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Blockchain Technology and Supply Chain Performance of Food and Beverages Manufacturing Firms in Kenya (A Case of Nairobi County)

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ABSTRACT: Blockchain entails a digitalized, distributed and decentralized ledger system for splitting and storing information. Due to globalization and volatile supply chain environment blockchain technology has materialized as significant recognition and optimistic technology for the food industry. This study sought to analyze the effect of blockchain technology on supply chain performance of food and beverages manufacturing firms in Nairobi County. The effect of traceability, supply chain transparency and supply chain digitalization on supply chain performance was examined. The study was guided by Knowledge Management Theory, Technology Acceptance Model and Balance score Card. The target population was 138 senior procurement managers from manufacturing firms of food and beverages in Nairobi County. A sample of 103 respondents was established and used in the study. A self-administered semi-structured questionnaire was distributed to the target population. A total of 88 questionnaires were returned giving a response rate of 85.4%. Statistical package was used to undertake descriptive and inferential statistical analysis. Bivariate linear regression and linear multiple regression analysis were used to assess the effect of blockchain technology and supply chain performance. Model Summary, ANOVA Statistics and regression coefficients were generated and interpreted. The results indicated that traceability, supply chain transparency and supply chain digitalization have a positive and significant effect on supply chain performance of food and beverages manufacturing firms in Nairobi County when considered singly and when combined together. The findings indicates that there are vital benefits accrued from block chain technology and conclude that it is the best strategy in global procurement as it enhances performance. The study recommends that manufacturing firms should execute blockchain technology to escalate their robust potentiality through supply chain performance.
Key words: Blockchain technology, Traceability, Supply chain digitalization, Supply chain digitalization, Supply chain performance.

1. INTRODUCTION

1.1 Background of the Study

The globalization of food supply chains (FSCs) and markets has led to a remarkable increase in information and product movements between countries. Blockchain can be defined as decentralized digital ledger that can be programmed to share and store data. It can also be studied as a distributed ledger, which is based on decentralized network or a peer-to-peer (P2P) encompasses of ongoing cycle of blocks.

According to Swan (2017) digital ledgers and blockchain are ordinarily interchangeable. In a blockchain system, all the members can concurrently record and distribute the blocks, which must be authenticate and confirmed by all parties in the network. Blocks are linked by the cryptographic hash function. Each transaction is trackable by scrutinizing the block information linked by hash keys (Chen *et al.,* 2018). Blockchain champion and protest transparency, accessibility, non-falsifiability and speed as the cornerstones of this current paradigm (Apte &Petrovsky, 2016).

Sultan and Lakhani (2018) proponed that the blockchain is a decentralized database consisting sequential, cryptographically linking blocks of digitally signed asset transactions, governed by a consensus model. Digital ledgers provide some important attributes, which can be embraced in the supply chain (Dobrovnik *et al.,* 2018). However, despite of benefits of technology benefits, there is still several new challenges to FSC like consumers awareness of and need for real-time information through digital media (Song *et al.,* 2018). As a result, food product safety, traceability and transparency issues have become a vital concern to food distributions, processors, retailers and farmers (Gharehgozli *et al*., 2017).

1.2 Statement of the Problem

Food supply chain research has distinctive attributes (Er Kara *et al.*, 2020). Ranging from temperature-sensitive, perishability, seasonal and dependent in essence of production (Fredriksson & Liljestrand, 2015). Food and beverage sector is an integral aspect of big four agenda in Kenya and account 21% of the manufacturing firms in Kenya, this sector has been experiencing poor performance thus the need to adopt technology to improve performance (Magutu, Aduda, & Nyaoga, 2018). Blockchain technology is a latest phenomenon for SCM, and there exists evidence of research gaps that have not yet been exploited. According to Yli-Huumo *et al.,* (2016) there are latent benefits blockchain technology adoption on performance as well as problems which have been left unstudied formerly. Comparably study should also be tackled in other organizations in order to determine how blockchain technology influences organization performance Despite the importance of blockchain technology on supply chain management firms stills lacks a particular study to manage its performance. Wangui and Marika (2018) in their study on perception of professional on the adoption of blockchain technology and its impact on supply chain management concluded that the contemporary technology practiced in SCM do not creditably address problems of traceability. In addition, Mung'asio, and Morenge (2019) studied blockchain technology and performance of logistics firm. They suggested further research of blockchain technology on organisation performance. Therefore, in Kenya there is evidence of research gap and has created a major knowledge gap especially in this era of business uncertainty, thus the need to bridge this gap.

