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INFLUENCE OF BLOCKCHAIN TECHNOLOGY ON PERFORMANCE OF LOGISTICS FIRMS IN KENYA

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ABSTRACT

The main objective of the study was to establish the influence of blockchain technology on performance of logistics firms in Kenya. The study specifically aimed to determine the influence of Supply chain integration, determine the influence of inventory management systems, establish the influence of information sharing and to identify the influence of transactions security on performance of logistics firms in Kenya. The study was undertaken in 6 logistics firms situated in Nairobi. The study adopted a descriptive research design and the target population was a total of 396 logistics management staff from 6 of the selected logistics firms. The study adopted a stratified sampling technique to select a total of 202 respondents. Questionnaires were used as the main data collection instruments and a pilot study was conducted to pretest questionnaires for reliability. Descriptive statistics and multiple regression analysis were used to analyze the gathered data and the results were presented on tables and charts. Findings from the study showed that Supply chain integration; inventory management costs; information sharing and transaction security influences the performance of logistics firms in Kenya. The study concluded that block chain technology influences the performance of logistics firms through enhancing supply chain integration; reduction of inventory management costs; increased effectiveness in information sharing and improving transaction security across the supply chain players. The study recommended that the management of logistics firm should adopt blockchain technology in the execution of all supply chain integration functions. The study also recommended that management of logistics firms should effectively integrate blockchain technology in all inventory management functions, transaction processes and continuously update effective transaction security systems in order to safeguard confidential transaction information that is processed through the use of block chain technology.

Key words: *Supply Chain Integration, inventory management systems, Information Sharing, Transactions Security, block chain technology, Logistics Firms in Kenya*

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INTRODUCTION

Globally, the evolution of technology and advancement in the use ICT have brought, new changes in the way businesses undertakes transactions and one of the key notable changes is the adoption of Blockchain Technology or Virtual Currencies. This has been found to reduce business transactions costs and to facilitate application of effective and efficient method of conducting business in the global market place. Over the last decade internet and softwares have made the transaction of money convenient. Firms easily make online purchase and trade securities (Soosay & Hyland, 2015).

Blockchain Technology refers to a type of data structure that enables identifying and tracking transactions digitally and sharing this information across a distributed network of computers, creating in a sense a distributed trust network (Casey & Wong, 2017). The distributed ledger technology offered by blockchain provides a transparent and secure means for tracking the ownership and transfer of asset. Initially Blockchain Technology was used as the transactional technology behind cryptocurrency (or digital currency), blockchain technology has started to gain traction in the enterprise as well, with applications far and wide including in areas such as real estate, product tracking, voting platforms among other myriad applications. Cryptocurrencies and forex online trading are among the many alternative investment schemes which have been gaining currency in across the region and globally. The most known product of blockchain technology is bitcoins (Nakamoto, 2010).

Across global supply chains, financial services, healthcare, government and many other industries, innovators are exploring ways to use blockchain technology to disrupt and transform traditional business models. Many industry leaders have already achieved significant business benefits, including greater transparency, enhanced security, improved traceability, increased efficiency and speed of transactions, and reduced costs (Soosay & Hyland, 2015).

Blockchain technology is a critical element of cryptocurrencies, without it, digital currencies like Bitcoin would not exist. Before it was ever used in cryptocurrency, it had humble beginnings as a concept in computer science, particularly, in the domains of cryptography and data structures. In USA and other developed countries blockchain technology has helped many logistics many firms to reduce operational costs and increase great efficiency in financial and inventory management functions. Blockchain keeps a record of all data exchanges, this record is referred to as a “ledger” in the cryptocurrency world, and each data exchange is a “transaction “. Every verified transaction is added to the ledger as a “block. It utilizes a distributed system to verify each transaction a peer-to-peer network of nodes. Once signed and verified, the new transaction is added to the blockchain and cannot be altered (Barratt, 2014). In general, blockchain allows to transfer transactions safely between two or more parties in a digital decentralized ledger without the need for intermediaries (Swan, 2015)

In Africa, many logistics firms are still struggling to embrace technologies that that could lead to increased supply chain performance. One of the technologies is blockchain technology, however it is only in few countries where logistics firms have managed to successfully adopt blockchain technology such as South Africa and Egypt and this has had a significant effect on supply chain performance. This has made many firms in South Africa and Egypt to gain a competitive advantage in the global supply chain (Greunen, Herselman and Niekerk 2010)

In Kenya, the concept of blockchain technology to improve performance has not yet been embraced by many companies and as result many firms are facing competition both from multinational companies and imports in the domestic markets. The new competition parameters include improved quality, products with higher performance, reduced cost, a wider range of products with better services; all

delivered at the same time. Many companies have not succeeded in maximizing their supply chains prospective because they have failed to implement effective technologies and to develop the performance measures and metrics desired to fully integrate their supply chain, thereby maximizing effectiveness and efficiency (Ruth, 2012)

Statement of the Problem

Supply chain performance is major problem facing many logistics worldwide. Block chain technology can help many logistics firms to manage the experienced supply chain performance challenges (Nowiński & Kozma, 2017). Blockchain Technology enables firms in identifying and tracking transactions digitally and sharing this information across a distributed network of computers, creating in a sense a distributed trust network. The distributed ledger technology offered by blockchain provides a transparent and secure means for tracking the ownership and transfer of assets. Blockchain technology provides major benefits that are of influence on logistics firms performance (Sporny, 2017). In the United States of America (USA), over 70% of firms that have adopted blockchain technology indicated to realize benefits in terms of, increased transparency, enhanced security, improved traceability, increased efficiency and speed of transactions, and reduced costs. This strongly reduces the risk of a backdoor transaction and unauthorized intervention (Popper & Lohr, 2017).

