

[119.] Zhang, W.B. (2008). International Trade Theory. Capital Knowledge, Economic Structure, Money.

## 7. Appendices

**Independent Variables** **Dependent Variable**

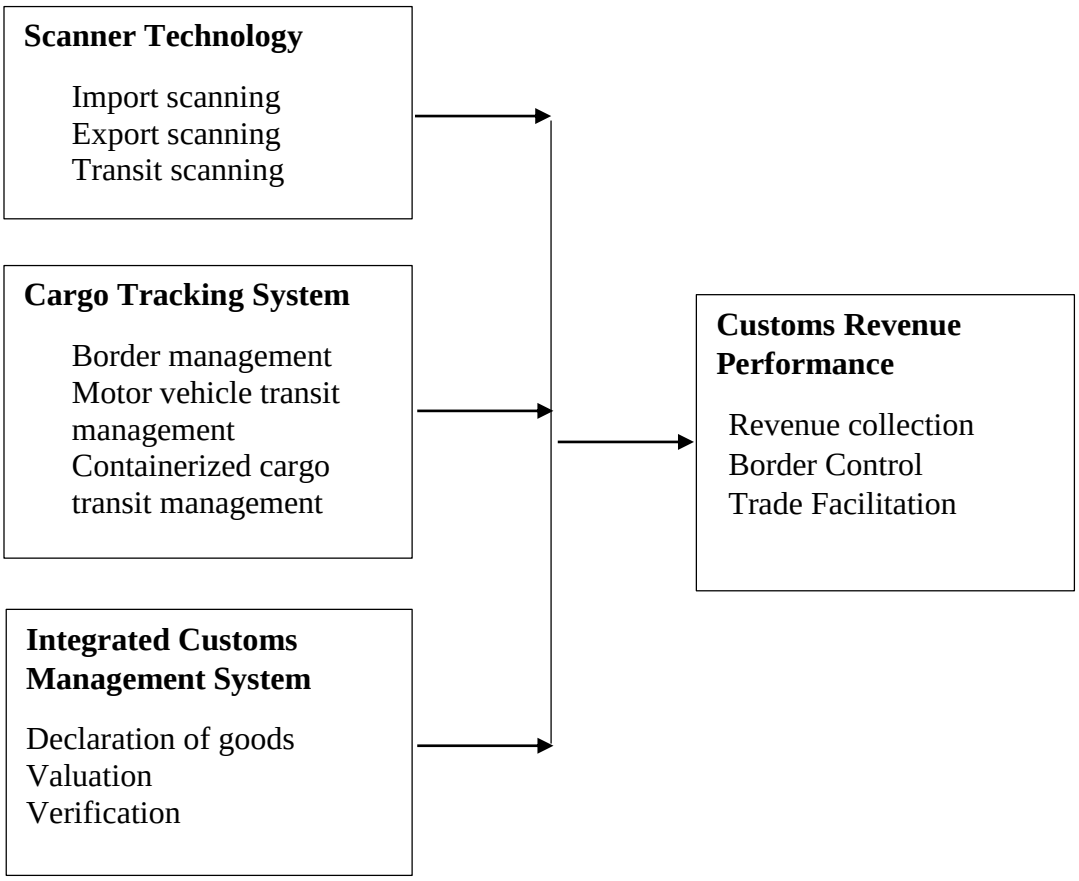


Figure 2.1: Conceptual Framework

*Source: Author (2020)*

*Table 3.1: Test of Reliability of Questionnaire*

| Cronbach's Alpha | No. of Items |
|---|---|
| 0.819 | 20 |

*Cronbach Alpha Score*

*Table 3.2: Operationalization of study variables*

| Variables | Indicators | Source | Data Collection Instrument | Measurement Scale | Type of Analysis |
|---|---|---|---|---|---|
| **Independent** | Cargo Tracking System | Freeman (2017) | Questionnaires | Ordinal Scale | Quantitative<br>Regression analysis |
| | Integrated Customs Management System | Moyi & Ronge (2016) | Questionnaires | Ordinal Scale | Quantitative<br>Regression analysis |
| | Scanner Technology | Chalfin, (2004) | Questionnaires | Ordinal Scale | Quantitative<br>Regression analysis |
| **Dependent** | Customs Revenue Performance | Greenwood et al, (2008) | Questionnaires | Ordinal Scale | Quantitative<br>Regression analysis |

*Table 4.1: Response Rate*

| Response | Frequency | Percentage |
|---|---|---|
| Returned | 205 | 90% |
| Unreturned | 22 | 10% |
| **Total** | **227** | **100%** |

