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The Relationship between Communication Technologies and Performance of Shipping Lines in Kenya: The Moderating Effect of International Maritime Regulations

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Abstract:
Proper implementation and use of technology are reputed to offer a major capability in enhancing a firm's achievement of its goals. The maritime sector in Kenya, more so shipping, has been experiencing low logistics efficiency, which is usually characterized by poor track and trace, high transportation costs, customs clearance, and delayed delivery. The performance of these firms, much as the rest of organizations' performance, is greatly dependent on the adoption and use of the requisite technology. The purpose of the study was to assess the relationship between communication technologies and the performance of shipping lines in Kenya as moderated by international maritime regulations. The study was anchored on Technology Acceptance Model, Institutional Theory and Task Technology Fit Theory. The explanatory survey research design was utilized. Positivist research philosophy was employed in this study to create a practical solution to the problem bedevilling this sector, such as dismal performance. 2835 respondents formed the target population for this study and were drawn from the Sales and Marketing, Logistics, Finance and IT staff of the 53 shipping lines listed in Kenya business directory 2021. 438 respondents formed the appropriate sample size for the research study, which included: 103 Finance staff, 109 logistics staff, 130 sales and marketing staff, and 96 IT staff. In order to arrive at a specific respondent, a random stratified sampling design was used. The required data for research was gathered through self-administered structured questionnaires. In order to check the reliability and validity of the research instrument, a pilot study was done in 6 shipping lines from Mombasa, and 44 questionnaires, which formed 10% of the target population, were administered. Reliability was ascertained by the use of Cronbach's alpha index at 0.7, while validity was checked through KMO Bartlett's test and factor analysis. Quantitative data was analyzed using SPSS version 20 after being well-coded. Descriptive statistics and inferential statistics (Pearson correlation coefficient, multiple linear regression and hierarchical regression model) were generated and presented in tables and graphs. The research findings indicated the existence of a direct and positive association between the use of Communication technologies and shipping lines' performance. The study further indicated that the moderating variable positively influenced the relationship between Communication technologies. The study concluded that shipping lines should invest more in communication technologies to improve their performance.

Keywords: *Relationship, communication technologies, performance, shipping lines, international maritime regulations*

1. Introduction

1.1. Background of the Study

Shipping lines, according to Rodrigue and Notteboom (2017), are a major subset of water transport; through this, interstate trade is advanced by making it possible to transport goods from one nation to another by means of water transportation and consequently making a significant contribution to a country's economy. In addition, according to UNCTAD 2020 review of maritime transport, up to 90% of international trade volume is attributed to maritime transport. The global conference on making use of water resources for economic development while protecting the environment was held in Kenya in 2018; it came up with a number of resolutions that can accelerate the sustainable development of the blue economy; one of the solutions passed to solve current problems was identify and adopt appropriate technologies (Data

blue economy survey republic of Kenya, 2018). Shipping lines deal with vast volumes of trade, which makes it crucial to come up with ways of improving their performance. One way through which the performance of these companies can be improved is through the proper utilization of appropriate communication technologies. A number of studies linking the use of communication technologies and improved operational efficiency have been carried out. Muhammad et al. (2013) contended that the use of communication technologies led to improved performance. Ayantoyinbo (2015) asserts that the utilization of information communication technologies improved performance. Bauk et al. (2017) concur with the above statement that the use of these technologies enhances performance. Kyomo (2019) contended that the use of communication technologies gives rise to improved performance.

The performance of these companies is more like the performance of other firms' which is a construct with multi-facets. It can, therefore, be evaluated using different Key performance indicators, but the major purpose is to assess whether the objectives of the organization have been attained. Several researchers have assessed performance differently depending on the context. Fugate *et al*. (2010), for example, argue that shipping lines' performance can be assessed from three dimensions: differentiation, effectiveness, and efficiency. Similarly, Aramyan *et al.* (2007) contended that operational efficiency can be measured from perspectives of quality, ability to fulfil customers' needs and level of adjustability. The above view is in harmony with Toyli *et al.* (2008), who argued that these firms' operational efficiency is multi-dimensional, involving service level, logistics cost and operational metrics. Several studies that form the background of this study on the use of these technologies and the performance of these organizations have been conducted as follows.

1.1.1. Shipping Lines' Performance

The performance of a firm refers to the degree to which goals and objectives an organization achieves. As evidenced in the following research, the key indicators of logistics performance are timely delivery, cost reduction, improved security, quality customer service, increased profitability and market share.

At the global level, Karia and Wong (2013) argued that proper implementation and utilization of the right technology-enabled logistics firms to perform better by reducing their cost of doing business. However, more studies are needed to evaluate how various logistics-based technologies can be used in combination to improve an organization's operational efficiency.

Sadovaya and Thai (2015) contended that the implementation and use of the model for the management of maritime security had a positive influence on security, business resilience, and customer satisfaction, hence leading to shipping companies achieving their goals. Munim and Schramm (2018) opine that a significant relationship does exist between the use of technology and the performance of these companies.

Regionally, research has been conducted on the performance indicators of these companies. Onyemejor (2015) suggests that the Logistics performance index and global competitive index are key measures of performance. According to Zikomo (2016), inefficiencies resulting from cargo handling factors such as bureaucracy, lack of handling equipment and delay in cargo clearance had a significant negative influence on the operational efficiency of logistics service providers. The view is reinforced by Karibo (2019), who contended key indicators of performance in these companies include on-time delivery and increased sales.

At the local level, investigations of performance indicators of shipping lines have been carried out. According to Ruto and Datche (2015), poor performance in marine logistics arises from logistical factors such as restriction of navigational channels, poor Information Communication Technology networks and infrastructure that lead to delays and increased transportation costs. Njagi *et al.* (2016) argue that profitability, which is a major performance indicator in the shipping industry, arises from the use of strategic management determinants.

Technological innovations that have been made in the logistical sector provided benefits, including competitive advantage to the firm, efficiency in operation, reduced cost of doing business, and customer satisfaction. Maina (2017) opined that cost factors such as bunker, charter hire, insurance, and container management have a direct influence on the profitability of logistics service providers.

