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Deployment of Block Chain Technology on Supply Chains: Opportunities during Emergencies. Insights from Related Literature

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ABSTRACT

Corona Pandemic, Covid-19 as was declared by the World Health Organization was a worldwide disaster. It closed off countries and destabilized businesses. Corona pandemic had unprecedented effects on global trade with many countires on lock down. With the 2nd wave hitting quite a number of countries, the worst was expected. Interestingly Africa was not as adversely affected in terms of infections as earlier predicted. However the cross border business was affected. The aim of this paper was to find out the ripple effect of the Covid-19 pandemic on the global supply chain with a focus on Kenya and the business opportunities that the pandemic offered to Africans. Being a very new area, this research was an analysis of trends and opportunities in order to create knowledge. This was done through review of available information. Aspects like e-commerce and blockchain analysis were the focus of this paper. Supply chains were facing uprecedented challenges from Artificial Intelligence (AI) . With the 4th industrial revolution also coming in, then businesses having to think outside the box to come up with solutions that would stand the test of time. Technology was seen as inevitable in such circumstances.

Keywords: BlockChain, Covid 19, Supply Chain, Internet of Things.

1.0 INTRODUCTION

The financial crisis of 2008, made a group of activists to develop a decentralized, stable, autonomous and sustainable financial system

that would not be influenced by any institution. Bit coin as both a payment and a digital currency, Cryptocurrency was launched in 2009 (Leemon, 2017) and by 2018, they were over 1300 digital currencies and 500 tokens. The concept of blockchain is evolving, and while the future of Bitcoin remains unclear (as it is for the most elements of the economy) it is evident that the blockchain holds enormous potential for large-scale improvements of many different areas of economic system. (Jirenuwat, Bayatsogt, Ewing, Su-Hyun, & Bradsher, 2010)

Blockchain technology, as a source of total supply chain efficiency is important in eliminating the dependence on trust-based business transactions. A supply chain built on block chain technology would reflect efficieny in every stage of the chain thus improving efficiency. (Wangui, 2017). Nakamoto, (2008), defined Block chain as a decentralized shared network of ledgers that have many other uses. Reijers, O'Brolchain, & Haynes, (2016), stated that first applied in the design of Bitcoin in 2008, emerged from a movement of anarchists, computer scientists and crypto-enthusiasts who saw the potential of the technology as a breakthrough in the long-awaited realization of an old "cypherpunk" dream of money that is free from the control of the state and other third parties, such as commercial banks.

Dujak & Sajter, (2019), state that Blockchain technology promises overpowering trust issues and allowing trustless, secure and authenticated system of logistics and supply chain information exchange in supply networks. The new implementations within supply chain are shifting from blockchain to a wider notion of distributed ledger technologies. Paper presents description and rationale behind current and possible future applications of blockchain in logistics and supply chain. Blockchain has found its applications and is under development in logistics and supply chain activities as well. Radio-frequency identification (RFID), telematics, barcode and 2D codes, sensors-enabled technologies, Internet-of-things (IoT) and numerous other technologies are used for tracking products through the supply chain. (Dujak & Sajter, 2019).

However, until recently their true potential was not fully exploited as the underlying data was available only within an institution, a company, or perhaps exchanged with limited groups of trustworthy partners. Typically, there are numerous supply chain members each with their own information systems, but communication between these systems is limited at best. The main barrier was (and still is) the lack of trust in exchanging information. Based on these features and blockchain development in general, the pace of new implementations within supply chain is accelerating rapidly. Pilot projects are launched worldwide and supply chain industry is expecting changes. (Dujak & Sajter, 2019)

This paper aims to introduce and present the concept of blockchain and its current applications in supply chain management, current applications and future trends, the goal is to provide basic material for academics and practitioners when considering its application in supply chain activities.

This paper is structured in five sections. After the introduction, the second section presents the current state of the progress in supply networks. Third section analyses the features of blockchain as it came from the

cryptocurrency universe, while the next one presents its current implementations and advantages in supply chain and logistics. The fifth section concludes.