1.3 Objectives of the Study

The study was aimed at achieving the following objectives

i. To examine the effect of traceability on supply chain performance of food and beverage manufacturing firms in Kenya.
ii. To assess the effect of supply chain transparency on supply chain performance of food and beverage manufacturing firms in Kenya.
iii. To investigate the effect of supply chain digitalization on supply chain performance of food and beverage manufacturing firms in Kenya.

2. LITERATURE REVIEW

2.1Theoretical review

2.1.1 Knowledge Management Theory

Knowledge management theory is thought to be appropriate for this study in order to acknowledge the influence of blockchain technology on performance of food and beverage manufacturing firms in Kenya, hence it gives a theoretical background of this study. Knowledge management entails organizational processes and mostly intangible resources which enhance organizational capabilities and competencies through innovation and new product development (Kurt *et al*., 2004). It promotes sharing of knowledge between supply chain partners creating value both internally and externally resulting to supply chain collaboration and responsiveness.

Knowledge management theory advocates for knowledge development, capturing, discovering, keying into the system, retaining, utilizing, transmitting from one member to another. Knowledge creation encompasses activities accompanying with the avenue of contemporary knowledge into the system and comprises knowledge development, discovery and capture. Knowledge retention comprises all tasks that preserve knowledge and allow it to endure in the system once initiated. It also entails those business that perpetuate the potentiality of knowledge within the SC. Knowledge transfer refers to activities related with the flow of knowledge from one party in SC to another aimed at the customization of goods and services (Marcus, 2010).

2.1.2 Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) was initiated by Davis (1989). The main goal of this model is to delineate the behavior of technology usage, incorporating what are the main causes of potential adopters of technology to reject or accept information communication technology usage. TAM predicts the

acceptance of the information system and designs as the problems before users experience the system (Davis 1989). The TAM prediction of user acceptance and any technology is based on perceived functionality and perceived usefulness.

Davis (1989), expound perceived usefulness as the level of belief in a person regarding the use of particular information systems and how it might enhance the accomplishment of a task. Both the perceived adequacy and the perceived convenience are grounded on the perceptions of the users‟ beliefs about the system. Therefore, TAM impacts significantly on a user's attitude towards the utilization of a system (Davis, 1989).

2.1.3 Balance score Card

Kaplan and Norton (1996) scrutinized that organizations were acting in complex turbulent environments thus; they need to understand their goals and techniques to achieve a crucial aspect for their own sustainable survival. He came up with the Balanced Scorecard that measures operational performance through four perspectives: 1. Customers 2. Financial 3. Learning and Growth and 4. Business Processes. Customer perspective evaluates the firm's capabilities to perform quality services and to produce quality products. Customer relationship management by ensuring better customer service and after sales services, adding value to the customers, building long-term relationship with customers, continuous improvement and customized product (Chaffey, 2015). Financial perspective this can be attained by increasing profitability by ensuring costs are reduced through delivery reliability (Crandall *et al.*,2014).