According to Ndonye (2014), when firms dealing with cargo transportation utilize information technology, they achieve logistical efficiency and effectiveness. Hence, the study concluded that an association exists between the use of technology and enhanced performance. There is an improved port logistical performance due to the use of effective clearance procedures, reduced dwell time and quay crane Nyema (2014). Gacuru & Kabare (2015) contend that quality and firms' competitiveness in their operations, time and cost reduction are some of the positive effects that result from the proper use of technology by firms.

Macharia, Iravo, Tirimba and Ombui (2015) opine that technology utilization enhances the performance of logistics service providers by reducing cost and time. Ojwang (2016) argues that shipping lines' performance indicators achieved through the use of technology include coordination, feedback, lead time, cost, and quality of services. There is a positive correlation coefficient of 0.866 between the use of information technology and organizations' effectiveness.

1.1.2. International Maritime Regulations

Shipping, which is a key user of oceans, delivers 90% of the world trade. It is a regulated convention that is drafted by IMO, which is a United Nations that formulates measures to prevent marine pollution by ships and enhance the security and safety of international shipping (Kenton, 2020).

Mwashigadi (2014) contends that shipping lines' operational efficiency is negatively influenced by factors like poor information and communication technology infrastructure, political interference, bureaucracy, and poor integration of harmonized regulations.

Kombo (2018) argues that there is an association between marine strategy and coastal region security advancement. Maritime strategy and the security of the state of the coastal region have an influence on the efficiency of the shipping lines. The introduction and enforcement of the IMO 2020 regulation has led to low market share among the ship liners, as opined by Anna (2018). Ships have to comply with the stipulated rules and regulations irrespective of whether they are going to be impacted upon in terms of their operational efficiency.

Ship owners have to use alternative fuels in an effort to limit low-sulphur marine fuel oil in shipping, which is an IMO 2020 regulation that has led to higher costs of doing business (Van, Ramirez, Rainey and Ristovski, 2019). The drafting and emphasis of IMO regulations, which the shipping lines have to comply with, further complicate the operational efficiency of the shipping lines.

2. Theoretical and Empirical Literature Review

2.1. Technology Acceptance Model

2.1.1. Empirical Literature Review

Communication technologies include General packet radio systems, single window systems and radio navigation satellites. These technologies are effective in relaying the real-time information that is required during the cargo transportation process to the parties involved, as evidenced in the studies that follow. When well implemented and utilized, communication technologies offer the capability to connect the physical and virtual flow of goods, relay real-time information, keep customers informed, share information, and be responsive to customers and effective collaboration.

The research conducted by Muhammad, Saahar, Hasan, Fiah and Nor (2013) aimed to analyze the role of communication systems in the logistics industry in Malaysia. The parameters under investigation were communication systems and their influence on the logistics industry's operational efficiency. IT was guided by three objectives:

- To determine the methods of communication used by logistics firms in Malaysia.
- To analyze the network of communication utilized by key players in the logistics industry in Malaysia.
- To find out the existing difficulties in channels of communication used by the logistics industry in Malaysia.

The research study used quantitative research methods, and data was collected using questionnaires. Convenient sampling was used to select the logistics players that would participate in the research study. 950 respondents formed the study sample. Collected data was analyzed using descriptive and inferential statistics. The findings of the study based on objective one was that mobile communication had the highest mean score of 4.25, email 4.03, SMS 3.84 and PA system had the lowest mean of 2.53. The findings of objective two were that three network tools were in use: GPS 2.93, handheld 2.72, and BBM 3.22. On the third objective, the findings were as follows: lack of ICT had a mean score of 3.82, 'red tape bureaucracy' had a mean of 3.62, lack of resources had a mean of 3.56, and rapid changes had a mean of 3.54. The research study concluded:

- Firstly, mobile technology and its applications were commonly used in the logistics industry.
- Secondly, a lack of ICT would negatively affect the performance of logistics firms and
- Thirdly, the logistics department was the key user of ICT networks.

The recommendations of the study were:

- Firstly, the authorities in charge should improve information communication technology.
- Secondly, the internet connection should be uplifted to make it more efficient for users.

The research majored with the wider scope of logistics as opposed to this study, which focuses on shipping lines, which is a subset of logistics.

More studies have been conducted in this area. Bauk, Kapidani and Schmeink's (2017) study investigated ICT intelligence usage in maritime-based business organizations. The study variables were information communication technology and the performance of maritime organizations. The study was carried out in Croatia, and its objective was to assess the extent of ICT usage in maritime businesses. The study employed a focus group study method. Purposive sampling was used to come up with the right sample size. The research data was collected using questionnaires from selected representatives of the selected maritime organizations. The study findings were that the use of ICT in maritime organizations enables efficient internal and external communications for these organizations. This differs from the current methods, and the organizations researched are wider than this research, which focuses on shipping lines only.

A study conducted by Tharaka (2018) sought to assess how supply chain integration and performance can be enhanced by the adoption of the Internet of Things. The variables were the Internet of Things and the firm's operating efficiency. It was conducted in Australia with the following specific objectives:

- To investigate the impact of the Internet of Things on the integration of supply chain processes to enhance performance.
- To analyze the uses of the Internet of Things in the retail supply chain in Australia to enhance performance.

The mixed research methods were utilized to exploit the strengths of the various methods applicable. 554 respondents formed the sample size and comprised supply chain and IT managers. The data collected by the use of questionnaires was analyzed through descriptive statistics. The research information collected through the use of interviews was transcribed and analyzed through the open-coding process in Nvivo 11. The outcomes were that the Internet of Things contributed a significant positive effect on the operating efficiency of the supply chain and perceived effect on the firm's internal processes, customers and suppliers, which in turn improves a firm's performance. RFID and ICT are the commonly used Internet of Things technologies, and they assist in supply chain integration and improve the performance of supply chain processes. The conclusion of the study was that proper implementation and use of the

Internet of Things can improve the performance of the retail industry. The research study recommends the extension of the framework to participants of the supply chain, such as wholesalers, distributors, and manufacturers, among others.