1. Supply chain Networks

Supply chain networks are a network of facilities and activities that deal with procurement of raw materials, transform them into intermediate and final goods, and finally ensuring that the products are delivered to the final consumer through the distribution channels. There are quite a number of relationships in these networks which include relationships with suppliers, distributors and customers at different levels and with different objectives. Thus activities in the networks include planning the activities, managing the activities, controlling the activities and managing the complex relationships that come with the supply chains.

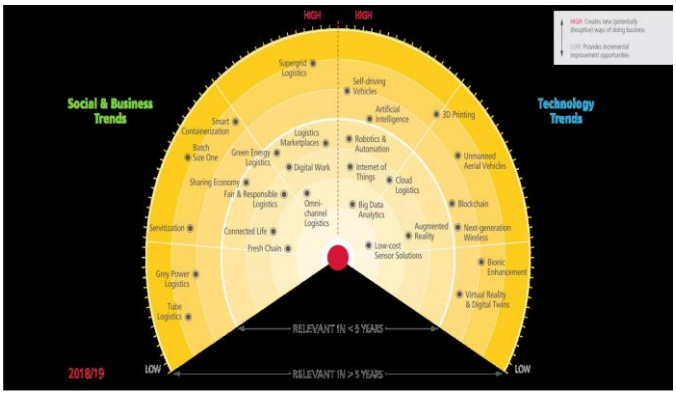
As stated by Christopher, (2011), materials management is part of supply chain networks that actually deals with upstream suppliers and the end product deals with down stream suppliers. These networks are quite complex and are gaining competitive advantage by competing among themselves and not organizations competing by themselves. Successful performance in supply networks requires ensuring proper supply network design and continuous optimization of processes that occurs within. Design of the supply network is primarily a strategic, long-term concern. Therefore, when designing a supply network, it is necessary to ensure that the supply chain configuration is effective in relation to the expected conditions, but also robust and flexible to adapt to unexpected changes in the surrounding conditions. (Dujak & Sajter, 2019). Facilities in supply network (factories, warehouses, distribution centers, stores) constitute its structure and influence its performance and cost at the same time. While adding facilities enables better customer service (shorter lead time, increased product variety and availability, improved customer shopping experience, increased visibility of supply chain order and increased product return capability), it also means increase in inventory holding and facility costs, and decrease in transportation costs. Therefore, the goal of optimizing the design of the supply or distribution network is to find a trade-off between minimizing the total cost of holding inventory, warehouse costs and transportation costs, while satisfying customer demand related primarily to delivery time. Simply put, network is optimized, "when a minimum of distribution facilities that will meet the customer's response time is reached" (Christopher, 2011).

The 4th industrial revolution that is taking place can only work if supply chains are competitive and work efficiently and effectively. This in collaboration with the use of Artificial Intelligence and Block chain technology can then ensure that the opportunities that will come in will change the way business are done. World Economic Forum, (2018) conference on block chain stated that block chain solutions in supply chain can increase GDP's of countries by upto 5% due to the unexplored opportunities of blockchain in supply chain. The report also stated that global trade will improve by upto 15% due to the ripple effect of the expansion of the trade from introduction of block chain in supply chain. The digitization of important documents in supply chain like bill of lading, packing lists, voyage report, voyage tracking,

insurance etc rely on the effectiveness of technology to ensure that the activites are not affected. The advent of 5G mobile network technology ensures that there is greater bandwidth and lower latency. This coupled with Google baloons ensures that even the most remote areas have access to internet and technology, all they need is software and hardware to ensure that the supply chains use the technology.

Boschi, Regero, Raimundo, & Battochio, (2018), stated that supply chains need to ensure that the ledgers in the blocks are well maintained in a trustless environemnt and this can only be achived through having smart contracts. Accordingly, a smart contract is a requisite condition in the operation written on a code. The smart contract automatically executes the transactions and record the information onto the ledger without any human intervention. The aim of smart contracts is to provide security, which is superior to traditional contract law and to reduce other transaction costs associated with contracting. It is explained as cutting costs to near-zero with a smart contract. Networked members mutually agree on the smart contract. It is a key component for establishing trust and efficiency between parties. Smart contract eliminates all the paperwork, streamlining the entire process and saving time and money.