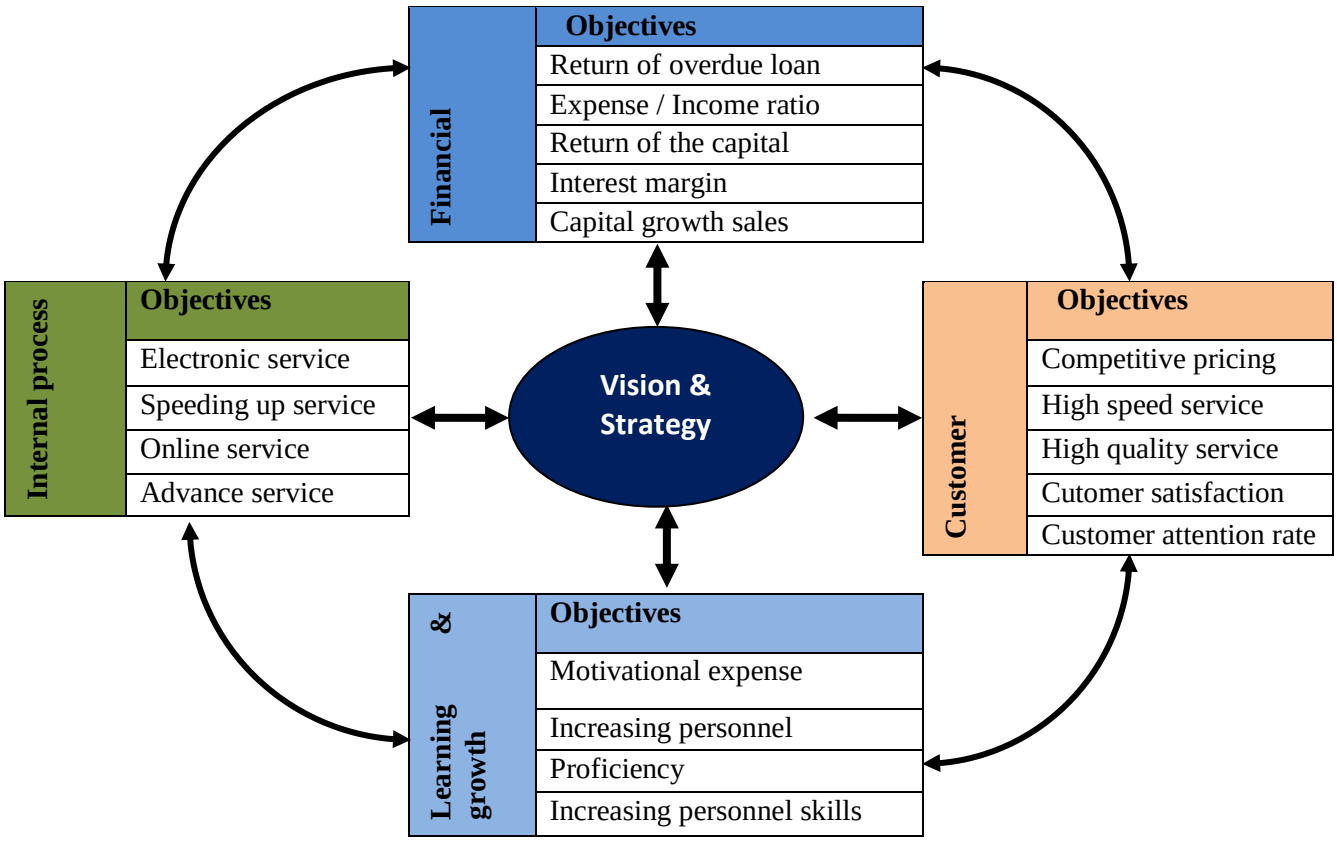

Figure 1: Balance score Card

Dittmann (2017) suggested that learning and growth can improve performance in various ways:1. Research and development will enable knowledge sharing of new methods of production, technologies and resilience strategies, 2. Innovation will lead to improvement of product through joint creation of innovation products and best business strategies through sharing of ideas and 3. Improvement of core competence to become the best performer in the industry. Chopra & Meindl (2015) advocated that business process

involves inter and intra firm integration of all SCM processes: sourcing, production, distribution, returns, planning, quality management, inventory management, IT management, logistics management and risk management.

2.3 Empirical Review

2.3.1 Supply Chain Traceability

Traceability is the potentiality to track food products all over multiple entities and processes in the FSC. Traceability in the food industry is difficult to execute in a complex globalization world, with multiple tiers of and buyers and supplier thus need for technology (Mao, Hao, et al. 2018; Azzi, Chamoun, and Sokhn 2019). In addition, contemporary practices of centralizing tracking information source severe information asymmetry and data fragmentation and in the FSC (Salah et al. 2019; Tsang *et al.,* 2019). Blockchain through distributed and tamper-proof ledger design guarantee every member in the FSC to possess access to authentic information at any given time. Therefore, SCM parties are allowed to track food in real-time (Kos and Kloppenburg 2019) with more effectiveness and accuracy than conventional centralized systems (Al-Jaroodi and Mohamed 2019; Pearson *et al.*, 2019). SCM also anticipate blockchain speed-up the tracking process significantly.