For the past decade, firms have been adopting different forms of technologies as a measure to manage supply chain challenges. However, performance in many logistics firms remains as key challenge in spite of having new technologies in place (Rosen, 2014). In Kenya, many logistics firms are yet to adopt blockchain technology hence leading to lack of alterative and effective solution to manage supply chain performance problems. According to Popper and Lohr (2017) over 50% of logistics firms lose millions of funds annually as result of supply chain performance challenges.

According to Lammi (2016) successful implementation of blockchain technology can play an important role towards improvement of the overall sector performance in logistics firms. Despite the importance of blockchain technology on performance of logistics firms there lacks a specific study that have managed to effectively address the influence of blockchain technology on performance of logistics firms in Kenya. This has therefore created a major knowledge gap on how blockchain technology can contribute to performance of logistics firms. It is therefore against this background that this study was undertaken to fill the missing knowledge gap by determining the influence of blockchain technology on performance of logistics firms in Kenya.

Study Objectives

The overall objective of the study was to establish the influence of blockchain technology on performance of logistics firms in Kenya. The specific objectives were:-

- To determine the influence of supply chain integration on performance of logistics in Kenya
- To determine the influence of inventory management systems on performance of logistics firms in Kenya
- To establish the influence of information sharing on performance of logistics firms in Kenya
- To identify the influence of transactions security on performance of logistics firms in Kenya

LITERATURE REVIEW

Theoretical Review

A Theory is a set of statements or principles devised to explain a group of facts or phenomena especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena (Camp, 2010). The theoretical review relates to the philosophical basis on which the research takes place and forms the link between the theoretical aspects and practical's components on the study problem (Cooper & Schindler, 2006). This

section explores theories that will be used by the study in order to determine the influence of blockchain technology on performance of logistics firms in Kenya.

General Systems Theory

General systems theory (GST) was developed in the 1950s and 1960s and attempted to explain and predict the behaviour of the entire organization which includes people, structure, environment and technology. General System theory was proposed by Ludwig von Bertalanffy. (Von Bertalanffy, 1968). GST states that a system is a collection of part unified to accomplish overall organisations goals. A system has inputs such as resources, raw materials, money, technologies, processes and people. A supply chain is a system which comprises of activities such as operational management, inventory management and information sharing. According to Kshetri (2018) a firm's operation management exist in a system entailing a range of activities such as documentation, transaction processing and involvement of supply chain agents. When a single activity fails in a system the whole operations functions fails. This theory is therefore relevant to determine the influence of supply chain integration on performance of logistics firms (Bocek *et al.,*2017).

Theory of Economic Order Quantity Model

Economic order quantity (EOQ) is the level of inventory that minimizes total inventory holding costs and ordering costs. This is a Mathematical model developed by F.W. Haris in 1913, to explain and establish the optimal inventory level (Arsham, 2006). EOQ only applies when demand for a product is constant over the year and that each new order is delivered in full when the inventory reaches zero. There is a fixed cost charged for each order placed, regardless of the number of units ordered (Horvath, 2011).

EOQ is used to determine the optimal number of units of the product to order so that to minimize the total cost associated with the purchase, delivery and storage of the product The required parameters to the solution are the total demand for the year, the purchase cost for each item, the fixed cost to place the order and the storage cost for each item per year. Note that the number of times an order is placed will also affect the total cost, however, this number can be determined from the other parameters (Horvath, 2011).

Diffusion of Innovation Theory

Diffusion of innovation (DOI) theory was developed by Everett Rogers in 1962. The theory explains how, why and at what rate new ideas and technology spread through cultures operating at the individual and the firm level (Venkatesh, Morris, Davis & Davis, 2013). DOI theory sees acceptance of technology (innovation) as being communicated through channels over time and within a particular social system. Individuals are seen as possessing different degrees of willingness to adopt innovation and thus, it is generally observed that the portion of the population adopting innovation is normally distributed over time (Venkatesh et al, 2013). Adoption of new technology in an organization leads to innovation on methods of production, development of new products, services provided in an organization marketing systems and accessing information on new markets for products, new products and better methods of production. Blockchain technology leads to adoption of new technology which increases the accuracy, effectiveness in information sharing process across the supply chain partners. DOI Theory is thus relevant to explain the influence of information sharing on performance of logistics firms in Kenya.

Theory of Constraints (TOC)

Theory of constraints (TOC) was developed by Eliyahu Goldratt. The theory of constraints (TOC) adopts the common idiom "A chain is no stronger than its weakest link" as a new management paradigm.

(Eliyahu, 2004) This means that processes in organizations are vulnerable because the weakest person or component can always damage or break or reduce the outcome. The TOC explains that any manageable system is limited in achieving more goals by very limited number of constraints and there is always at least one constraint. The TOC identifies the constraint and restructure the rest of the organizations around it (Eliyahu, 2004).