In a similar study, Ayantoyinbo (2015) conducted a study that sought to assess how freight distribution logistics are affected by information communication technology. The variables were Information communication technology and the performance of freight distribution logistics. The study was done in Nigeria, and its main objective was to determine the effect of ICT on freight distribution. The study employed a descriptive research design, and data was gathered through questionnaires. The sample size of the study was 77 respondents. The collected data was analyzed using descriptive statistics. The findings of the study were that information communication technology was being used by the firms, which enabled them to improve their performance. The conclusion was that the use of these technologies in logistics firms helps them to improve their performance. The recommendations of the study were:

- The government should assist in sensitizing the application and function of information communication technology.
- Training and education policies should be emphasized to promote the use of these technologies in public and private companies.

The study fails to prove whether information communication technology is the only enabler of performance in freight distribution. Though conducted in a developing country, it differs in terms of methodology, making use of a survey method, which differs from the current study.

According to Mlimbila and Mbamba (2018), their study sought to analyze the influence of information systems on the performance of port logistics. The variables being studied were Information communication technology and port logistics performance. It was conducted in Tanzania, and its key aims were as follows:

- To analyze the impact of information system usage on the reduction of shipping and trucking costs.
- To assess the role of information systems in the delivery of goods and services.
- To examine the influence of the information systems on increasing trade volume.
- To analyze the impact of information systems usage on improving the capability of logistics in an organization.

The study was anchored on task technology fit theory and made use of quantitative research methods, and questionnaires were used to gather the data. The study population consisted of users and employees of the port of Dar es Salaam, and participants were made up of three users from the following categories: importers, exporters, clearing and forwarding agents, ICT officers, and ordinary port employees. The study data was analyzed using canonical. The findings of the study were that the usage of information systems, to a great extent, led to the reduction of shipping and trucking costs. It also led to the improved timely delivery of goods and services and improved trade and organizational logistics capability. The study recommends that policy-makers should encourage logistics participants to make use of information systems to enhance their logistical capabilities.

Kyomo (2019) conducted a study to find out how the performance of logistics is impacted by information communication technology; he focused on cargo transporting firms in Dar-es-salaam, Tanzania. The variables were information communication technology and the performance of logistics. The objectives that guided this study were:

- To find out the impact of information flow on logistics performance.
- To evaluate the impact of fleet management on logistics performance.
- To analyze the influence of inventory management on logistics performance.
- To determine the impact of logistics integration systems on logistics performance.

The study was anchored on two theories: approach theory and resource-based view theory. The study employed a descriptive research design. The research participants were 105 in number out of a target population of 350. The data that was collected through the use of a questionnaire was analyzed using both qualitative and quantitative techniques. The findings of the study were that different types of systems, such as inventory management, fleet management, logistics integration and information flow that use information communication, have a positive impact on the performance of logistics firms. The conclusion of the study was that ICT has a significant positive effect on the performance of logistics. The research recommends that cargo transporting companies should adopt information communication technologies to improve their operating efficiency.

Additional research conducted in this area includes that of Onwuegbuchunam, Aponjolosun and Ogunsakin (2021), the study sought to investigate the adoption of ICT in the operations of Nigerian ports. The study variables were Information communication technology and port operational performance. The specific objectives were:

- To determine applications of ICT by operations of these terminals,
- To analyze the integration of ICT in the operations of terminals and
- To determine ICT usage limiting factors in the operations of ports.

The study made use of a survey method, and 86 respondents consisted of terminal operators, port shipping company agents, stevedores and customs agents, and clearing and forwarding agents. The required data was obtained by the use of a structured questionnaire and analyzed by both descriptive and inferential statistics. The findings showed that a significant association existed between the use of ICT and port operations performance. The research is different from the current one in terms of methods and theory, and it addresses a wider scope of maritime industry stakeholders. There is a need to narrow the scope to a single stakeholder.

Atieno (2014) conducted a study to find out how information communication technology affects logistics firms' supply chain efficacy. The study variables were information communication technology and impacts on logistics firms' operating efficiency. The study was carried out in Nairobi and had specific objectives:

- To analyze the degree to which ICT is used in the supply chains of these logistics firms.
- To find out the level to which the use of these technologies and lead time affect the performance of the supply chain of the logistics firms in Nairobi.
- To determine difficulties encountered in the usage of ICT in logistics firms' supply chain performance.

The study made use of descriptive research design to investigate how the variables relate. The target population for the study was the 30 large logistics firms that operate in Nairobi. In each of these firms, two respondents were selected, giving a sample size of 60 respondents. Required data was obtained by means of questionnaires and analyzed by descriptive statistical tools, and presented in tables and charts. Inferential statistics were also used to establish the association between the variables of the research. The study findings were that there is a 57.4% positive correlation between the use of ICT and a logistics firm's supply chain performance. The study concluded that ICT plays a crucial role in enhancing the performance of logistics first supply chains. The research recommends:

- Firms should adopt upgraded technology in order to improve their performance.
- Supply chains should decide on the right strategy to remain competitive in their market of operations.
- It is crucial for logistics firms to assess the lead time to reap benefits from it.

The story differs in methodology from this study.

Kithia (2015) conducted a study that sought to investigate the impact of e-logistics on the performance of firms offering logistics services. The variables of the study were e-logistics technologies and their impacts on logistics firms' performance. The research was carried out in Kenya, and its objective was to assess the impact of e-logistic technology on logistics firms' performance. The study was anchored on transaction cost theory and resource-based view theory. The study made use of a case study method. The population of the study was 107 employees of Maersk Kenya Limited. Stratified and purposive random sampling was used to derive a sample size of 75 respondents. Data were collected through the use of a questionnaire and analyzed by use of SSPS. The findings of the study were that these technologies positively influenced the performance of logistics firms. The study recommends the adoption of these technologies in other areas of logistics, such as warehousing and clearing and forwarding. The study differs from the current study in terms of methods and theories.

Abbas (2016) conducted a study that sought to find how a firm's logistics performance is enhanced by mobile technology use. The variables studied were mobile technologies and the performance of logistics firms. The research study was conducted in Kenya and was guided by three specific objectives:

- To determine the extent to which this technology is being used by these firms.
- To determine the effect of this technology on logistics firms' performance and
- To determine Factors affecting the adoption of this technology by firms.