A report by Kukelhaus, (2019), analysed the trends of how supply chains will have to adapt in both the short term and the long term through various scenarios. He summarised it in a diagram as stated below.



(Source Kukelhaus, 2019)

And from the diagram, we can see smart conternarization, wireless technology, blockchain, servitization, artificial intelligence and value chains as being quite important in ensuring that the supply chains adapt and tap into the next big things in the 4th industrial revolutions that is coming up.

2. Features of Blockchain

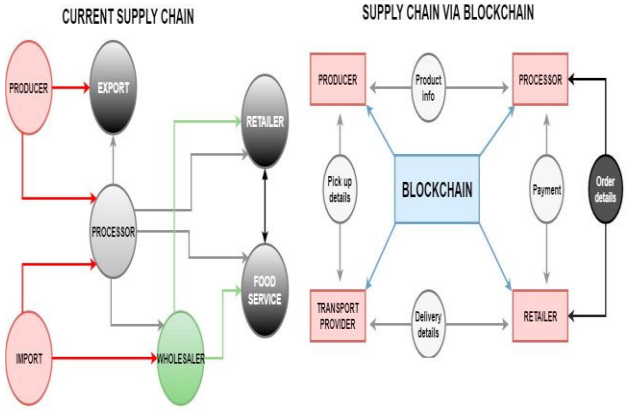
The economic meltdown of 2008 led tech gurus to develop the block chain technology through bitcoin so to avoid the impact of large banks and other companies holding institutions hostage. According to Nakamoto, (2008), the developer of bitcoin and blockchain bitcoin was evolved due to third party mediation, increase in costs, and trust issues that were erupting on the use of technology. He further stated that the cost of mediation increases transaction costs, limiting the minimum practical transaction size and cutting off the possibility for small casual transactions, and there is a broader cost in the loss of ability to make non-reversible payments for nonreversible services. A certain percentage of fraud is accepted as unavoidable. These costs and payment uncertainties can be avoided in person by using physical currency, but no mechanism exists to make payments over a

communications channel without a trusted party. (Nakamoto 2008).

Since 2008, the development of Bitcoin became the first example of a Blockchain application. Valid transactions are collected into blocks that are permanently sealed. In the report by Swinburne University (2018), they further stated that Today, applications of Blockchain technology are emerging across all sections of society and industry. For example, in the finance sector, Blockchain can simplify business processes while creating safe, trustworthy records of agreements and transactions.

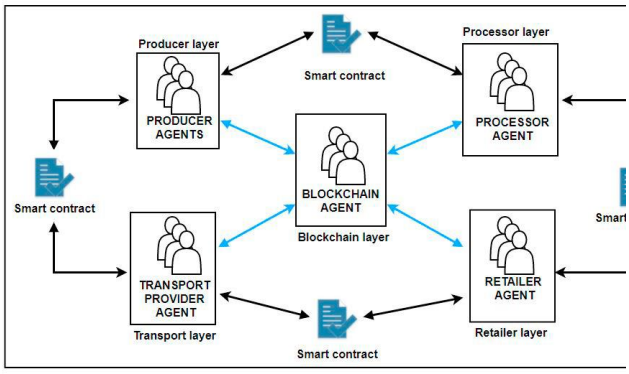
A global consortium of more than 80 institutional members has formed to develop proof of concepts and prototypes of finance systems that are disrupting the finance sector by automatic execution of finance transactions in real-time. Furthermore, in case of food supply chains for example, a Blockchain-enabled ecosystem can facilitate an end-to-end service that alleviates interruptions in supply chain occurrence of fraudulent products. By integrating supply chain management with an Internet of Things (IoT) system that supports an automated machine-to-machine communication an optimal and safe value transfer can take place across the entire process. (Swinburne 2018). Succeeding in the next industrial era requires manufacturing companies to define and shape their core value drivers enabled by digital technologies. Industry 4.0 will drive operational efficiencies through Smart Factories and Smart Supply Chains as well as grow opportunities through innovation and bespoke solutions to increase customer value. They will ultimately lead to completely new business models and service-offerings enabled through digitalization.