Resource Based Theory

The resource based theory was developed by Jay Barney in 1984, the theory states that resources are inputs into a firm's production process and are classified into three categories notably, physical capital, human capital and organizational capital. A firm capability is the capacity of a set of firms' resources to perform set of tasks or activities. The differences in firms' performance are driven by their unique resources and capabilities (Barney, 2012). Organizations have set of resources and capabilities which determines ability of the firm to generate the required returns. In supply chain management organizations physical capital, human capital and organizational capital determines a firm's capability to undertake inventory management functions and meet the required inventory management costs.

Conceptual Framework

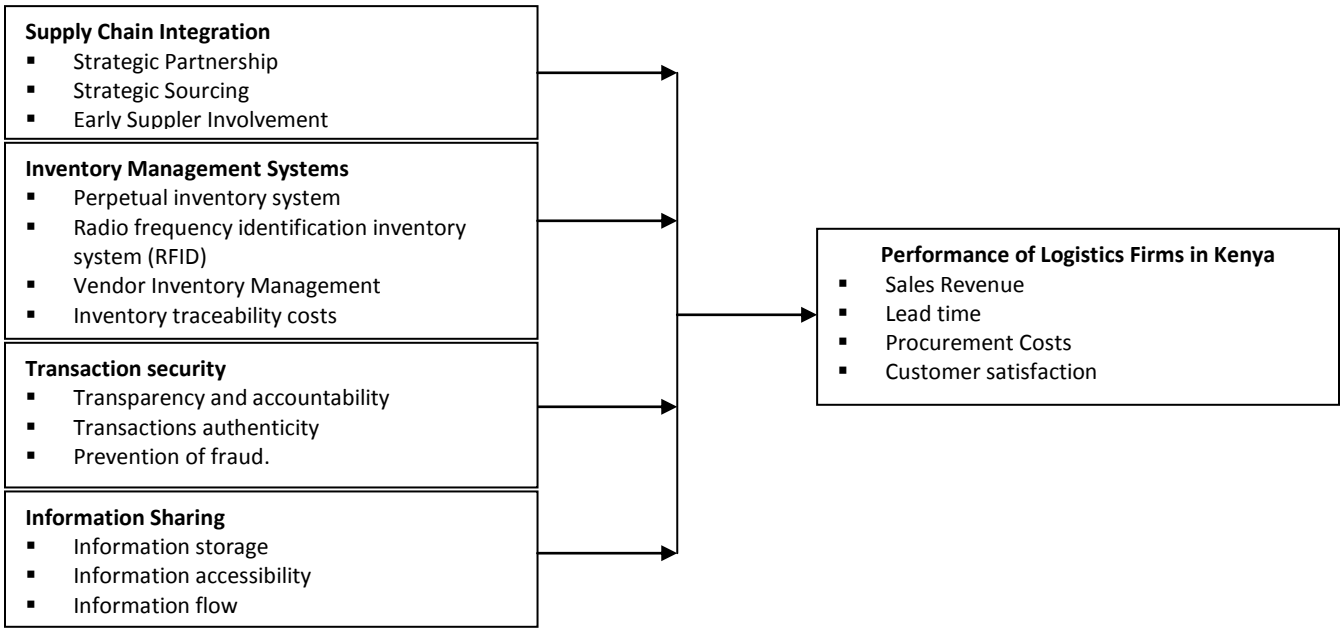

Figure 1: Conceptual Framework

Source: Author (2019)

Empirical Review

Supply Chain Integration

Owino (2015) sought to determine the effect of supply chain integration on organizational performance of commercial banks in Kenya. The study adopted a cross sectional research design. The study found out that reverse logistics, knowledge management, top management support, information technology adoption, customer orientation and customer service affect performance of commercial banks. Narasimhan and Jayaram, (2008) found that strategic sourcing initiatives improve supply chain performance and through examining the type of sourcing decisions, strategic sourcing decisions were found to be strongly related to manufacturing goal

achievement in a study of 215 North American manufacturers. In addition, the construct strategic supplier partnership is an integral element to the second order construct of supply chain management (Li, Ragu and Rao, 2006).

A study by Ngatia (2013) found out that the use of technology has made many firms to use various technologies that assist in supply chain integration. Findings by Krystsina (2017) identified that Supply chain integration facilitates delivery of goods to different distribution centers and ensuring that the to be supplied are of the right quality and quantity during need analysis and costs of ordering, transporting and holding goods is also reduced considerably. Blockchain technology ensures that correct distribution is done as it ensures that proper demand forecasting is done, proper scheduling is done and right order processing is carried out in time (Kosba, 2015).

A study by Krystsina (2017) found out that many logistics firms in UK are looking for various technologies to improve performance of their logistics activities and a key technology solution that has been identified and embraced by many firms is blockchain technology. Krystsina (2017) noted that over 50% of logistics firms in UK have benefited in use of blockchain technology since blockchain technology offers a key solution to the reduction business distribution costs in terms of demand forecasting, reduced scheduling and order processing procedures and these plays a significance role in facilitating reduction of the total transactions costs incurred in across the supply chain players leading to improved performance.