Under the theoretical framework, the study was anchored on the resource advantage theory of competition, the technology acceptance model and the task technology fit theory. In order to obtain qualitative information, the study made a descriptive cross-sectional research design. The sample size was made up of 228 clearing and forwarding firms. The data collected was analyzed using descriptive statistics, and regression models were used to express the relationship between the variables. The findings of the study were that mobile phone technology had a significant positive influence on the performance of the firms because it offers the communication capability of timely information required during cargo transportation. The study concludes that there is a significant relationship between this technology and the performance of clearing and forwarding firms. The research recommends that firms increase the adoption of these technologies to improve their performance. The study fails to highlight other determinants of logistics organizations' performance. The study differs from the current one in terms of theories and methods.

Gakuubi (2018) conducted a study to investigate the influence of ICT on Nairobi bottlers' logistics performance. The variables were information communication technology and the performance of logistics. The specific objectives were:

- To determine the influence of the use of ICT by logistics firms to achieve competitive advantage.
- To analyze difficulties faced in the application of ICT to achieve logistics performance.
- To evaluate the association between this technology and logistics firm's performance.

The study adopted a descriptive research design to get a fitting representation of the study variables. The study sample size was made up of 76 employees out of the target population of 325 employees. Simple random sampling was used to select the employees who participated in the study to avoid bias. The data that was gathered utilizing questionnaires was analyzed by descriptive and inferential statistics. The findings were that there is a significant positive relationship of 0.603 between the use of ICT and the logistics firm's operational efficiency. The conclusions of the study were:

- The use of ICT enables an organization to achieve a competitive advantage due to the ability to share information.
- Management bureaucracy affects the adoption and use of ICT.

The study recommends that Nairobi bottlers increase their use of ICT to minimize vehicle theft, cost localization of vehicles, and tracking. Employees should be advised not to resist change, and the firm should endeavor to invest more in technology.

2.2. Conceptual Framework

The independent variable was communication technologies, and the dependent variable was shipping lines' performance being moderated by International maritime regulations. International maritime regulations in this study were used as a moderator in the relationship between communication technologies and the performance of shipping lines.

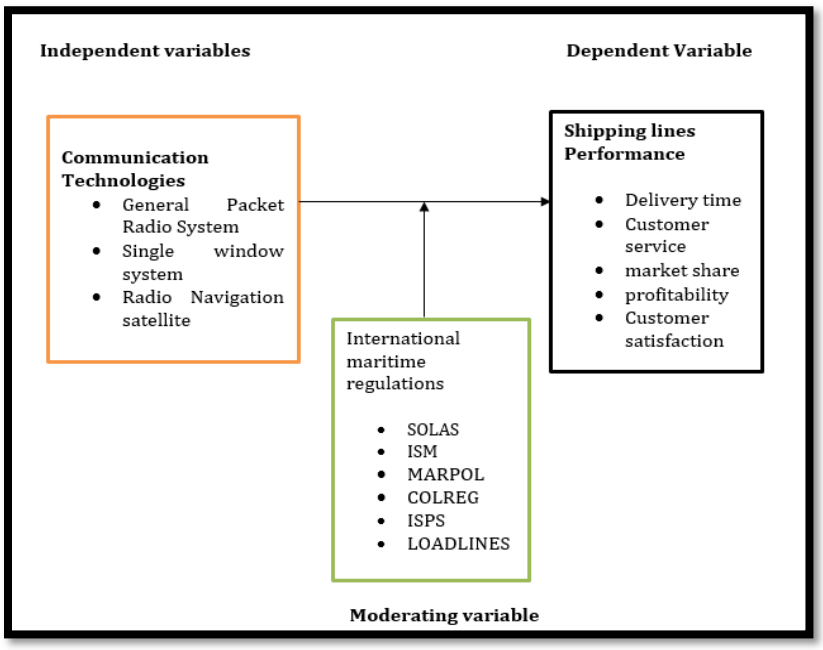

Figure 1: Conceptual Framework
Source: Researcher (2021)

3. Methodology

A research philosophy is a researcher's perception of the world and how it gives rise to assumptions that underpin one's research process (Antwi & Hamza, 2015). They further assert that research philosophies are broadly categorized into positivism, Interpretivism, realism or pragmatism.

Positivism research philosophy underpinned this study and held that the goal of knowledge was simply to describe the phenomenon that people experience (William, 2006; Robert, 2008). The positivist paradigm mostly involves quantitative methodology. It also involves the administration of pre-and post-tests to measure gain scores. Here, the researcher is external to the research site and is the controller of the research process (Taylor & Milton, 2013).

In the positivist view, science is the way of getting the truth, understanding the world well and hence controlling it. According to Eric (1998), positivists study the parts to understand the whole. The positivists look for regularities and casual relationships to enable them to understand and predict the social world.

3.1. Research Design

The explanatory research design was used to investigate the influence of sensor technology on the performance of shipping lines in Kenya by estimating the relationships between various aspects of sensor technology and the performance of shipping lines. According to Kothari (2004), explanatory research design facilitates research to be as efficient as possible, yielding maximum information. According to Creswell (2005), explanatory research design can be used to predict an outcome such as the performance of shipping lines.

3.2. Sample Size

For the purpose of obtaining a sample that was considered optimum and needed to make generalizations about the whole population (Table 1: staff from shipping lines targeted for this study), the size of the sample will be determined using the Yamane (1976) formula. The sample size will be calculated as follows:

n= N÷ (1+Ne2)

Where:

n=number of samples

N=total population

e = error tolerance

n=2835 ÷1+ (2835*0.052) = 350

n=350

In similar studies, response rates have ranged between 68% and 80%. (Atieno, 2014 -68.3%; Abbas, 2016 - 78%: Kilonzi & Kanai, 2020 - 75%). The study will provide for non-response in line with Sivo et al. (2006), who argue that in social sciences that gather data through a self-administered questionnaire, the response rate is normally 80%. In this study, therefore, the expected non-response rate will be 20%; hence, the final sample size will be 350/ 0.8 = 437. =438

The sample size of 438 respondents was selected using stratified and simple random sampling from the four departments' employees, which were grouped into four strata. IT department, Finance department, Logistics department and sales and marketing department of these shipping lines that form the target population were used to gather the research data. This sampling technique ensures equal chances of every item in the population being selected in the target population (Mugenda & Mugenda, 2013).