In the context of Casado-Vara, Prieto, De la Prieta, & Corchado, (2018), they stated that current supply chains are linear economy models in nature and as such directly or indirectly fullfil the supply chains needs. Accordingly, this model was not quite adequate. In this regard, they did a comparative model as shown below which shows the integration of block chains into supply chains. Below is the comparative model as developed by Casadro-vara *et al* (2018)



Casadro-vara *et al* (2018)

Thus the new model is non-linear but interactive and simple in its context of implementations. According to the model, blockchain uses multi agency approach so as to achieve its objectives vs a linear economy to a circular economy. Smart contracts are at every node so as to ensure that the data is viable and realtime. Below is a model that also shows how blockchain can be used in multiagency approach with different levels of smart contratcs across the chain.



Sadouskaya, (2017).

One model of understanding blockchain is through comparing it to the new application layer for Internet protocols because blockchain can enable both immediate and long-term economic transactions, and more complicated financial contracts. It can be a layer for transactions of different types of assets, currency or financial contracts. Moreover, a registry and inventory system for recording, tracking, monitoring, and transacting of all assets could be managed with blockchain. No one can change the information in blocks because they are chained to each other

Thus, we can say that the fundamental concepts of block chains are; -

Node. Peer or Node is a computer with the special software that maintains a Blockchain. All nodes are connected to the Blockchain network so they can receive and submit transactions.

Network. It is a result of cooperation of all nodes that run Blockchain software to communicate with e-*Smart contracts*. These are contracts converted into codes to be carried.

Submit transaction. When users submit transactions, they are sent to the nodes on the network who subsequently send them to other nodes.

Transaction Validation. All transactions are cryptographically validated by the nodes on the Blockchain network. Invalid transactions are ignored.

Block. It is a group of transactions collected by nodes into a bundle. To be valid blocks must be formed according to pre-determined set of rules: They must not exceed a maximum size in bytes, contain more than a maximum number of transactions, and must reference to the most recent valid block.

Blockchain. It is a chain of blocks that is organized by the following system: Each new block is attached to the most recent valid block.

Consensus. It is an agreement of all nodes in the Blockchain. To enable distributed system operation, multiple processes cooperate with each other. Faults in such systems can occur anywhere, that is why they use consensus protocols.

Hash function. It is a one-way function that reflects an input of selectable size to a fixed sized output called hash. Properties of a cryptographic hash function: 1) easy to generate the hash given the input, 2) infeasible to generate the original input given the hash, 3) virtually impossible for two similar inputs to have the same output in a so called “collision”. SHA256 – example of cryptographic hash function.

A smart contract should provide:-

a. Autonomy: can be developed by anyone, no need of intermediaries such as lawyer, brokers or auditors.

b. Efficiency: removing process intermediaries often results in significant process efficiency gains.

c. Backup: a Blockchain and smart contract deployed to it can provide a permanent record, allowing for auditing, insight, and traceability even if the creator is no longer in business

d. Accuracy: replacing human intermediaries with executable code ensures the process will always be performed the same way.

e. Cost saving: replacing intermediaries often provides significant cost reduction.

Block chain technology will now drive the 4th industrial revolution and change the dynamics of the industries through which supply chains operate. They will destabilize traditional methods of financial transactions setting an unprecedented use of artificial intelligence in the world at large.

There are basically three types of block chains as stated by Dujak & Sajter, (2019). These are:-

a) Permisionless Block chain – these include bitcoins and Etherium, that are decntralized and institutionless, fully public peer to peer netwoks where any members can join.
b) Permisionned block chains – this is almost like a federation where members form a group and new members have to be refeered to by old members – almost like a members club
c) Private block chain – where permissions are centralized with one organization which manages all the chains.