Inventory management Systems

A study by Luther and Olson (2013) found out that in UK logistics firms' application of inventory management systems helps firm to reduce inventory management costs. Inventory management systems comprises the combination of technology (hardware and software) and processes and procedures that oversee the monitoring and maintenance of stocked products, whether those products are company assets, raw materials and supplies, or finished products ready to be sent to vendors or end consumers (Camp, 010). Inventory management systems notably perpetual inventory system, radio frequency identification inventory system (RFID) and Vendor Inventory Management. These have a significant influence on performance of logistics firms (Walch, 2014). The scope of inventory management entails the fine lines between replenishment, lead time, carrying costs, asset management, inventory forecasting, inventory valuation, inventory visibility, future inventory price forecasting and quality management and stores management amongst other inventory management functions. Blockchain technology plays a significant role in reducing inventory management costs by facilitating application of inventory management system. These have a significant influence on performance of logistics firms.

Information Sharing

Information sharing is the process of exchanging data between various organizations, people and technologies. Blockchain technology facilitates effective information sharing between supply chain partners by allowing easier way of storing information, by providing effective ways for information accessibility and by enhancing easier way of automation of information amongst all members in a supply chain (Wu *et al*., 2017).

In Germany, Luther and Olson (2013) study on blockchain technology and information sharing amongst supply chain partners in logistics firms supply chain found out that blockchain technology has offered an easier and effective solution to information sharing challenges faced by logistics firms across the supply chain. Luther and Olson (2013) identified that transactions histories are more transparent and shared across many networks through the use of blockchain technology since

blockchain technology provides a distributed digital ledger that allows all networks participants to share the same documentation as opposed to individual copies. The shared version of information can only be updated through consensus, which implies that everyone across the network must agree.

In Japan, a study by Nakamoto (2010) established that many logistics firms in Japan have succeeded in improving information sharing across the supply chain partners through the use of blockchain technology and this has played a significant role in improvement of the overall logistics firms performance. Nakamoto (2010) study identified that blockchain technology allows easier way of storing information, provides effective ways for information accessibility and by enhances effective automation of transaction information amongst supply chain participants.

Transactions Security

Transaction security is the safety of confidential business transaction information created when business entities or individuals communicate to complete a transaction. (Lieber, 2017). Blockchain technology offers a solution to transaction security challenges involved during electronic transaction processes and provides secure transmission of all transaction data involving businesses. Blockchain technology offers a decentralized way which allow it to simultaneously store data on large number of computers instead of one computer. Blockchain technology makes use of a distributed ledger which allows storage of transaction information on a network of millions of computers around the world which makes it virtually unhackable. This helps in improvement of transaction security in terms of transaction transparency and accountability, transaction authenticity and prevention of fraud and these leads to improved supply chain performance (Lieber, 2017).

Kakavad (2015) did a study on blockchain revolution in UK firms and established that blockchain technology offers a unique way for logistics firms to improve on transaction security since it eliminates many possible ways of tampering with transaction process by unauthorized persons and this improves transaction transparency and accountability, transaction authenticity, prevents fraud and these leads to improved performance. Kosba (2015) study identified that in India and China, blockchain technology has revolutionized the operation of many logistics firms through provision of an effective platform for improving businesses transactions security, Kosba (2015) found out that many logistics firms in China have recorded increased cases of transaction transparency and accountability, transaction authenticity, reduced cases of fraud. These have had a major positive impact on performance of many logistics firms.

Performance of Logistics Firms

A study by Sporny (2017). found out that the Performance of many logistics firms in United States was dependent on effectiveness of implementation of blockchain technology. Fawcett (2010) found out that blockchain technology played a major role in determination of the performance in many USA logistics firms. Fawcett (2010) noted that performance was determined by rate of delivery of quality products and services and delivery of goods in right quantities and at precise times. Lammi (2016) noted that in many Chinese manufacturing firms, blockchain technology enhanced realization of increased level of performance by minimization of total cost of the products and services and realization of increased level of customer satisfaction due to better customer service.

Davila, Gupta and Palmer (2013) noted that blockchain technology plays an important role in demand forecasting in many manufacturing firms in England. Eei, Husain and Mustaffa (2012) made inferences that information sharing is a very critical factor that supports effective implementation of block chain technology which promotes the

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performance of many manufacturing companies in Malaysia. A study by Mose, Njihia & Magutu (2013) revealed that manufacturing planning play a major role towards promoting performance in many manufacturing firms in South Africa.

METHODOLOGY

This research was conducted through a descriptive survey design. According to Kothari (2008) descriptive survey research includes a cross sectional survey and fact-finding enquiries and describes the state of affairs as it existed at the time. The target population was a total of 1298 logistics firms in Kenya. According to the Kenya Revenue Authority (2018) report there are 1298 licensed freight and logistics firms registered to undertake business in international trade. The target population therefore comprised 6 logistics firms notably; Maersk Line Kenya; Seaways Kenya LTD; Global Freight Logistics LTD; Siginon Global Logistics; Aircom Cargo Logistics LTD and Top-Link Logistics Services Limited. The study population comprised of a total of 396 supply chain management staff working in 6 logistics firms in Nairobi. The study collected primary data through the use of a semi structured questionnaire (open and close ended questions). The study used questionnaire containing both open-ended and closed-ended items. Data was analyzed using the Statistical Package for Social Sciences (SPSS) Version 22. Since there are four independent variables in this study, the multiple regression model generally assumed the following equation; $Y= \beta_0 +\beta_1X_1+\beta_2X_2+\beta_3X_3+ \beta_4X_4+€$