Department	No. of Staff	n.Xi/N	Sample Size
Logistics	706	706 ÷ 2835 × 438	109
Finance	666	666 ÷ 2835 × 438	103
Information technology	623	623 ÷ 2835 × 438	96
Sales and marketing	840	840 ÷ 2835 × 438	130
Total	2835		438

Table 1: Sample Size
Source: Kenya Business List Directory (2021)

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3.3. Communication Technologies

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.710
Bartlett's Test of Sphericity	Approx. Chi-Square	86.796
	Df	15
	Sig.	.000

Table 2: Kaiser-Meyer-Olkin and Bartlett's Test for Communication Technologies
Source: Field Data (2022)

Bartlett's test of Sphericity is used to test the validity of the instruments. A score of .000 was recorded, showing that the variable was suitable for factor analysis. A score of less than 0.05 indicated a rejection of the null hypothesis since the correlation matrix was an identity matrix. This, therefore, showed that the variables were suitable for factor analysis. On the adequacy of the sample size using the Kaiser-Meyer-Olkin (KMO) test, a score of 0.710 was recorded. This indicated that there was sample adequacy for factor analysis.

The study findings showed that all six items had a factor loading above 0.5; therefore, all 6 items were retained. According to Chakraborty (2010), items with a factor loading of 0.5 or more should be retained, while those with a factor loading lower than 0.5 should be dropped.

3.3.1. Model Specification 1

To examine the relationship between communication technologies and the performance of shipping lines in Kenya.

$Y=\beta o+\beta 1CT+\varepsilon$ …… (1)

Where:

Ɣ= performance of shipping lines
CT= Communication technologies
Bo= Constant (Y intercepts)
β1= coefficient of the regression
ε= error term

3.3.2. Model Specification 2

In the second step, the moderating factor was introduced to equation 1 above to have the following equation:

$Y = \beta o+\beta 1CTM + e$ …… (2)

Where:

Y = Firm's performance
βo= Constant (Y intercepts)
β1-4=Regression coefficient
CT = Independent variables (Communication)
M = International maritime regulations
e = margin of error

4. Results and Discussions

4.1. Communication Technologies

Communication technologies encompass General Packet Radio Systems, Single Window Systems and Radio Navigation Satellites. These technologies are effective in relaying real-time information that is required during the cargo transportation process to the parties involved. The researcher aimed to assess the application of these technologies in the organization and their effectiveness in relaying real-time information, connecting the virtual and physical flow of goods and keeping customers informed. The information gathered in linkage to communication technologies has been analyzed and tabulated in table 3.

Statement	N	Min	Max	Mean	Std. Dev	Skewness	Kurtosis
There is use GPRS by your firm in its Operations	360	1	5	3.63	.956	-.811	.425
GPRS are adequate in relying real time information in your firm	360	1	5	3.72	.836	-1.065	1.773
There is utilization of SWS is as a communication technology by your firm in its operation	360	1	5	3.70	.949	-.900	.797
SWS are adequate for connecting virtual and physical flow of goods	360	2	5	3.93	.695	-.207	-.166
There is use of RNS as a communication technology in your organization	360	2	5	4.34	.741	-.891	.219
RNS are adequate in sharing of information and keeping customers informed	360	2	5	4.39	.700	-.860	.064
Overall Score	360			3.951	.8128	-.789	.5187

Table 3: Descriptive Statistics Results on Communication Technologies
Source: Field Data (2022)

Table 3 shows that those who responded agreed that there is use GPRS by your firm in its Operations (M=3.63 SD= .956). Further, the results indicated that the majority of the respondents agreed that GPRS is adequate for relying on real-time information in your firm (M= 3.72 SD=0.836). Similarly the results indicated that there is the usage of SWS as communication technologies by your firm in its operation (M=3.70 SD=.949). In addition, results showed that SWS are adequate for connecting virtual and physical flow of goods (M= 3.93 SD= .695).

Several of the respondents who answered agreed that there is the use of RNS as a communication technology in your organization (M= 4.34 SD= .741). Many more respondents agreed that RNS is adequate for sharing information and keeping customers informed (M= 4.39 SD= .700).

The skewness values based on table 3 did not have outliers, nor were they excessive, but were the threshold of -2 and +1, which showed that data had a normal distribution. The results additionally indicated skewness with an overall score value of -0.789, disclosing that the tail was slightly longer on the left as opposed to the right. This meant responses tending towards one were fewer in comparison with those tending to five. Consequently, the observations were said to be approximately symmetrical. The outcome also showed that Kurtosis values had no outliers, were not excessive and were within the range of -2 and +2, implying that the data was approximately symmetrical. The overall Kurtosis score value of 0.5187 was below 3, indicating that the data was right-tailed and possessed a platykurtic shape. Thus, the data was distributed normally. The results further indicated a standard deviation, which scored at an average of 0.8128, showing that all the communication technologies constructs were not dispersed. This proved there was great internal consistency, which may be analyzed in similar ways (communication Technologies). In general, the various study items on communication technologies' objectives showed aggregate mean and Std. deviation of 3.951 and 0.8128, respectively, which indicated there were differences in respondents' answers as to what degree communication technology influenced shipping lines' performance. The aggregate mean score value of 3.951 proved that shipping lines in Kenya are utilizing communication technologies in order to improve their performance.

These findings concur with the study by Bauk, Kapidani and Schmeink (2017), who posited that the use of Communication technologies positively affected shipping performance due to its capability to deliver real-time information. In addition, the study is in line with the studies by Ayantoyinbo (2015) and Mlimbila & Mbamba (2018), who argued that the use of communication technologies has a positive impact on maritime industry performance improvement. To further this, the study findings concur with the study carried out by Kyomo (2019), Atieno (2014) and Kithia (2015), who contended that the use of these technologies had a positive influence on shipping lines' performance by offering capabilities of informing customers of well in advance. This is in line with the studies that were conducted by Abbas (2016) and Gakuubi (2018), who argued that there was an association between the use of technologies and shipping lines' performance.