3. Opportunities of block chains in supply chain

Since supply chains deal with ensuring the 12 rights of supply chain are adhered to, which are the right price, right quality, right time, right place, right source, right quantity, right attitude, right contracts, right materials, right transportation, right condition and right customer. For these services to be well delivered, then a number of activites and processes need to take place and a trusted system of suppliers and consumers in place.

a) Track product flow visibility

Due to the increase transparency and automation of documents and activities, it is quite possible to track product flow from supplier through the transporation schedule to point of delivery covering a number of principles. As such, clearing and forwarding agents cannot lie, or delay in service delivery as the procurement officer can know when to start which process depending on the service level agreements that have been set. Thus product loss is minimized or eliminated compeletely leading to an efficient supply chain process.

To increase tracking of products through the supply chain, radio frequency identification technology (RFID), and transponders (Tags) are used to carry the information required. They can be read through the scanners and the information that is shared will vary depending on the size of the tag on the product.

b) Demand Forecasting

Demand forecasting is one of the most important things in supply chain as it helps in knowing what to buy and when to buy, to ensure that there is constant flow of materials during production taking into consideration consumption patterns, distribution, upstream supply chains and lead times. While forescasting, environemtal issues and risk management are taken into consideratons so as to ensure that the forecast is as accurate as possible. Proper forecasting ensures that the bullwhip effect in supply chain is eliminated and efficiencies and effectiveness mantained

By being able to use Enterprise Resources Planning softwares and integrating them with materials management and manufacturing requirements planning will enable prompt demand forecasting. This coupled with effieicent tracking of products means that product turnover will be quite high in the stores, and that means less losses in terms of obsolescence and less stock being held. At the end of the day efficiency and effectiveness in demand forecasting and usage of stock will be achieved leading to lean supply chain. Exchange of data between upstream suppliers, buyers and downstream suppliers is essential for demad forecasting to be effective.

c) Open Access to Information

Being a technology enabled activity means that there are threats of cybercrime among others. On the other hand, it's transactional activites allow access to information among the nodes or blocks in the block chain. This access to information ensures that the suppliers know whom they are dealing with and so do the customers. Access to information normally leads to longterm collaborative realtionships that help build competitive advantage of the supply chains. This collaborations can be in product development, research among other partnerships.

Digitization of documents and tracking of activities avoids communication between supplier and buyer as they can access the information in the block chain ledgers that is secure, authentic, and verified. This is one aspect that is most important in any business and any supply chain as a whole. Information wil be accurate and realtime as it is updated frequently within the blocks.

d) Decrease in fraud and counterfeit risks

Since the information made in these chains cannot be changed, it is easy to track who made the information, source of the products among all the information required to trace authnenticity of the products and services. Accounting activities are approved using digital signatures and as such there will be reduction in fraud and counterfeit risks. Trustless transcations that are authentic will ensure that there is legitimate businesses going on that have an audit trail of all activities and information that cannot be erased once entered.

By using the distributed ledgers, information is verified and secure throughout the chain as it is stored in a manner similar to RFID. This means security, authenticity, regulated, visibility, and verifiable information on products, documentation and services related to blockchain technology. Drugs are most prone to counterfeits and by use of this technology it is possible to track the drugs through the ledgers from point of origin to

point of consumption thus reducing fraud and counterfeits.

e) Transaction automation

Blockchains uses technology and Internet of Things and as such any organization will have to automate before it can embrace it. Integrating ERP with block chain means that automation is mandatory. By using technology, efficiency and effectiveness will be improved. The initial cost of automation may be high but the lifetime costs will be lower. Tax rebated and carbon footprints are reduced due to the fact that the paper documentation is reduced and electronic documentation is increased.

Block chains also work with smart contracts that are already incorporated in the system. This then cascades to all others, and there is no need for third parties like banks in the contracts. Aspects like fuel consumption, fuel reimbursesments, fleet management can all be automated and block chain used in their activities. It is also important to know that you can work with organizations that offer environmetal friendly products and services. Since their information is available, it can be verified then the tripple bottomline, people, planet and profits principle used in the supply chain.

f) Environment conservation

Since automation of most, if not all activities is done, paper trail is not there, leading to conservation of the environment in many ways. The blue and green technology is used alongside sustainability. Use of blockchain opens diverse opportunities in many areas including telecommunication, and thus focus can be on all aspects of the tripple bottom line, people, planets, and profits. Other principles in use include reuse, reduce and recycle concepts in the supply chain, both upstream and downstream.

