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Blockchain Technology And Supply Chain Performance Of Food And Bevareges 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. The aim of the study will be to determine the effect of blockchain technology on supply chain performance of food and beverages manufacturing firms in Nairobi County. The research will examine the effect of traceability, supply chain transparency and supply chain digitalization on supply chain performance. Supply chain performance will be anchored on balance score card. Cross-sectional descriptive research design will be adopted, target population constituted 138 respondents and a sample size of 103 respondent was embraced. Semi-structured, self-administering questionnaires anchored in 5 likert scale was used to collect data from respondents. According to the dependability results, every variable satisfies the requirement for a Cronbach's alpha value of greater than 0.7. Criteria, content and construct validity were also examined. Both inferential and descriptive statistics were employed to exhibit the degree of relationship among variables. SPSS version 26 was employed to process the data and presented by operating in frequent tables. 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 recommended that manufacturing firms should execute blockchain technology to escalate their robust potentiality through supply chain performance.*

Keywords: **Blockchain technology, Traceability, Supply chain digitalization, Supply chain digitalization, Supply chain performance.**

1.INTRODUCTION

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 SPECIFIC OBJECTIVES

The study was based on the following research objectives:

1. To examine the effect of traceability on supply chain performance of food and beverage manufacturing firms in Kenya.
2. To assess whether supply chain transparency has an effect on supply chain performance of food and beverage manufacturing firms in Kenya.
3. To determine the effect of supply chain digitalization on supply chain performance of food and beverage manufacturing firms in Kenya.

2. LITERATURE REVIEW

2.1 THEORY FRAMEWORK

2.1.1 KNOWLEDGE MANAGEMENT THEORY

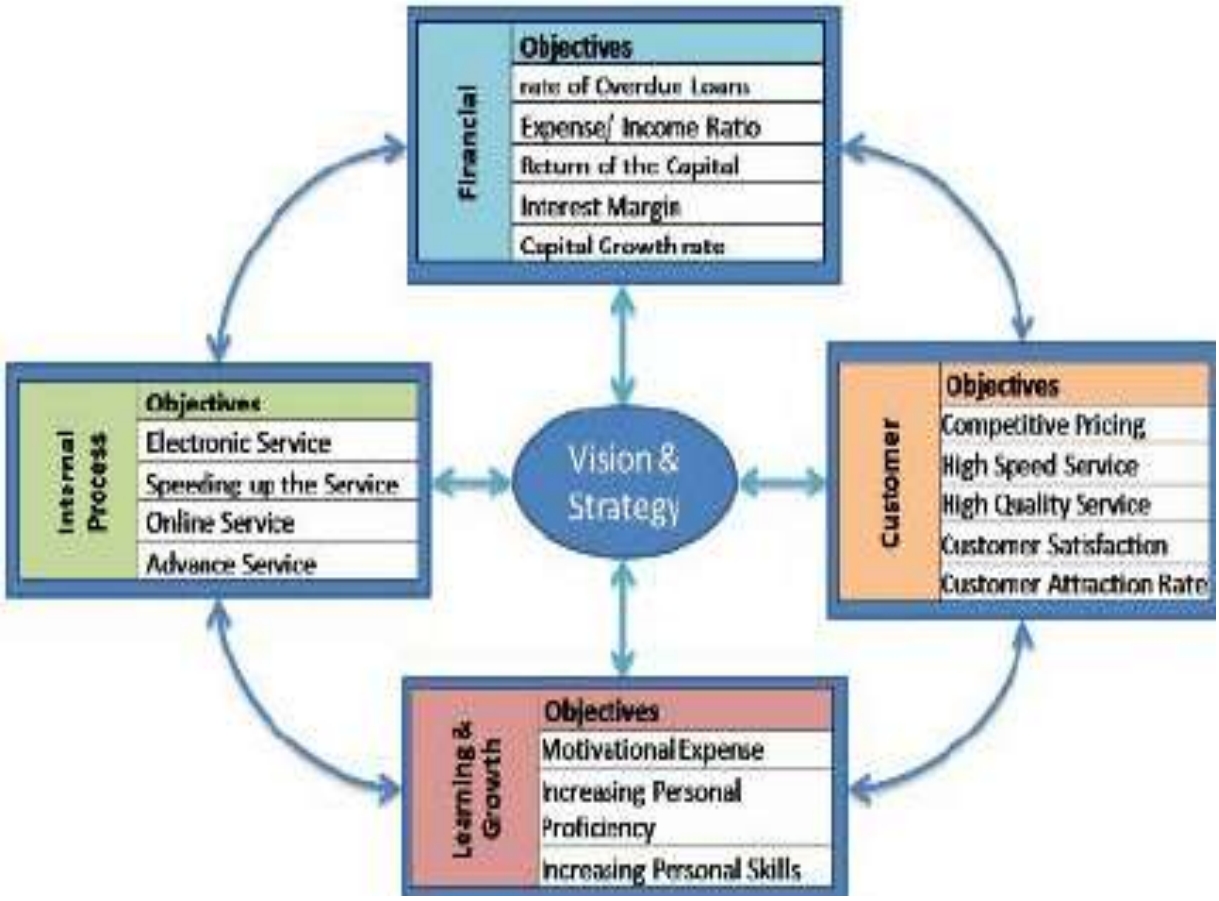
Knowledge management theory is thought to be appropriate for this study in order to acknowledge the influence of blockchain technology on performance of food and beverage manufacturing firms in Kenya, hence it gives a theoretical background of this study. Knowledge management entails organizational processes 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).

2.2 MODEL

2.2.1 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).