4.2. Performance of Shipping Lines

Shipping lines' performance entails the measurement of the extent to which a firm achieves its goals and objectives. The sampled responses in relation to the Performance of shipping lines have been assessed and presented in table 4.

Statement	N	Min.	Max.	Mean	Std. Dev	Skewness	Kurtosis
The utilization of technology has led to reduced delivery time for the firm	360	1	5	4.05	.750	-.803	.922
The use of supply chain management technologies has made your Firm increase its market share	360	1	5	4.29	.625	-.513	.402
The use of supply chain management technologies has made your Firm increase its market share	360	1	5	4.31	.707	-.675	-.213
The profitability of the firm has increased since your firm started using these technologies	360	2	5	4.27	.679	-.720	.660
Customer satisfaction has been improved with the use of these technologies by your firm	360	3	5	4.45	.571	-.424	-.760
Customer satisfaction has been improved with the use of these technologies by your firm	360	3	5	4.45	.571	-.424	-.760
Overall score	360			4.274	0.6664	-0.627	0.2004

Table 4: Descriptive Statistics for Shipping Lines' Performance
Source: Field Data (2022)

The findings indicated that the overall score for shipping lines' performance was a mean of 4.274. The variation of responses was low, with a standard deviation of 0.6664, whereas the individual statements recorded a standard deviation of around 1.000. The highest variation of 0.750 was recorded for the statement 'The utilization of technology has led to the reduced delivery time of the firm,' which had a mean of 4.05. The lowest variation of 0.571 was recorded for the statement' Customer satisfaction has been improved with the use of these technologies by your firm,' which had a mean of 4.45. This means the research respondents agreed with the statement on improving shipping lines' performance through the use of supply chain management technologies. This resonates with the study carried out by Karibo (2019), who argued that the use of supply chain management technologies had a significant positive effect of 0.982 and 0.964 on shipping performance in terms of timely delivery and increased sales, respectively.

In the statement 'The use of supply chain management technologies has made your Firm increase market share,' the research respondents agreed at a mean of 4.31 and a variation at a standard deviation of 0.707 that shipping lines' performance has improved in terms of increased market share. This is in agreement with the studies that were conducted by Ndonye (2014), Macharia, Iravo, Tirimba & Ombui (2015) and Maina (2017), who contended that there is a positive relationship between the use of technology and shipping lines' performance in terms of cost reduction, time reduction, quality service and competitiveness in their operations.

In the statement Customer service of the firm has improved with the use of supply chain management technologies,' the respondents agreed with a mean of 4.29 and a variation showing a standard deviation of 0.625. This is in line with the study by Ojwang, who posited that the use of technology improved shipping line efficiency by reducing lead time, providing quality services and providing timely feedback.

On the statement, 'The profitability of the firm has increased since your firm started using these technologies,' the respondents agreed at a mean of 4.27 and a variation showing a standard deviation of 0.679. This is in agreement with the study carried out by Njagi, Namusonge, and Mugambi (2016), who posited that there is a positive relationship between the use of technology and the profitability performance of shipping firms.

4.3. International Maritime Regulations

International maritime regulations are presented by conventions such as SOLAS, ISM, MARPOL, COLREG, LOADLINES and ISPS, each serving a distinct purpose. These regulations are meant to guard the lives of seafarers, marine pollution, and cargo weight limit. International maritime regulations have an impact on the relationship between supply chain management technologies and the performance of shipping lines. The researcher sought to find out the moderating effect of these international maritime regulations on the relationship between supply chain management technologies and shipping lines' performance. The sampled responses in relation to international maritime regulations have been assessed and presented in table 5.

Statement	N	Min	Max	Mean	Std. Dev	Skewness	Kurtosis
Your organization strictly observes the SOLAS convention during its operations	360	1	5	4.15	.938	-1.380	1.743
ISM adherence affects your operations and consequently affects your performance	360	1	5	4.23	.705	-.987	2.227
Observing the MARPOL convention has an effect on your firm's operation	360	1	5	4.29	.837	-1.697	4.024
Your organization strictly observes the COLGEG convention	360	1	5	4.38	.812	-1.805	4.478
Your organization adheres to the LOADLINES convention during its operations	360	1	5	4.34	.815	-1.310	1.737
Your organization strictly observes ISPS conventions during its operations, and this affects its performance	360	1	5	4.40	.753	-1.810	5.101
Overall score	360			4.298	0.810	-1.4981	3.2183

Table 5: Descriptive Statistics for International Maritime Regulations
Source: Field Data (2022)

Table 5 shows that the overall score for international maritime regulations was a mean of 4.2983. The variation of responses was low, with a standard deviation of 0.810, whereas the individual statements recorded a standard deviation of around 1.000. The highest variation of 0.938 was recorded for the statement 'Your organization strictly observes SOLAS convention during its operations,' which had a mean of 4.15. The lowest variation of 0.705 was recorded for the statement' ISM adherence affects your operations and consequently affects performance,' which had a mean of 4.23. This means the research respondents agreed with the statement that international maritime regulations affect shipping lines' performance gained after using supply chain management technologies. This agrees with the studies carried out by Kombo (2018) and Oraith (2020), who posited that international maritime regulation significantly moderates the relationship between the two.

In the statement 'Observing MARPOL convention has an effect on your firm's operations,' the research respondents agreed at a mean of 4.29 and a variation at a standard deviation of 0.837 that observing the MARPOL convention has an effect on your firm. In the statement, 'your organization strictly adheres to LOADLINES convention,' the respondents agreed with a mean of 4.34 and a variation showing a standard deviation of 0.815. This is in agreement with the study carried out by Oraith (2020), who posited that international maritime regulation has a significant moderating effect on the relationship between the two On the statement' your organization strictly observes ISPS convention during its operations, and this affects its performance,' the respondents agreed at a mean of 4.40 and a variation showing a standard deviation of 0.753. On the statement' your organization strictly observes COLREG convention during its operations,' the respondents agreed at a mean of 4.38 and a variation showing a standard deviation of 0.812. This agrees with the study carried out by Kombo (2018), who posited that international maritime regulation has a significant moderating effect on the relationship between the two.