Being able to track all products from source to consumption, the reverse is also possible. This is to ensure that the carbon footprints are reduced and work with companies that ensure proper environmental conservation is maintained.

g) Smart Contracts

All Block chains have smart contracts embedded in them that govern what organizations do. The first successful implementation of a blockchain-based smart contract was Bitcoin Script, a purposely not-turing-complete language with a set of simple, pre-defined commands. As simple forms of smart contracts, standard types of Bitcoin transactions, such as pay-to-public-key-hash (P2PKH) and pay-to-script-hash (P2SH), are all defined with Bitcoin Script. In addition, there also exist platforms that enable more complex contractual functionalities and flexibilities, e.g., Ethereum, which adopts a turing-complete language for smart contracts. Newer blockchain platforms such as Neo and Hyperledger Fabric allow smart contracts to be written in various high-level languages. (Hu, Liyanage, Manzoor, Thilakarathna, joujon, & Seneviratne, 2019).

There are many areas of usage for block chain and they include health care records where patients records can be accessed by health providers across the chain. Another area is identity management by countries, counties and organizations where records of an individual are kept at a central point and used by those who require. Banking is another area

where smart contracts can be used to help in financial transcations and eliminate the need for third party partners. Electronic voting is also another area where smart contracts can be used and information remain safe. Finally though not limted to the mentioned areas, smart contracts can be used in instituting insurance agreements.

h) Smart containerization

As an underlying technology, blockchain lends itself to processes that involve multiple participants, contracts, transactions, levels of approval, legal contracts, and security requirements. Supply chains are perfect examples of these complex, multi-party processes. Supply chain partners can use blockchain-based applications to meet different business needs. Smart containers are the only equipment that offers visibility into transport execution and cargo conditions from door to door. They generate valuable real-time physical tracking and monitoring data. For example, smart containers can generate data about events such as a door opening or closing, arrival or departure at a geofenced area, or temperature, humidity, and shock events occurring during the journey. This raw data is collected and processed according to the parameters of a specific use case. Attributes such as provenance, volume, timing, content, correct labeling, and others are critical for accurate supply chain analysis.

Unlike traditional business intelligence (BI) tools that cannot control data collection, require skilled users, and take extended periods of time to deliver meaningful information, AI-based analysis provides insights that matter in real time. With unprecedented insight into the cargo's journey, AI based services provide a lever for supply chain stakeholders. When this information is secured in a blockchain, it is "fingerprinted" and can be trusted by all stakeholders. The powerful combination of AI and blockchain technologies enables stakeholders to automate and accelerate decision-making with trusted information. Smart container physical data, AI, and blockchain bridge the physical world with document flows and enhance distributed business processes. Smart container analytics can be shared with shippers and other members of the supply chain to: Reduce cargo loss, damaged goods, packaging costs, and non-quality costs Levy fines (or reduce them) and assess legal costs or insurance fees, accelerate investigation processes, quickly remediate deficiencies, and minimize the impact of unavoidable delays Reduce back orders, cancelled orders, and delivery of defective products

i) Financial Transactions.

Financial institutions around the world find themselves continually barraged by external innovations they are often unable to absorb and internalize. The emergence of innovative digital financial technologies has challenged traditional players in the sector by demonstrating new ways to deliver value across the entire financial value chain. Blockchain, or distributed ledger technology, is just such a disruptive and possibly game-changing innovation. Distributed ledger technology is still in an early stage of development and deployment, yet it is widely thought to have the potential to deliver a new wave of innovation to the financial technology, or fintech, ecosystem by providing a ‘trustless’ distributed system to exchange value. Established financial

institutions are more likely to use blockchain for intra-organizational projects intended to reduce organizational complexity, improve efficiency, and reduce costs.