Traceability is ability to track specific locations, historical events and different firm functions (Astill *et al.*, 2019). The role of traceability in SCM is to identify elements and the chronological order of SC activities (Venkatesh *et al.*, 2020). This can be through following the expedition of a product and recognize the point of origin up to the point of consumption (Ko *et al.*, 2018). It assists in detecting inefficiencies in the SC activities, such as defect materials and machine breakdowns (Venkatesh *et al.*, 2020). Additionally, traceability enhances consumer's confidence in the product, by enabling verification of ethical impact and product quality (Bai & Sarkis, 2020). Blockchain enhances traceability through information being stored into blocks with specific timestamps. Enabling monitoring and control of all SC activities and enabling customers benefits of improved product-related information which impact positively the willingness to pay more for the products. (Kamble *et al.*,2020). Finally, academic research also aims to facilitate end-to-end traceability for food products, many studies developed applications using smart contracts and blockchain in food traceability (Lin et al.,2019)

2.3.2 Supply Chain Transparency

According to Zelbst *et al.,* (2019) transparency can be defined as the ability to see through the supply chain. Lack of transparency can develop quality and safety problems in the SCM (George *et al.,* 2019). Supply chain transparency entails information being accessible to end-consumer and other SC parties within the chain (Francisco and Swanson, 2018). Blockchain can transmit information of products' movement and custody along the chain to every party in real-time (Kumar, Liu, and Shan 2020; Mondal *et al.*, 2019), permitting FSCs to be more transparent. This is a significant improvement in managing food safety and quality, especially for product lines in which different types and grades of food can be easily mixed, such as processed milk (Pearson et al. 2019) Furthermore, SCM can depend on blockchain to acquire reliable information about food provenance and communicate such information to customers to gain superior performance over their competitors. (Helo and Hao 2019; Montecchi, Plangger, and Etter 2019; Caldarelli, Rossignoli, and Zardini 2020). Blockchain gurantees transparency by permitting each party to track, view and trace all transactions stored in the chain. SCM activities and product movements both upstream or downstream can be traced. Increased visibility brings inherent advantages such as end-to end traceability of the product movement (Lin *et al.,* 2019; Chen *et al.,* 2020).

Blockchain can generate the essential transparency even in multi-tier global SC including various third-party retailers and service providers (Bai & Sarkis, 2020; Venkatesh *et al.,* 2020). This can be achieved through blockchain's facilitation of transactions of information (Wong *et al.,* 2020). Like when a new set of data transactions is being made, it is automatically updated into the blockchain system, and all the parties to examine the information. Enabling supply chain parties to get real-time information (Ko *et al.,* 2018). Transparency within food supply chains warrant the cooperation, trust, sharing information availability, accuracy and accessibility and permit the degree of sharing it among SC parties. Transparency

is a vital measure to better management of vertical relationships within FSCS as it lowers transaction costs (Stranieri *et al.,* 2017).

2.3.3 Supply Chain Digitalisation

According to Legner *et al.*, (2017), defined digitalization as a process connected with transforming analog signals into a digital model and the influence of these technologies generated by operation and acquiring. Digitalization has gain considerable recognition from organizations all over the world, as it delivers superior significant to SCM. Digitalization in the supply chain enables the greatest use of digital technologies to implement and plan contracts, activities and communicates (Sanders & Swink, 2020). These digital technologies in the SCM normally incorporate big data analytics (BDA), decentralized agent-driven control, latest manufacturing technologies with sensors, augmented reality, advanced robotics, ultra-modern tracing and tracking technologies, and 3D printing (Ivanov *et al.,* 2019). The utilization of digital technologies escalates the speed, efficiency and resilience of the supply chain. The implementation of ERP, MRP II and MRP I in SCM has reduce inventory reduce human errors, ordering costs, improved communication and paper-based work, as well as increase the effectiveness and efficiency of SC. (Gharehgozli *et al.,* 2017).