4.4. Correlation Analysis

The research used the Pearson product-moment correlation coefficient to test the strength of the relationship between the variables. The Pearson product-moment correlation coefficient was used to determine the strength of a linear relationship between the independent variable (supply chain management technologies) and the dependent Variable (Shipping lines' performance). The Pearson correlation coefficient assumes values between +1 and -1, where +1 indicates a strong positive correlation, -1 indicates a strong negative correlation, and a value of 0 means there was no relationship between the independent and dependent variables. Values closer to 0 indicated a weak relationship, either positive or negative. The results of the correlation analysis of the research are presented in table 6.

		CT	SL P
CT	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	360	
SLP	Pearson Correlation	.382**	.1
	Sig. (2-tailed)	.000	
	N	360	360

Table 6: Correlation Analysis
Source: Field Data (2022)

The research also showed that there was a positive correlation between communication technologies and shipping lines' performance, with a correlation coefficient of 0.382 at a 5% level of significance. The p-value of the relationship was .000, which indicated that the correlation was significant since the obtained p-value of .000 conformed to a p-value <0.05. These results showed that a significant change in shipping lines' performance was explained by the use of communication technologies. This is in line with the study of Bauk et al. (2017), which contended that the use of communication technologies led to the performance of shipping lines.

4.5. Communication Technologies and Shipping Lines' Performance

The research study sought to assess the relationship between communication technologies and the performance of shipping lines in Kenya. To achieve the objective, the following hypothesis was tested: **Ho**3, there is no statistically significant relationship between communication technologies and the performance of shipping lines in Kenya. The model formulated was Y = βo +β2CT+ ε, where Y is the performance of shipping lines, βo is a constant, β2 coefficient of regression, CT is the independent variable, and ε is the error term. To achieve objective three and test the hypothesis, the researcher carried out a regression analysis of the variables whereby the R and R2 were obtained. The results are shown in table 7.

5. Model Summary on Communication Technologies and Shipping Lines' Performance

The model summary in table 7 shows values of R, R2 and the adjusted R2, as well as the standard error of the estimates, which were used to determine how well a regression model fitted the data. The model summary showed the extent of variation in the outcome variable to the predicator variables in the model. The results are presented in table 7.

Model Summary					
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**Change Statistics**
					R Square Change
1	.364[a]	.132	.130	.30859	.132

Table 7: Model Summary for Communication Technologies and Shipping Lines' Performance
a. Predictors: (Constant), Composite Effect of CT
b. Dependent Variable: Shipping lines' performance
Source: Field Data (2022)

The results in table 7 above show that the value of R2 is 0.132 or 13.2 %, which implies that 13. 2% of the variations in shipping lines' performance are explained by communication technologies, whereas 86.8% of the variations in performance are explained by other factors.

5.1. ANOVA on Communication Technologies and Shipping Lines' Performance

The Analysis of Variance (ANOVA) was used to check the model's fitness in predicting the relationship between the dependent and independent variables. In this case, the relationship between communication technologies and shipping lines' performance. The results of the analysis are presented in table 8.

ANOVA[a]						
Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	5.202	1	5.202	54.630	.000[b]
	Residual	34.o99	358	.095		
	Total	39.295	359			

Table 8: ANOVA on Communication Technologies and Shipping Lines' Performance
Source: field Data 2022
a. Dependent Variable: Shipping Lines' Performance
b. Predictors: (Constant), Composite Effect of CT

Table 8 shows the computed values and the p-value. The calculated value of F (1, 358) = 54.630 and a p-value of 0.000. Using the p-value to check the model's fitness showed that the model was fit to explain the relationship between the predicator variable Communication Technologies and the dependent variable shipping lines' performance since the p-value obtained 0.000 is less than 0.05. Further, this is confirmed by the use of the F values. The calculated value of F at (1,358), where 1 was the numerator and 358 was the denominator, showed that the calculated F value was 54.630, while the critical F value at a 5% significance level was 3.8676.

5.2. Coefficients of Communication Technologies and Shipping Lines' Performance

From the results and discussion, the researcher conducted a regression coefficient to establish the mean change in shipping lines' performance for a unit variation in communication technologies among the shipping lines in Kenya. The regression coefficients were thus established to show the mean change in the dependent variable due to the change in the independent variable. The model allowed the prediction of a dependent variable given an independent variable. The findings are presented in table 9.

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.516	.143		17.640	.000
	CT	.265	.036	.364	7.391	.000

Table 9: Regression coefficients on Communication Technologies and Shipping Lines' Performance
a. Dependent Variable: Shipping lines' performance
Source: Field Data (2022)

Table 9 shows the constant coefficient, that is, the point where the regression line touched the y-axis in the graph was positive since most of the shipping lines had reported positive returns after the use of Communication technologies based on the findings. The slope of the line was also positive, showing a change in performance with the continued proper use of sensor technology. Table 9 indicates that the constant coefficient βo is 2.516 while the standardized β1 is .265. This shows that the unit change in Communication technologies brought about a change in performance of .265.

To test the hypothesis using a t-test, the t-value obtained of 7.391 at a 95% level of significance was higher than the critical t-value of 1.6496 for the sample size used in this study. This, therefore, led to the rejection of the null hypothesis **Ho**.

Based on the above results, the study derived the following simple linear regression equation for communication technologies on shipping lines' performance.

$Y = 2.516 + .265CT + \varepsilon$

The first objective of the research study was to examine the relationship between communication technologies and the performance of shipping lines in Kenya. From the findings, it was established that there was a significant positive relationship between communication technologies and the performance of shipping lines in Kenya. Based on the results, the null hypothesis **Ho**3: There is no statistically significant relationship between communication technologies and the performance of shipping lines in Kenya, was rejected since the calculated t-value 7.391 is greater than 1.645.

The study findings concur with those of Kithia (2015) and Abbas (2016), who showed that the use of communication technologies has an effect on shipping lines' performance. The findings further agreed with Gakuubi (2018) and Kyomo (2019), who showed that there is a significant and positive relationship between communication technologies and shipping lines' performance.

The second objective of the research study was to assess the Moderating effect of International maritime regulations on the relationship between communication technologies and the performance of shipping lines in Kenya.