Where; Y = Performance
β_1, β_2, β_3, β_4 = Variables Coefficients
X_1 = Supply chain integration
X_2 = Inventory Management Systems
X_3 = Information Sharing
X_4 =Transactions Security
€ = Error term

FINDINGS

Supply Chain Integration

Table 1 showed that, majority of the respondents agreed that the organization strategic sourcing relationship has been able to meet customer demands as indicated by a mean score of 4.409 and a standard deviation of 0.9476. Majority of the respondents agreed that the firm had improved its competiveness as a result of strategic partnership with key supply chain partners as indicated by a mean score of 4.409 and a standard deviation of 0.9476. The study established that blockchain technology facilitated speedy delivery of goods and service due to Early Supplier Involvement as indicated by a mean score of 4.361 and a standard deviation of 0.8784. Lastly, majority of the respondents agreed that strategic sourcing helps in mutual benefits, continuous improvement of quality and risk management as indicated by a mean score of 4.438 and a standard deviation of 0.7585.

On average all the supply chain integration reductions statements had an average mean score of 4.403 and a standard deviation of 0.8615. The integration of technology, people, business and processes is crucial for survival and competitive edge in the current digital age and this is not important only within the organization but also across extended enterprises (Owino, 2015). Supply chain management is one of the most strategic functions of an organization which can be exploited to gain a sustainable competitive advantage in the market place.

Table 1: Supply Chain Integration Descriptive Results

Supply Chain Integration Reductions statements	N	Minimum	Maximum	Mean	Std. Deviation
a. The firm's Strategic Partnership has improved its competiveness	120	2.00	5.00	4.409	0.9476
b. The firm has a better relationship with suppliers and as a result of strategic sourcing.	120	2.00	5.00	4.438	0.7585
c. Blockchain Technology facilitates Early Supplier Involvement which enhanced speed delivery of goods and services	120	1.00	5.00	4.361	0.8784
Average	120			4.403	0.8615

Inventory Management Systems

Table 2 showed that majority of the respondents agreed that blockchain technology assist in application of perpetual inventory system improves firm's performance as indicated by a mean score of 4.295 and a standard deviation of 0.9600. Majority of the respondents moderately agreed that blockchain technology helped in radio frequency identification inventory system (RFID) which led to increased firm's performance as indicated by a mean score of 4.361 and a standard deviation of 0.8449. Finally, majority of the respondents agreed that vendor inventory management system helps in reduction inventory management costs leading to increased firm's performance as indicated by a mean score of 3.657 and a standard deviation of 1.3786. On average all the inventory management systems had an average mean score of 4.104 and a standard deviation of 1.0611. These findings indicated that majority of the respondents agreed with all inventory management systems statements in terms of perpetual inventory system, Radio frequency identification inventory system (RFID) and vendor inventory management system.

The results in table 2 also implied that only few respondents had divided opinions since all the standard deviation and variance results on all inventory management systems statement were less than 1 and only inventory traceability cost had a standard deviation slightly greater than 1, this indicated that most respondents gave similar opinions and only few respondents had divergent views. According to Greener (2012) standard deviation and variance are both measures of variation for interval ration variables and describe how much variation or diversity there is in a distribution.

According to Saunders, Lewis & Thornhill, (2015), a standard deviation and variance greater than 1 means respondents had divergent views and a standard deviation and variance less than 1 means that respondents had similar responses on the research questions. These findings indicated that majority of the respondents agreed that blockchain technology helps in application of perpetual inventory system, Radio frequency identification inventory system (RFID) and vendor inventory management system leading to increased firm's performance. These findings are in agreement with Smith and Buterin (2016) where they identified that application of blockchain technology plays a major role in assisting the use of Radio frequency identification inventory system (RFID) and vendor inventory management system.

Table 2: Inventory Management System Descriptive Results

Inventory Management Costs	N	Minimum	Maximum	Mean	Std. Deviation
a) Blockchain technology assist in application of perpetual inventory system improves firm's performance	120	2.00	5.00	4.295	0.9600

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b)	Blockchain technology helps in Radio frequency identification inventory system (RFID) which leads to increased firm's performance	120	2.00	5.00	4.361	0.8449
c)	Vendor inventory management system helps in reduction inventory management costs leading to increased firm's performance	120	1.00	5.00	3.657	1.3786
Average		120			4.104	1.0611

Information Sharing

Table 3 showed that, majority of the respondents moderately agreed that blockchain technology contributed to effective way of information storage and this improves firm's performance as indicated by a mean score of 3.152 and a standard deviation of 1.6039. Majority of the respondents agreed that information accessibility by authorized users led to increased firm's performance as indicated by a mean score of 4.438 and a standard deviation of 0.7585. Lastly, majority of the respondents agreed that automation of business transactions process eases information sharing and this improves information leading to increased firm's performance as indicated by a mean score of 4.314 and a standard deviation of 0.8913. On average all the information sharing statements had an average mean score of 3.901 and a standard deviation of 1.1943.