**Source: Research, 2020**

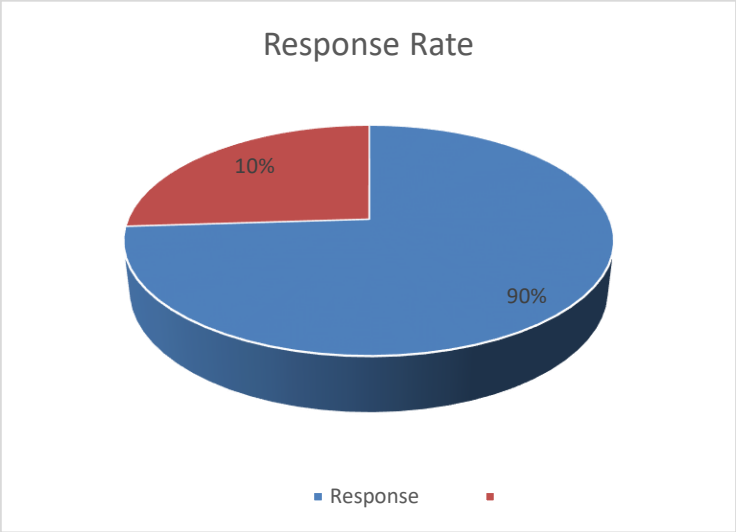


Figure 4.1: Response Rate
Survey Data (2020)

*Table 4.2: Demographic Information*

| Characteristics | Frequency | Percent (%) |
|---|---|---|
| **Age group** | | |
| Below 25years | 18 | 8.78 |
| 26-35years | 52 | 25.4 |
| 36-45years | 66 | 32.2 |
| 46-55years | 23 | 11.2 |
| Above 56years | 46 | 22.4 |
| **Total** | **205** | **100** |
| **Highest Education Level** | | |
| Primary | 10 | 4.8 |
| High school | 29 | 14.2 |
| Diploma | 88 | 42.9 |
| Degree | 65 | 31.7 |
| Others | 13 | 6.3 |
| **Total** | **205** | **100** |
| **Length of service** | | |
| 0-3 years | 24 | 11.7 |
| 3-5 years | 54 | 26.3 |
| 5-10years | 79 | 38.5 |
| Above 10years | 48 | 23 |
| **Total** | **205** | **100** |

*Survey Data (2020).*

*Table 4.3: Tests of Normality*

| | Shapiro-Wilk | | |
|---|---|---|---|
| | **Statistic** | **df** | **Sig.** |
| Standardized Residual | .984 | 205 | .180 |
| Unstandardized Residual | .984 | 205 | .180 |

*Table 4.4: Multicollinearity Test*

| **(Constant)** | **Collinearity Statistics** | |
|---|---|---|
| | **Tolerance** | **VIF** |
| Scanner Technology | .674 | 1.483 |
| Cargo Tracking System | .548 | 1.826 |
| Integrated Customs Management System | .536 | 1.865 |
| **Total** | | **1.724** |

*Dependent Variable: Revenue performance*

*Table 4.5: Scanner Technology*

| **Statement** | **Min** | **Max** | **Mean** | **Std. Dev** |
|---|---|---|---|---|
| Scanners affect accountability and efficiency of customs officers and cargo owners | 1 | 5 | 4.26 | 0.657 |
| Exposure of goods to high energy X ray affects full implementation. | 1 | 5 | 3.87 | 0.925 |
| Access controls affected the quality of service and clearance time at the border posts. | 1 | 5 | 4.15 | 0.855 |
| Costs implications affect revenue authorities' investment in Scanner Technology. | 1 | 5 | 4.77 | 0.936 |
| Human labour will soon be rendered obsolete from use of scanners. | 1 | 5 | 4.05 | 0.778 |
| **Mean** | | | | **4.22** |

*Table 4.6: Cargo tracking system*

| **Statement** | **Min** | **Max** | **Mean** | **Std. Dev** |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| There has been training and capacity building on Cargo Tracking Systems | 1 | 5 | 3.87 | 0.412 |
| Cargo Tracking Systems are costly to implement | 1 | 5 | 4.93 | 0.602 |
| Containerized cargo theft has reduced since Incorporation of Cargo Tracking Systems | 1 | 5 | 4.32 | 0.605 |
| Use of physical escorts during transit is more preferable | 1 | 5 | 4.82 | 0.592 |
| This tool affects the volumes of trade and accountability. | 1 | 5 | 4.7 | 0.66 |
| **Mean** | | | | **4.52** |