5.3. Model Summary of International Maritime Regulations, Communication Technologies and Performance of Shipping Lines

The model summary in table 10 shows the values of R, R2, and the adjusted R2, as well as the standard error of the estimates, which were used to determine how well a regression model fitted the data. The summary also shows the extent of variation in the outcome variable relative to the predicator variables in the model. The results are presented in table 10.

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics
					R Square Change
1	.364[a]	.132	.130	.30859	.132
2	.372[b]	.139	.134	.30792	.007

Table 10: Model Summary of International Maritime Regulations, Communication Technologies and Performance of Shipping Lines
a. Predictors: (Constant), IMR, the Composite Effect of CT
b. Dependent Variable: Shipping Lines' Performance
Source: Field Data (2022)

The results in table 10 above show that the R2 for the relationship between sensor technology and shipping lines' performance is 0.132 or 13.2 % before the moderator's introduction. After the introduction of the moderator (international maritime regulations) in the relationship, the R2 increases to 0.139 or 13.9%. This shows that international maritime regulations accounted for 0.007 or 0.6% of the increase in shipping lines' performance.

5.4. ANOVA on International Maritime Regulations, Communication Technologies and Performance of Shipping Lines

The Analysis of Variance (ANOVA) was used to check the fitness of the model in predicting the link between the moderator, the dependent, and the independent variables. In this case, the link between International maritime regulations, communication technologies, and shipping lines' performance. The results of the analysis are presented in table 11.

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	5.202	1	5.202	54.630	.000[b]
	Residual	34.093	358	.095		
	Total	39.295	359			
2	Regression	5.445	2	2.723	28.716	.000[c]
	Residual	33.850	357	.095		
	Total	39.295	359			

Table 11: ANOVA on International Maritime Regulations, Communication Technologies and Performance of Shipping Lines

a. Dependent Variable: Shipping Lines' Performance

b. Predictors: (Constant), IMR, Composite Effect of CT

Source: Field Data (2022)

Table 11 shows the computed values and the p-value for models 1 and 2. The calculated value for model 1 (before the introduction of the moderator) for F (1, 358) = 54.630 and a p-value of 0.000. While the calculated value for model 2 (after the introduction of the moderator) for F (2,357) = 28.716. Using the p-value to check the fitness of the model in assessing the moderating effect showed that the model was fit since the p-value obtained of 0.000 is less than 0.05. The same results were found when using the F-value to test the fitness of the model. The calculated value of F (2,357), where 2 was the numerator, and 357 was the denominator, showed that the calculated F-value = 28.716 was higher than the critical F-value = 3.02101 at a 5% significance level.

5.5. Coefficients of International Maritime Regulations, Communication Technologies and Performance of Shipping Lines

From the results and discussion, the study conducted a regression coefficient to establish the mean change in shipping lines' performance for a unit variation in international maritime regulations among the shipping lines in Kenya. The regression coefficients were thus developed to show the moderating effect of international maritime regulation on the relationship between a dependent variable and the independent variable. The model allowed the prediction of the moderating effect of international maritime regulations on the relationship between Sensor technology and shipping lines' performance. The results are shown in table 12.

Coefficients[a]						
Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.516	.143		17.640	.000
	CT	.265	.036	.364	7.391	.000
2	(Constant)	2.390	.162		14.714	.000
	CT	.239	.039	.329	6.111	.000
	IMR	.053	.033	.086	1.601	.003

Table 12: Coefficients of International Maritime Regulations, Communication Technologies and Performance of Shipping Lines

Dependent Variable: Shipping Lines' Performance

Source: Field Data (2022)

Table 12 shows the coefficients in a straight-line equation on the moderating effect of international maritime regulations on the relationship between communication technologies and shipping lines' performance. These were the coefficients that were used to predict the moderating effect of international maritime regulations on the relationship between Communication technologies and shipping lines' performance. The constant βo, as shown in table 12, was positive, implying that the regression line started on a positive point on the Y-axis. This was because most shipping lines have an improvement in performance due to the use of this technology. The slope of the line was also positive, implying that international maritime regulations have a positive moderating effect on the relationship between communication technologies and shipping lines' performance. Table 12 shows the unstandardized constant coefficient β0 2.390 while unstandardized coefficient β2 = .239 while β6 =0.053

To test the Ho2 hypothesis using the t-test, the calculated t-value of 7.391 at a 95% level of significance was found to be higher than the critical t-value of 1.6496. Hence, the null hypothesis Ho2, international maritime regulations have no statistically significant moderating effect on the relationship between communication technologies and the performance of shipping lines in Kenya, was rejected because 7.391 is greater than 1.6496.

Based on the above results, the study derived the following linear regression equation for the moderating effect of international maritime regulations, which have no statistically significant moderating effect on the relationship between communication technologies and the performance of shipping lines.

$Y = 2.390 + .239CT + 0.053M + \varepsilon$

6. Conclusion and Recommendations

The study's main objective was to examine the relationship between communication technologies and the performance of shipping lines in Kenya and the moderating effect of international maritime regulations on independent and dependent variables.

7. Relationship between Communication Technologies and Performance of Shipping Lines in Kenya

The first objective of the study was to assess the relationship between Communication Technologies and the performance of shipping lines in Kenya. The research findings showed that the respondents agreed that shipping lines use communication technologies such as General Radio Packets, Single window systems and Radio navigation satellites in their operations. The respondents were of the view that the communication technologies used in their firms are adequate in relaying real-time information and informing customers well in advance. The respondents also agreed that the ability of the shipping lines to use communication technologies contributed to their improved performance.

Correlation analysis indicated that there was a significant positive relationship between communication technologies and the performance of shipping lines. Regression analysis also showed that communication technologies and the performance of shipping lines have a significant positive relationship of R2 0.132. These results indicated that communication technologies adequately explain the performance of shipping lines in Kenya. The second hypothesis of the study (Ho2), that there is no statistical relationship between communication technologies and the performance of shipping lines in Kenya, was hence rejected, and the conclusion reached is that there is a significant positive relationship between communication technologies and the performance of shipping lines in Kenya.

It was concluded that there is a statistically significant positive relationship between communication technologies and the performance of these firms. The study also concluded that international maritime regulations positively influence the relationship between communication technologies and the performance of shipping lines in Kenya.

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