These findings indicated that majority of the respondents agreed that blockchain technology led to easier information sharing in terms of effective way of information storage, information accessibility and automation of transaction processes which leads to increased firm's performance. These findings were in line with findings by Samart (2016) where he found out that information sharing is improved by blockchain technology in terms of effective methods of information storage, effective way of accessibility of transaction information by authorized users and effective automation of business transaction processing functions hence leading to increased firm's performance.

The study findings were in agreement with literature review by Krystsina (2017) that the main reasons why many firms automate is to curb the problems of shortage of labour, high cost of labour, need to increase productivity and to reduce the manufacturing lead-times. All this put together, it implies that automation leads to lower operational costs and improved customer service.

Table 3: Information Sharing Descriptive Results

Information Sharing Statements		N	Minimum	Maximum	Mean	Std. Deviation
a)	Blockchain technology contributes to effective way of information storage	120	1.00	5.00	3.152	1.6039
b)	Information accessibility by authorized users leads to increased firms performance	120	2.00	5.00	4.314	0.8913
c)	Automation of business transactions process eases information sharing	120	1.00	5.00	4.238	1.0877
Average		120			3.901	1.1943

Transaction Security

Findings in Table 4 indicated that, majority of the respondents disagreed that blockchain technology led to increased transparency and accountability in business transactions and this led to improved performance as indicated by a mean score of 2.752

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and a standard deviation of 1.3642. Majority of the respondents agreed that blockchain technology led to transactions authenticity and this led to improved performance as indicated by a mean score of 3.752 and a standard deviation of 1.2386. Lastly, majority of the respondents agreed that blockchain technology led to prevention of fraud and this led to improved performance as indicated by a mean score of 3.895 and a standard deviation of 1.0462. On average all the transactions security statements had an average mean score of 1.2163 and a standard deviation of 1.496.

These findings indicated that majority of the respondents disagreed that blockchain technology led to increased transparency and accountability in business transactions and this led to improved performance. This was as result that blockchain technology had not been used for a long a time ad changes in ICT may fail to guarantee was security benefits in future. Majority of the respondents also moderately agreed that blockchain technology leads to transactions authenticity and this leads to improved performance and blockchain technology leads to prevention of fraud and this leads to improved performance.

These findings concurred with findings by Njuguna (2010) where he identified that many supply chain managers fail to embrace blockchain technology since they do not agree that blockchain technology leads to increased transparency and accountability in business transactions and this leads to improved performance. However according to Morris (2016) blockchain technology led to transactions authenticity and prevention of fraud and this leads to improved performance.

Table 4: Transaction Security Descriptive Results

Transaction Security Statements	N	Minimum	Maximum	Mean	Std. Deviation
a) Blockchain technology leads to increased transparency and accountability.	120	1.00	5.00	2.752	1.3642
b) Blockchain technology leads to transactions authenticity.	120	1.00	5.00	3.752	1.2386
c) Blockchain technology leads to prevention of fraud and this leads to improved performance.	120	1.00	5.00	3.895	1.0462
Average	120			3.466	1.2163

Performance of Logistics Firms

Table 5 showed that, majority of the respondents agreed that lead time determined the performance of logistics firms as indicated by a mean score of 4.421 and a standard deviation of 0.7797. Majority of the respondents agreed that procurement costs determines the performance of logistics firms as indicated by a mean score of 4.473 and a standard deviation of 0.7415. Lastly, majority of the respondents agreed that level of customer satisfaction determined the performance of logistics firms as indicated by a mean score of 4.536 and a standard deviation of 0.7964. On average all the performance statements had an average mean score of 4.428 and a standard deviation of 0.7941. These findings indicated that the performance of logistics firms is determined by lead time, procurement costs and the level of customer satisfaction. These findings were in agreement with findings by Walch (2014) where he identified that the performance of logistics firms is determined or measured in terms of lead time, procurement costs and the level of customer satisfaction. According to Nelson (2017) firms that have adopted blockchain technology have realized increased supply chain performance in terms of delivery of high quality of services, increased reduction in procurement costs and achievement of

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high level of customer satisfaction.

Table 5: Performance of Logistics firms Descriptive Results

Performance	N	Minimum	Maximum	Mean	Std. Deviation
a) Quality of services	120	2.00	5.00	4.421	0.7797
b) Purchasing and distribution costs	120	2.00	5.00	4.473	0.7415
c) Customer satisfaction	120	2.00	5.00	4.536	0.7964
Average	120			4.428	0.7941

The study determined the performance of logistics firms for the past five years (2014 to 2018). The performance of logistics firms was measured on basis of lead time, purchasing and distribution costs and sales revenue for five years. The results were as presented in table 6, table 7, table 8 and table 9. On rating lead time for the five years, table 6 presented that on average 5% of the respondents rated that the lead time was poor,10% below average,18% average,44% good and 23% excellent. This demonstrates that the lead time was below average and this affected the performance of logistics firms.