*Table 4.7: Integrated customs management system*

| Statement | Mean | Std. Dev |
|---|---|---|
| ICMS Training is available to all stakeholders. | 4.88 | .680 |
| Using estimates during customs valuation is more favourable. | 3.14 | .624 |
| Self-declaration of goods and import data sharing has affected compliance. | 3.32 | .693 |
| Using ICMS decentralizes customs operations affecting time costs. | 4.19 | .748 |
| ICMS is critical in streamlining customs procedures. | 3.69 | 924 |
| **Mean** | **3.844** | |

*Table 4.8: Customs Revenue Performance*

| Statement | Mean | Std. Dev |
|---|---|---|
| Systems automation affect customs compliance and revenue collection. | 4.75 | .632 |
| Customs valuation has grown in accuracy since ICMS, Scanners inception and Cargo Tracking systems. | 4.27 | .577 |
| Demographical gaps affect border control customs operations | 3.58 | .499 |
| Access controls affects the quality of service at the border posts | 3.53 | .621 |
| Customs operations methods affect regional trading activities | 4.46 | .614 |
| **Mean** | **4.11** | |

*Table 4.9: Systems Automation Impact on Customs Revenue Performance.*

| Automation System | Measure | No. of Interventions | Revenue raised (Ksh. Mn) | Revenue Raise (Ksh. Mn) |
|---|---|---|---|---|
| | | Actual FY 2018/19 | Actual FY 2018/19 | Actual FY 2017/18 |
| Scanning | Containers scanned | 339,359 | | |
| | Without Discrepancies | 329,226 | | |
| | With Discrepancies | 10,133 | 2176 | 1,630 |
| | No. of scanners installed | 5 | | |
| Regional Cargo Tracking System | No. of transit trucks under e-seal monitoring | 17,592 | | |
| | BIF Saved | 1,193 | 1,843 | 568 |
| | CIF value for non-containerized cargo | | 0.184 | 0.151 |
| | Recoveries | 1,427 | 67 | 65 |

Source: *KRA Annual Revenue Performance 2018/2019*

*Table 4.10: Correlation Matrix*

| | | Customs Revenue Performance | Scanner Technology | Cargo Tracking System | ICMS |
|---|---|---|---|---|---|
| Customs Revenue Performance | Pearson Correlation | 1 | | | |
| | Sig. (2-tailed) | | | | |
| | N | 205 | | | |
| Scanner Technology | Pearson Correlation | .713** | 1 | | |
| | Sig. (2-tailed) | .000 | | | |
| | N | 205 | 205 | | |
| Cargo Tracking System | Pearson Correlation | .663** | .509** | 1 | |
| | Sig. (2-tailed) | .000 | .000 | | |
| | N | 205 | 205 | 205 | |
| ICMS | Pearson Correlation | .635** | .524** | .641** | 1 |
| | Sig. (2-tailed) | .000 | .000 | .000 | |
| | N | 205 | 205 | 205 | 205 |

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

**Survey Data (2020)**

*Table 4.11: Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .808[a] | .652 | .647 | .28782 |

**a. Predictors: (Constant), Intergrated Customs Management System, Scanner Technology, Cargo Tracking System**

**b. Dependent Variable: Customs Revenue Performance**

*Table 4.12: ANOVA*

| Model | | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 31.218 | 3 | 10.406 | 125.615 | .000[b] |
| | Residual | 16.651 | 201 | .083 | | |
| | Total | 47.868 | 204 | | | |

**a. Dependent Variable: Customs Revenue Performance**

**b. Predictors: (Constant), Integrated Customs Management System, Scanner Technology, Cargo Tracking System**

*Table 4.13: Coefficients*

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | .692 | .186 | | 3.726 | .000 |
| | Scanner Technology | .373 | .042 | .451 | 8.910 | .000 |
| | Cargo Tracking System | .300 | .056 | .303 | 5.383 | .000 |
| | Integrated Customs Management System | .175 | .049 | .204 | 3.598 | .000 |

**a. Dependent Variable: Customs Revenue Performance**

*Table 4.14: Summary of Hypothesis Testing*

| Hypothesis | P-value | Conclusion |
|---|---|---|
| **$H_0$1:** The use of scanner technology has no significant effect on customs revenue performance in Kenya. | 0.000 | Reject $Ho_1$ |
| **$H_0$2:** The cargo tracking system has no significant effect on customs revenue performance in Kenya. | 0.000 | Reject $Ho_2$ |

| | | |
|---|---|---|
| **$H_0$3:** The use of Integrated Customs Management System has no significant effect on customs revenue performance in Kenya. | 0.000 | Reject $Ho_3$ |

**Source: Research, 2020**