Blockchain allows supply chain digitalization leading to efficiency of SC processes by use of electronic systems for instance EDI and ERP subsequently minimize transaction and production costs, lean logistic, automated manufacturing, enhanced inventory turnover and speed-up payment and billing settlement (Mukhopadhyay & Kekre, 2021). Firms can improve their manufacturing quality and productivity, and decrease the number of breakdowns by initiating intelligent manufacturing operations by employing digital technologies. (Bjorkdahl, 2020). Furthermore, digitalization has the potentiality to boost the productivity of expedite product design and new product development by eliminating the need for prototypes and physical artifacts (Bjorkdahl, 2020). Moreover, firms can improve its internal efficiency through digital transformation enabling growth and adding value for consumers. Digitized processes and systems facilitate value addition to consumers by providing efficient service delivery and transactions, leading to satisfaction in the increasing customers demand for personalized services and products (Gorbach, 2017). Firm can reduce its cash conversion cycle through the use of improved SCD which significantly impact the profitability and enhances its performance. Mostly SC actors have adopted mobile payments instead of cash transactions (Bjorkdahl, 2020).

2.4 Conceptual Framework

The frame work presented in Figure 3 represents the relationship between the dependent variable (*traceability, supply chain transparency and supply chain digitalization)* and the independent variables (supply chain performance of food and beverages manufacturing firms)

Independent Variables **Dependent Variable**

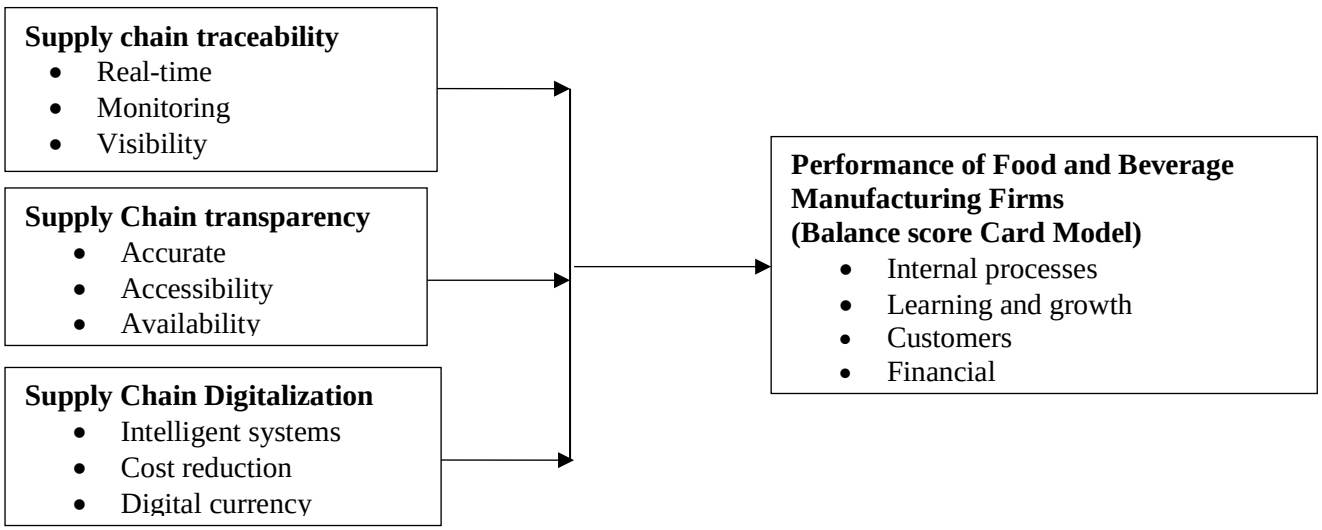

Figure 2: **Conceptual Framework**

3. RESEARCH METHODOLOGY

3.1 Research Design

Research design is a plan or a blue print on how the researcher is going to carry out the research (Mugenda and Mugenda, 2009). The study used descriptive research design. According to Kothari & Garg (2019), descriptive research design was used to acquire information regarding phenomena and to outline what exists built on chosen variables.