Table 6: Lead Time

Lead Time/Delivery Time After Ordering	Years					
	2014	2015	2016	2017	2018	Average
1) Poor	8%	6%	4%	4%	2%	5%
2) Below Average	50%	40%	42%	50%	40%	44%
3) Average	13%	20%	16%	18%	22%	18%
4) Good	12%	14%	10%	8%	6%	10%
5) Excellent	17%	20%	28%	20%	30%	23%
Total	100%	100%	100%	100%	100%	100%

On rating the purchasing and distribution costs for the five years, table 7 presented that on average 8% of the respondents rated that purchasing and distribution costs to be very low,14% low,36% average, 27% high and 17% very high. This implied that logistics firms incurred high purchasing and distribution costs for the past 5 years and this affected the firms' performance.

Table 7: Procurement Costs

Purchasing and Distribution Costs	Years					
	2014	2015	2016	2017	2018	Average
1) Very Low	8%	6%	10%	8%	6%	8%
2) Low	12%	14%	22%	12%	8%	14%
3) Average	28%	30%	40%	36%	44%	36%
4) High	32%	32%	20%	24%	26%	27%
5) Very High	20%	18%	10%	20%	16%	17%
Total	100%	100%	100%	100%	100%	100%

Table 8 presented that on average 5% of the respondents rated that sales revenue to be Below Ksh 10M, 13% rated that sales revenue to be Ksh 10M-50M, 32% rated that sales revenue to be Ksh 50M-10OM, 33% rated that sales revenue to be Ksh 100M and above and 18% rated that sales revenue to be

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Over Ksh 15M. These indicate that sales revenue was high in may logistics firms.

Table 8: Sales Revenue

Sales Revenue	Years					
	2014	**2015**	**2016**	**2017**	**2018**	**Average**
a) Below Ksh 10M	6%	4%	6%	4%	4%	5%
b) Ksh 10M- 50M	14%	10%	14%	16%	10%	13%
c) Ksh 50M- 10OM	40%	42%	20%	30%	26%	32%
d) Ksh 100M and above	26%	24%	40%	32%	42%	33%
Total	100%	100%	100%	100%	100%	100%

Pearson Correlation Analysis

Pearson correlation was carried out to determine how the research variables related to each other. Pearson's correlation reflects the degree of linear relationship between two variables. It ranges from -1 to +1. A correlation of +1 means that there is a perfect positive linear relationship between variables (Bougie & Sekaran, 2010). As presented in table 9 all the independent variables had a strong positive correlation with performance of logistics firms (p-values < 0.01).

Table 9: Pearson Correlation Analysis Results

		Performance	Supply chain Integration	Inventory management systems	Information sharing	Trans-action security
Performance	Pearson Correlation	1		.	.	.
	Sig. (2-tailed)		.			
	N	120				
Supply Chain Integration	Pearson Correlation	.702**	1			
	Sig. (2-tailed)	.000				
	N	120	120			
Inventory management Systems	Pearson Correlation	.679**	.709**	1		
	Sig. (2-tailed)	.000	.000			
	N	120	120	120		
Information sharing	Pearson Correlation	.483**	.585**	579	.1	
	Sig. (2-tailed)	.000	.000			
	N	120	120	120	120	
Transaction security	Pearson Correlation	.393**	.519**	.439**	.580**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	120	120	120	120	120

*. Correlation is significant at the 0.05 level (2-tailed).

Regression Analysis

The study applied regression analysis to establish the statistical significance relationship between the independent variables and the dependent variable. Regression analysis is a form of predictive modelling technique which investigates the relationship

between a dependent (target) and independent variable(s) (predictor). Regression analysis technique is used for forecasting and finding the causal effect relationship between the variables. The reason for using regression analysis is that it indicates the significant relationships between dependent variable and independent variable and indicates the strength of impact of multiple independent variables on a dependent variable.

The independent variables included; (X_1) supply chain integration; (X_2) inventory management systems; (X_2) information sharing and (X_4) transaction security and the dependent variables (Y) was performance of logistics firms. Regression analysis helped in generating equation that described the statistics relationship between one or more predictor variables and the response variable (Bougie & Sekaran, 2010). The regression analysis results were presented using regression model summary Table, Analysis of Variance (ANOVA) Table and beta coefficients Table. The model used for the regression analysis was expressed in the general form as given below:

$Y= aB + B_1*X_1 + B_2*X_2 + B_3*X_3 + B_4*X_4 + e$

The relationships between the dependent variable and independent variables, and the results of testing significance of the model were respectively interpreted. In interpreting the results of multiple regression analysis, the three major elements considered were: the coefficient of multiple determinations, the significant of F statistic value, and the regression beta coefficients. R squared was used to check how well the model fitted the data. R squared is the proportion of variation in the dependent variable explained by the regression model. These elements and the results of multiple regression analysis were presented and interpreted in Table 10, Table 11 and Table 12.

The findings of the study showed that the regression model in Table 10 coefficient of determination (R2) was 0.807 and R was 0.898 at 0.05 significance level. These results implied that the four independent variables notably; (X_1) supply chain integration;(X_2) inventory management systems; (X_2) information sharing and (X_4) transaction security significantly influenced the dependent variable (Y) which was the performance of logistics firms. The coefficient of determination (R2, 0.807) indicated that 80.7% of the variation in performance of logistics firms was influenced by; supply chain integration; inventory management systems; information sharing and transaction security.