Banks and major financial institutions are working both collaboratively and independently to develop blockchain technology, as seen in the proliferation of global consortia. (International Finance Corporation, 2018). Blockchain's potential to disrupt the financial services ecosystem has been widely discussed, including its capacities for operational simplification, regulatory efficiency improvement (real-time monitoring of financial activity between regulators and regulated entities), counterparty risk reduction (agreements are executed in a shared, immutable environment), disintermediation for clearing and settlement of transactions, and transparency and fraud minimization in asset provenance and capital raising.

Other areas include anti money laundering and customer identification programs, trade finance and global payments, risk analysis and risk management programs, capital markets and derivatives transactions, and financing and cryptocurrency activities among others. A Kenyan company bitpesa was established in 2013 and is making inroads in this arena in Kenya and East Africa and has been able to raise venture capital to expand its territories.

j) E-commerce

The increasing spread of information and communication technologies, specifically the Internet; the global business community has been able to move towards electronic commerce. It is providing many new features such as the possibility of providing all goods on electronic platforms, providing detailed information of goods, about the products offered. Through the technologies of blockchain distributed ledger, consensus mechanism, identification, smart contract, encryption algorithm, etc., system optimizes the e-commerce business model, improves operational efficiency, and ensure financial security. A blockchain-based business service platform, has the features of distributed data storage, time series and tamperproof data, intelligent execution of smart contract, security and privacy protection. The distributed ledger uses consensus mechanism to negotiate the contents of the ledger, uses cryptographic algorithms and digital signatures to ensure the integrity of e-commerce, finance, and energy transactions. (Zhu & Wang, 2019).

Based on the blockchain architecture, the transaction system, payment system and trust system in ecommerce, it realizes the interconnection and intercommunication of e-commerce information value chain. Undoubtedly, the technology will be a crucial part of business or e-commerce in upcoming time which will lead the market world. (Sheikh, Azmathullah, & Rizwan, 2019)

k) Inventory management

A very good opportunity to control the inventory was presented during Blockchain Summit in April 26th, 2019 in San Francisco by Ernst Young (EY), where the visibility of inventory was demonstrated and how it can be used to improve supply chain management. The supply chain operations efficiency impacts an organization's competitiveness and is shaped by numerous factors. Information sharing methodologies

such as vendor managed inventory (VMI) create efficient replenishment models without the need for traditional orders (Boschi, Regero, Raimundo, & Battochio, 2018).

In theory, the blockchain can work, but supply chains are very hard to change and adapt. (Mougayar & Buterin, 2016). Mougayar thinks, that companies spend years putting supply chains in place and refining them. It is not very easy to insert a new technology inside established supply chain systems because the integration challenges are not to be underestimated." (Mougayar, 2016).

l) Vendor managed inventory

Vendor-managed inventory (VMI) is a very common supply chain (SC) management approach for improving multi-firm SC performance while establishing a mutual beneficial relationship between a vendor and a retailer. The main idea behind VMI is that the vendor is authorized to oversee product inventory for the retailer; therefore, the vendor is responsible for tracking, monitoring and replenishing the retailer's agreed-upon inventory. VMI is a streamlined approach to inventory management and order fulfillment in which both the retailer and the vendor may smoothly and accurately control the availability and flow of goods across the SC. (Casino & Dasaklis, 2019). Sometimes VMI is called Just in Time (JIT) II. For VMI to be successful, there is need to understand its requirements.

STRATEGIC	OPERATIONAL
• Information sharing • Long term Collaboration • Management Commitment • Quality of Information • Communication systems • Relationship quality • Trust • Systems Integration	• Automated data transfer system • Product Identification and tracking • Simple logistics flow and distribution channels • Low customization • Demand is easily forecasted • Data accuracy • Low variations in stock

From the above figure we see that implementation of VMI is in tandem with blockchain and it ensures that all the atributes of blockchain are also with VMI at both the operational and strategic levels. Thus, this implementation will see a reduction in stock held, capital held in stock, cost of stock, cost of obsolescence among other stock holding issues and streamline operations to ensure lean supply chain and JIT operations.