3.2 Target population and Sample Size

The target population consisted of 138 senior procurement managers from manufacturing firms of food and beverages in Nairobi County. A sample is a subdivision of the total population that can be used to make generalization about the population (Orodho, 2004). The study used purposive sampling technique to select only respondent with required information and these are senior procurement managers. The study embraces census sampling technique. Census entails enumeration of the entire subject (Cohen, Manion &Morrison, 2007). The study adopted Yamane (1967) formula.

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

Where n is the sample size,
N is the population size, and e is the level of precision.
The level of precision is set at 5% meaning 95% confidence level.
Therefore:

$$n = \frac{138}{1+138(0.05)^2}$$

n=102.6
n=103

3.3 Data analysis and presentation

The study used semi-structured, self-administering questionnaires to collect data from respondent with five likert scale. The collected data was coded, edited and then analyzed using Statistical Package for Social Sciences (SPSS). Both descriptive and inferential statistics analytical methods were used. Bivariate linear regressions were used to assess the effect of each independent variable on and dependent variable. Multiple linear regression was used to assess the combined effect of all the independent variables on the stated dependent variable.
The multiple linear regression model adopted by the study was;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e$$

Where: Y – Supply chain performance
β_0 – Autonomous factors
X_1 –Traceability
X_2 –Supply chain transparency
X_3 –Supply chain digitalization
e - Error term
The findings of the study were presented with the aid of frequency tables and then discussed as per the objectives of the study.

4. RESEARCH FINDINGS AND DISCUSSION

4.1 Response Rate

The data that was analyzed was obtained from 88 respondents out of 103 which respondents filled in the questionnaires and returned. This was 85.4% of the target group.

4.2 Traceability and supply chain performance

Regression analysis was conducted to establish the relationship between traceability and supply chain performance. The two variables were regressed to test whether there is significant relationship between

traceability and supply chain performance which was linked to objective one of the study. The results for model summary on Table 4.1 shows R value was 0.502 indicating that there is a positive relationship between traceability and supply chain performance of food and beverages manufacturing firms in Kenya. The R squared (R^2) value of 0.252 implied that 25.2% of the variations in changes in supply chain performance was explained by traceability when other factors are held constant.

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Table 4.1 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.502	.252	.243	.526

a Predictors: (Constant), traceability

The ANOVA as indicated in Table 4.2 shows F Value of 28.901 at p-value of .000 < p=.05. This implies that an F statistic of 28.901 was significant at 95% level of confidence which indicates that when traceability is considered singly it had a significant effect on supply chain performance of food and beverage manufacturing firms in Kenya.

Table 4.2 ANOVA on Traceability

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.982	1	7.982	28.901	.000
	Residual	23.751	86	.276		
	Total	**31.733**	**87**			

a Predictors: (Constant), traceability
b Dependent Variable: Supply chain performance

The result for model coefficients on Table 4.3 shows a beta coefficient of 0.366 which indicated a positive relationship between traceability and supply chain performance of food and beverage manufacturing firms in Kenya. The relationship is significant at 5% level of significance at p value of 0.000 which is less than 0.05. The finding of the study implies that an increase of traceability by one unit would increase the supply chain performance of food and beverage manufacturing firm by 0.366. This was an indication that traceability had a positive and significant effect on supply chain performance of food and beverage manufacturing firms when considered singly.

Table 4.3 Regression coefficient on transparency

Model	Coefficients	Standard Error	t Stat	P-value
Intercept	2.3119	0.2935	7.8770	0.0000
Traceability	0.3664	0.0682	5.3760	0.0000

a Dependent Variable: Supply chain performance

According to Venkatesh *et al.,* (2020) the role of traceability in SCM is to identify elements and the chronological order of SC activities.

4.3 Transparency and supply chain performance

Objective two of the study sought to assess the effect of supply chain transparency on supply chain performance of food and beverage manufacturing firms in Kenya. The two variables were regressed to test whether there is significant relationship between transparency and supply chain performance. The results for model summary on Table 4.4 shows R value was 0.486 indicating that there is a positive relationship between transparency and supply chain performance of food and beverages manufacturing firms in Kenya. The R squared (R^2) value of 0.236 implied that 23.6% of the variations in changes in supply chain performance was explained by transparency when other factors are held constant.