The remaining 19.3% of the variation in performance of logistics firms was determined by other variables not included in the study model. This showed that the model had a good fit since the value was above 75%. This concurred with Crossman (2013) that (R2) is always between 0 and 100%: 0% indicates that the model explains none of the variability of the response data around its mean and100% indicated that the model explained all the variability of the response data around its mean. In general, the higher the (R2) the better the model fit.

Table 10: Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.898(a)	.807	.799	.22457

a Predictors: (Constant), X4, X3, X2, X1

Table 11: Analysis of Variance (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.090	4	5.272	105.440	.000(a)
	Residual	5.043	115	.050		
	Total	26.133	119			

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a Predictors: (Constant), X4, X3, X2, X1
b Dependent Variable: Y

Table 12: Regression Coefficients

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.893	.185		4.831	.000
Supply Chain Integration –X1	.468	.061	.566	7.666	.000
Inventory Management -X2	.216	.050	.274	4.340	.000
Information Sharing - X3	.079	.047	.105	1.667	.003
Transaction Security - X4	.048	.058	.058	.835	.004

a Dependent Variable: Y

$Y=0.893+ 0.468X_1 + 0.216X_2 + 0.079X_3 + 0.048X_4$

The regression model above established that taking all the independent variables into account notably; supply chain integration; inventory management systems; information sharing and transaction security at zero constant influences performance of logistics firms (0.893). The results presented also showed that taking all other independent variables at constant zero; a unit increase in supply chain integration led to 0.468 increase in performance of logistics firms; a unit increase in inventory management system led to a 0.216 increase in performance of logistics firms; a unit increase in information sharing led to 0.079 increase in performance of logistics firms and a unit increase in transaction security led to 0.048 increase in performance of logistics firms.

These findings demonstrated that supply chain integration was the most significant variable that influences most the performance of logistics firms with a coefficient of 0.468, followed by inventory management systems with a coefficient of 0.216, then information sharing with a coefficient of 0.079 and lastly transaction security is the least significant variable with the lowest coefficient of 0.048. These findings were agreement with Kosba (2015) that blockchain technology influences the performance of logistics firms through enhancing supply chain integration; reduction of inventory management systems; increased effectiveness in information sharing and improving transaction security across the supply chain players.

CONCLUSIONS

Based on the study findings, the study concluded that blockchain technology influences the performance of logistics firms through enhancing supply chain integration; application of inventory management systems; increased effectiveness in information sharing and improving transaction security across the supply chain players. The study concluded that inventory management systems in terms of Radio frequency identification inventory system (RFID) and vendor inventory management system leading to increased firm's performance. Influences performance of logistic firms. The study drew conclusions that information sharing is improved by blockchain technology in terms of effective methods of information storage, effective way of accessibility of transaction information by authorized users and effective automation of business transaction processing functions hence leading to increased firm's performance. The study further concluded that, the performance of logistics firms is determined by reduction of procurement costs, sales revenue, lead time and the level of customer satisfaction. The study finally concluded that supply chain integration is the major factor that influences most the performance of

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logistics firms, followed by inventory management costs, then information sharing and lastly transaction security.

RECOMMENDATIONS

The management of logistic firms should adopt block chain technology for it enables supply chain integration which increases flexibility to adjust to client's needs, competitors action and events within the industry they also reduce waste and lower cost. Block chain technology should be incorporated in all firms' demand forecasting functions, distribution planning, scheduling and ordering processing activities.

The management of logistics firms should effectively integrate blockchain technology in all inventory management systems notably perpetual inventory system, Radio frequency identification inventory system (RFID) and vendor inventory management system leading to increased firm's performance. Inventory management systems in terms of perpetual inventory system, Radio frequency identification inventory system (RFID) and vendor inventory management system influenced performance of logistic firms.

The management of logistics firms should integrate blockchain technology in all business transaction processes in order to facilitate effective and efficient method of sharing business transaction information amongst the supply chain members. The logistics firms should adopt better information storage systems, improve on information accessibility to ensure that only authorized persons can access information and improve on automation of all business transaction processes.

The management of logistics firms should implement and continuously update effective transaction security systems in order to safeguard confidential transaction information that is processed through the use of block chain technology. The management of logistics firms should be trained on how to employ blockchain technology and how block chain technology leads to increased transparency and accountability, improvement of transactions authenticity and prevention of fraud. This will encourage many supply chain managers to adopt block chain technology hence leading to improved performance of logistics firms.

Areas for Further Research

The overall objective of the study was to establish the influence of block chain technology on performance of logistics firms in Kenya. The study narrowed into the influence of supply chain integration; inventory management systems; information sharing and transaction security on the performance of logistics firms in Kenya. The coefficient of determination (R2, 0.807) indicated that 80.7% of the variation in performance of logistics firms is influenced by; supply chain integration; inventory management systems; information sharing and transaction security. The remaining 19.3% of the variation in performance of logistics firms is determined by other variables not included in the study model. The study therefore suggests further studies to be carried out to determine the effects of blockchain technology which affects 19.3% of the variation in performance of logistics firms in Kenya.

Further studies should therefore be carried out to establish other areas in which blockchain technology influences the performance of logistics firms. Further studies should also be undertaken to establish the factors affecting adoption of blockchain technology in logistics firms and to determine measures to be put in place to promote adoption of block chain technology in organizations. Similar study should also be undertaken in other organizations in order to establish how blockchain technology influences organization performance.

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