2.2.2 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 and4.) 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). 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 supply chain enhancing visibility (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 a competitive edge 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 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).

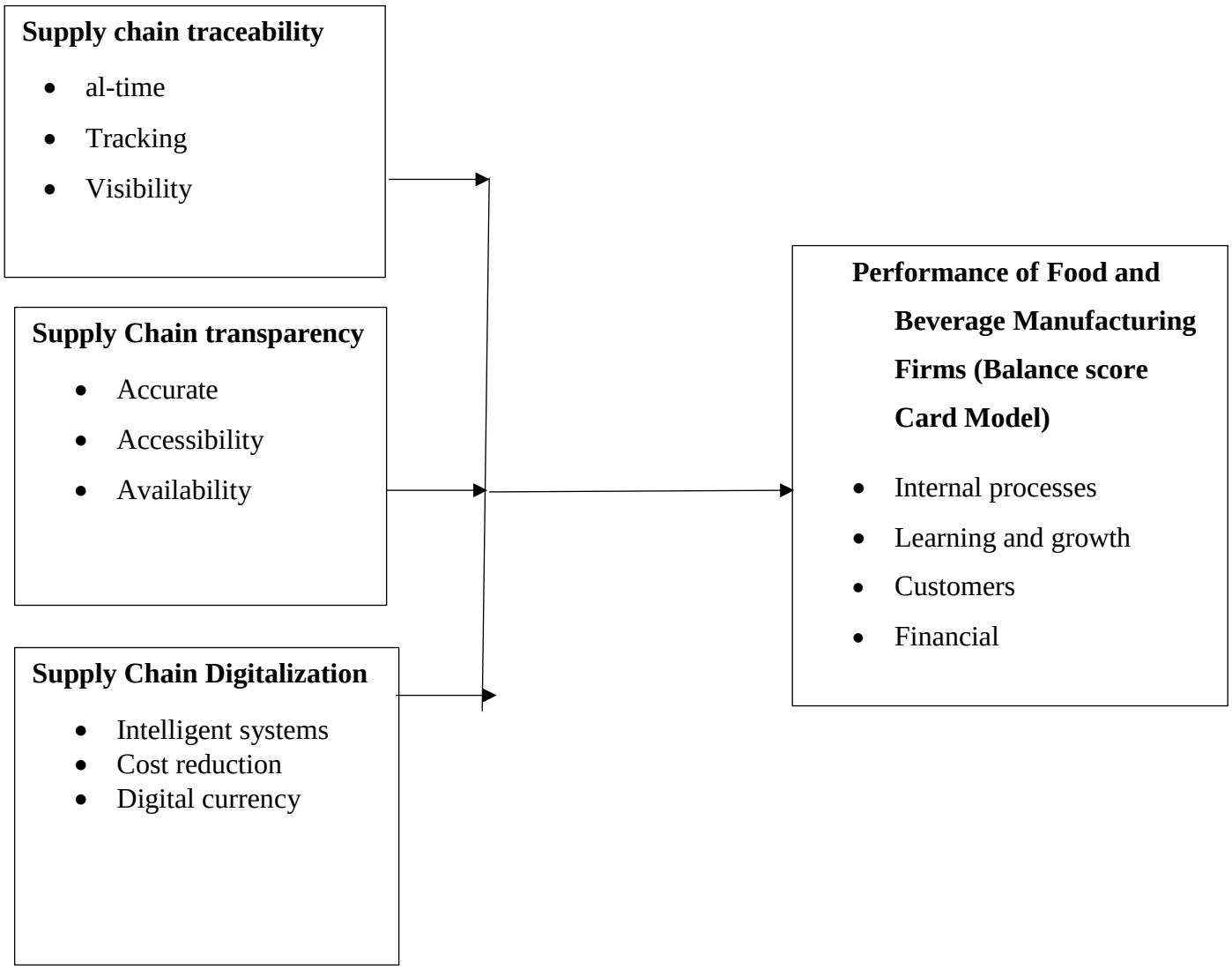
2.3.3 SUPPLY CHAIN DIGITALISATION

According to Legner *et al.*, (2017), eliducated 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



Independent Variable **Dependent Variable**

Figure 1: Conceptual Framework

3.0 RESEARCH METHODOLOGY

Research design is a plan or a blue print on how the researcher is going to carry out the research (Cohen, Manion &Morrison, 2007). The study used descriptive research design. According to Kothari & Garg (2014), descriptive research design is used to acquire information regarding phenomena and to outline what exists built on chosen variables. The target population consisted 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). Unit of observation was food and beverages

manufacturing firms in Nairobi County while unit of analysis was senior procurement managers. The study embraced simple random sampling technique to select respondent. The study will adopt 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

Primary data was collected by use of questionnaires. According to Oso & Onen, (2011) questionnaires are set of question in written forms used to collect information from respondent. The study used semi-structured, self -administering questionnaires to collect data from respondent with five likert scale. Pilot study was done to test validity and reliability of research instrument
(Hayes, Banner, Forrester& Navarro, 2019). According to Cohen, Manion and Morrison (2007), data analysis is a procedure of submitting order, structure and explanation to the abundance of collected data. The combined data was coded and edited then analyzed using both descriptive and inferential statistics. Descriptive statistics was used that is mean and percentages and inferential statistics on the other side correlation and regression. Statistical Package for Social Sciences (SPSS) was used to process the data. Multiple regression model was used to establish whether a group of variables combined predict a stated dependent variable (Gujarati, 2003).).
The study used multiple regression model to analyze regression coefficient.

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

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
Data was presented by use of tables.

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