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Table 4.4 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate

1	.486	.236	.227	.531

a Predictors: (Constant), transparency

The ANOVA as indicated in Table 4.5 shows F Value of 26.587at p-value of .000 < p=.05. This implies that an F statistic of 26.587 was significant at 95% level of confidence which indicates that when transparency is considered singly it had a significant effect on supply chain performance of food and beverage manufacturing firms in Kenya.

Table 4.5 ANOVA on transparency

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.493	1	7.49	26.587	.000
	Residual	24.239	86	.282		
	Total	**31.732**	**87**			

a Predictors: (Constant), transparency
b Dependent Variable: Supply chain performance

The result for model coefficients on Table 4.6 shows a beta coefficient of 0.2597 which indicated a positive relationship between transparency and supply chain performance of food and beverage manufacturing firms in Kenya. The relationship is significant at 5% level of significance at p value of 0.000 which is less than 0.05. The finding of the study implies that an increase of transparency by one unit would increase the supply chain performance of food and beverage manufacturing firm by 0.2597. This was an indication that transparency had a positive and significant effect on supply chain performance of food and beverage manufacturing firms when considered singly

Table 4.6 Regression coefficient on transparency

Model	Coefficients	Standard Error	t Stat	P-value
Intercept	2.9046	0.1939	14.9801	0.0000
Transparency	0.2597	0.0504	5.1563	0.0000

a Dependent Variable: Supply chain performance

George *et al.,* (2019) opined that lack of transparency can develop quality and safety problems in the SCM.

4.4 Digitalization and supply chain performance

Objective three of the study sought to investigate the effect of supply chain digitalization on supply chain performance of food and beverage manufacturing firms in Kenya. The two variables were regressed to test whether there is significant relationship between digitalization and supply chain performance. The results for model summary on Table 4.7 shows R value was 0.760 indicating that there is a positive relationship between traceability and supply chain performance of food and beverages manufacturing firms in Kenya. The R squared (R^2) value of 0.577 implied that 57.7% of the variations in changes in supply chain performance was explained by digitalization when other factors are held constant.

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Table 4.7 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.760	.577	.572	.395

a Predictors: (Constant), digitalization

The ANOVA as indicated in Table 4.8 shows F Value of 18.318 at p-value of .000 < p=.05. This implies that an F statistic of 18.318 was significant at 95% level of confidence which indicates that when digitalization is considered singly it had a significant effect on supply chain performance of food and beverage manufacturing firms in Kenya.

Table 4.8 ANOVA on Digitalization

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.318	1	18.318	117.441	.000
	Residual	13.414	86	.156		
	Total	**31.732**	**87**			

a Predictors: (Constant), digitalization
b Dependent Variable: Supply chain performance

The result for model coefficients on Table 4.9 shows a beta coefficient of 0.5090 which indicated a positive relationship between digitalization and supply chain performance of food and beverage manufacturing firms in Kenya. The relationship is significant at 5% level of significance at p value of 0.000 which is less than 0.05. The finding of the study implies that an increase of digitalization by one unit would increase the supply chain performance of food and beverage manufacturing firm by 0.5090. This was an indication that digitalization had a positive and significant effect on supply chain performance of food and beverage manufacturing firms when considered singly

Table 4.9 Regression coefficient on Digitalization

Model	Coefficients	Standard Error	t Stat	P-value
Intercept	1.9811	0.1785	11.0996	0.0000
Digitalization	0.5090	0.0470	10.8370	0.0000

a Dependent Variable: Supply chain performance

Sanders & Swink (2020) noted that digitalization in the supply chain enables the greatest use of digital technologies to implement and plan contracts, activities and communicates.

4.5 Overall Multiple Regression Analysis

Multiple regression analysis was conducted to establish the joint effect of the three independent variables (traceability, transparency and digitalization) on supply chain performance of food and beverage manufacturing firms. The result for model summary on Table 4.10 shows R value was 0. 964 indicating that there is a strong positive relationship between Blockchain Technology and supply chain performance of food and beverages manufacturing firms in Kenya. The R squared (R^2) value of 0.926 implied that 92.6% of the variations in changes in supply chain performance was explained by
Blockchain Technology variables under consideration.