Conclusions

With the world crisis that has shut down most operations in production and finance and seeing stock markets crashing, we need to think outside the box and look for solutions to make sure that the systems do not crash or get disrupted. The supply chain, being the

active area that ensures supply of goods, services, information and people during these challenging times are faced with complex obstacles in achieving intended goals. Dimensions such as blockchains are useful in the context of "working at home" to ensure continuity of services without crashing of business activities such as stock markets among others. There is a lot more to be looked into in research and entrepreneurship in trying new things in new ways. One may have inventions that solve business problems in easier ways. However, the technology world is the way to go. Different ways of using technology ensure that businesses stay afloat in the dynamic and unpredictable world full of risks and uncertainties.

References

Arredy, J. E. (2020). *Amid Corona Viris, THE world Closes its doors to China.* New York: Wall Street Journal.

Boschi, A. A., Regero, B., Raimundo, C. J., & Battochio, A. (2018). An Exploration of Blockchain technology in supply chain management. *Cambridge International Manufaturing Symposium*. London.

Casado-Vara, R., Prieto, J., De la Prieta, F., & Corchado, J. (2018). How Block Chains Improve Supply Chains: Case Study, Alimentary Supply Chains. *International Workshop on Internet of Things (IoT) Approached.* Elsevier Publishing.

Casino, F., & Dasaklis, T. P. (2019). Enhanced Vendor-Managed Inventory through Blockchain. *SEEDA-CECNSM.* Research Gate.

Casino, F., K, D. T., & Patsakis, C. (2019). A systematic Literature review of blockchain-based applications; Current status, Applications and Open Issues. *Elsevier, telematics and informatics*, Iss 36.

Christopher, M. (2011). *Logistics and Supply Chain Management.* London: Prentice Hall, 4th Ed.

Dujak, D., & Sajter, D. (2019). Block Chain Applications in Supply Chain. *Springer International Publishing*.

Dujak, D., & Sajter, D. (Springer International). *Block Chain Applications in supply Chain.* Osijeck, Croatia: 2019.

Hu, Y., Liyanage, M., Manzoor, A., Thilakarathna, K., joujon, G., & Seneviratne, A. (2019). Block-Chain Based Smart Contracts - Applications and Challenges. *Research Gate*.

International Finance Corporation. (2018). *Block Chain in FInancial Service in Emerging Markets.* New York: World Bank.

Jirenuwat, R., Bayatsogt, K., Ewing, J., Su-Hyun, L., & Bradsher, K. (2010, March 4). Covid 19 and the fall of economies. *New York Times*.

Kukelhaus, M. (2019). *Digitalization and the future of supply chains.* DHL.

Mougayar, W., & Buterin, V. (2016). *The Business Block Chain: Promise, Practice and Application of the next Internet Technology.* 1st Ed. New Jersey: Wiley and Sons Inc.

Nakamoto, S. (2008). *Bitcoin: A peer to peer Electronic Cash System.* Bitcoin.org.

Nakamoto, S. (2008). BitCoin: A peer to peer Electronic Cash system. *White Paper*. New York.

Reijers, W., O'Brolchain, F., & & Haynes, P. (2016). Governance in Block Chain Technologies & Social Contract Theories. *Ledger Journal*, Vol 1 Iss 1.

Sadouskaya, K. (2017). *Adoption of Blockchain Technology in Supply Chain and Logistics.* XAMK university.

Sheikh, H., Azmathullah, R., & Rizwan, F. (2019). A block chain based application transforms E-commerce perspective into a decentralized market. *International Journal of Management, Technology and Engineering.*

Swinburne University of science and Technology. (2019). *Blockchain and the 4.0 industrial revolution.* Swinburne University.

Wangui, R. (2017). *Perception of procurement proffesionals on the adoption of blockchain technologies and its impact in Kenya.* Nairobi: University of Nairobi.

World Economic Forum. (2018). *Block Chain.* New York: World Economic Forum.

Zhu, X., & Wang, D. (2019). Research on Block Chain Application for E-Commerce, Finance and Energy. *IOP conference Series.* IOP Publishers.