Table 4.10 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.964	.926	.927	.163

a Predictors: (Constant), digitalization

The ANOVA as indicated in Table 4.11 shows F Value of 367.9223at p-value of .000 < p=.05. This implies that an F statistic of 367.9223 was significant at 95% level of confidence which indicates that Blockchain Technology variables under consideration fitted regression model and had significant effect on supply chain performance of food and beverage manufacturing firms in Kenya.

Table 4.11 ANOVA on Traceability

Model	Sum of Squares	df	Mean Square	F	Sig.

1	Regression	29.488	3	9.829	367.9223	.000
	Residual	2.244	84	.282		
	Total	**31.732**	**87**			

a Predictors: (Constant), digitalization
b Dependent Variable: Supply chain performance

The result for model coefficients on Table 4.12 shows a beta coefficients of the resulting model indicate that traceability, transparency and digitalization had positive effect on supply chain performance of food and beverage manufacturing firms in Kenya with slopes of β1=0.4183 at p value of 0.0000 <0.05, β2= 0.0579 at p value of 0.0012 <0.05, and β3= 0.5198 at p value of 0.0000 <0.05 respectfully. This implies that holding all other variables constant, the Supply chain performance of food and beverages manufacturing firms increase by 0.4183 units when traceability goes up by one unit, increase by 0.0579 units when Transparency goes up by one unit, and increase by 0.5198 units when Digitalization goes up by one unit. This is an indication that traceability, transparency and digitalization had positive and significant effect on supply chain performance of food and beverage manufacturing firms in Kenya.

Table 4.12 Regression coefficient on digitalization

Model	Coefficients	Standard Error	t Stat	P-value
Intercept	(0.0400)	0.1234	(0.3238)	0.7469
Traceability	0.4183	0.0216	19.3628	0.0000
Transparency	0.0579	0.0172	3.3585	0.0012
Digitalization	0.5198	0.0216	24.0528	0.0000

a Dependent Variable: Supply chain performance

The findings of the study revealed that when all the variables are regressed together they affect each other and the regression results of their beta values in Table 4.12 can be substituted into the model adopted by the study to solve the equation as shown below. $Y= -0.0400+ 0.4183X_1 + 0.0579X_2 + 0.5198X_3 + \varepsilon_i$.
Where: Y = Supply chain performance, β0= Constant Term, β_1, β_2, β_3 and β_4 = Beta coefficients,
X_1 = Traceability, X_2=, Transparency X_3 = Digitalization, while ε_i = Error term

The finding of the study asserts earlier findings by Mukhopadhyay & Kekre, (2021) who noted that Blockchain allows supply chain digitalization leading to efficiency of SC processes by use of electronic systems for instance EDI and ERP subsequently minimize transaction and production costs, lean logistic, automated manufacturing, enhanced inventory turnover and speed-up payment and billing settlement. According to Bjorkdahl (2020), firms can improve their manufacturing quality and productivity, and decrease the number of breakdowns by initiating intelligent manufacturing operations by employing digital technologies. Ivanov *et al.*, (2019) stated that these digital technologies in the SCM normally incorporate big data analytics (BDA), decentralized agent-driven control, latest manufacturing technologies with sensors, augmented reality, advanced robotics, ultra-modern tracing and tracking technologies, and 3D printing.

5. Conclusions and Recommendations

Based on the study findings, the study conclude that traceability was found to be statistically significance and had a positive effect on supply chain performance of food and beverage manufacturing firms when considered singly and when combined with other variables in the study. Similarly, Transparency and Digitalization were found to be statistically significance and had a positive effect on supply chain performance of food and beverage manufacturing firms. The study concludes that there are vital benefits accrued from block chain technology which should be considered as the best strategy in supply chain management as it enhances performance.

Based on the study findings, this study recommends that manufacturing firms should execute blockchain technology to escalate their robust potentiality through supply chain performance. In addition,

organizations should continuously improve their supply chain processes, cooperation and trust among SC parties to enable the institutions to enhance supply chain performance of food and beverages manufacturing firms. Blockchain guarantees monitoring, connectivity, tracking, visibility, agility and interaction. This potentiality enhances performance through sharing of real-time information, cost reduction, supply chain reliability and efficient management of resources. The study further recommends top management should support and adopt the Blockchain Technology.

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