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THE POTENTIAL OF BLOCKCHAIN TO ENHANCE EFFICIENCY AND TRACEABILITY IN THE SHIPPING PROCESS: A STUDY OF VEHRO'S SUPPLY CHAIN MANAGEMENT

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ABSTRACT

In the age of globalization, people are now attempting to use new technology to improve the effectiveness and efficiency of their lives, particularly their enterprises. This study examines how blockchain technology can enhance Vehgro's supply chain's shipping efficiency. Vehgro is a Dutch company that specializes in organic food goods. The study looks into how blockchain fits into supply chain management and how it affects the shipping process and the information sharing among the parties involved. It examines how blockchain can improve administrative processes, stakeholder communication, data security, and traceability. The study aims to offer insights and recommendations for businesses engaged in routine shipping operations and other entities in the delivery system. Interviewing Vehgro representatives and blockchain experts is one of the qualitative data collection methods used in the research approach. To get conclusions, the data will be reviewed and merged. According to the research, blockchain may increase data accuracy, administrative procedures can be streamlined through smart contracts, and stakeholder cooperation and communication in the information sharing can all be improved and prevent the occurence of asymmetric information. The report suggests a hybrid blockchain strategy and highlights how crucial it is to solve issues with stakeholder consent and change management. Encouraging open communication, creating collaboration, and overcoming change resistance are recommendations for managing change. Through blockchain technology, Vehgro can boost transparency, dependability, and sustainability in its shipping operations, which will help create a more effective and durable supply chain.

Keywords: Blockchain, Supply Chain Management, Shipping Process, Information Sharing

BACKGROUND

Blockchain technology is a sophisticated database structure that allows transparently exchanging information in corporate networks. This technology refers to a distributed system for recording and keeping a consistent, immutable, linear transaction log between networked participants. The system includes methods to prevent the submission of illegal transactions and consistent data recording without necessarily being consistent in shared views. Blockchain technology is a distributed database of records or public/private shared logs of all digital activities done and shared amongst blockchain-participating agents (Crosby et al., 2016). This is functionally comparable to a distributed ledger maintained, updated, and verified by all parties engaged in a network's transactions. It functions via a peer-to-peer network transaction and a distributed data structure (Christidis & Devetsikotis, 2016; Marsal-Llacuna, 2018).

Supply chain management endeavours to distribute goods and services that include all processes transforming raw materials into finished commodities. The supply chain encompasses everything from manufacturing to product creation and the information systems required to coordinate these activities (Apa M, 2021). Supply chain management seeks to centrally control or connect a product's production, delivery, and distribution. By optimizing the supply chain, businesses may save costs, become more efficient, and expedite the delivery of items to customers. This is

achieved by maintaining substantial control over the company's internal inventory, manufacturing, distribution, sales and vendor inventory.

The capacity of blockchain to ensure the integrity, traceability, and authenticity of the information, together with intelligent contractual connections for a trustless environment, all foreshadow a substantial rethinking of supply chains and supply chain management. Blockchain technology has the potential to identify and characterize leastwise five key product attributes which are Nature (what it is), Quality (how it is), Quantity (how much there is), Location (where it is), and Ownership (who owns it at any moment).

Vehgro is a Dutch enterprise, more specifically located in Hengelo. This business provides organic food-based items. Vehgro's philosophy is healthy, competitive, and focused on quality. Vehrgo thinks that wholesome food may contribute to health, happiness, and a better world. Vehgro goods are classified as perishable, which denotes that they have a limited shelf life and are often sensitive to temperature and humidity. Vehgro works closely with all supply chain elements, demonstrating that Vehgro understands where our food originates from and carefully respects the local environment. Due to the nature of the items given by Vehgro, the shipping procedure is vital. In this instance, blockchain may monitor the quality and safety of food, particularly perishable food. Every hand movement or checkpoint, temperature, humidity, and location data may be uploaded into the distributed ledger system.

THEORITICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

Blockchain System and Decentralized System

A blockchain transaction may be a modest operation recorded in the public ledger. In contrast to conventional techniques, blockchain enables the peer-to-peer transmission of digital assets without intermediaries (T. Aste; P. Tasca; T. Di Matteo, 2017). The bitcoin blockchain enables peer-to-peer, decentralized transactions inside a worldwide peer-to-peer network. In the blockchain, decentralization refers to the movement of power and decision-making from a centralized entity (person, organization, or group) to a dispersed network. Decentralized networks seek to lower the degree of confidence that users must have in one another and to impede their capacity to assert authority or control over one another in a manner that degrades the network's operation. Blockchain effectively increases data transparency by allowing the transition from centralized to decentralized distributed systems. Blockchain is a shared, distributed ledger among a group of stakeholders that cannot be modified by a single administrator alone (Mao et al., 2018). Instead, it can only be altered following the protocols between network participants, and any modifications to the distributed ledger are auditable.

The fundamental blockchain architectural layers consist of Transactions, Nodes, Consesus, Smart Contracts. Transactions define a data record transferred from one device to another blockchain device where it will be stored. A transaction may be validated using the blockchain, and its validity can be ensured. Nodes gather new blocks containing deferred transactions. Each block in a blockchain stores a block header hash of the block that came before it. Hash is a function that solves the encrypted demands of a blockchain calculation. The hash sequence links each block to its parent, which forms a chain beginning with the genesis block. Blocks are valid transactions that have been hashed and encoded using a Merkle tree. Consensus, blockchain is a decentralized public shared ledger collaboratively controlled by the network. A consensus process is used to update the blockchain to ensure that the sequence of transactions is clear and unique. The consensus process ensures the consistency and integrity of the blockchain across different domains. Smart contracts (SC) are executable codes used to execute and enforce the terms of an agreement between untrusted parties (M. Alharby and A. Van Moorsel, 2017). Without relying on trusted authority, smart contracts are automatically performed on the blockchain when all conditions in the set contract are met.

Blockchain system in Supply Chain Management

Since its conception, blockchain technology has been utilized in several domains, such as manufacturing traceability (Milani et al., 2016; Galvez et al., 2018), supply chain transparency (Yoo & Won, 2018), and distributed billing (Abeyratne, 2016), among others. The unique shared and distributed blockchain database records the transaction data of all participants, therefore enhancing information transparency, ensuring data security, preventing tampering, and enhancing the efficiency of information transfer (Mackey & Nayyar, 2017). The uncertainty associated with decision-making and collaboration amongst supply chain members may be decreased by establishing trust because the trusting partner trusts the other party's reliability (Morgan & Hunt, 1994). Blockchain technology application outside the financial sector has been primarily exploratory. SCM, energy, and food/agriculture are anticipated to offer some of the most potential non-financial uses of blockchain technology. When combined with IoT technology, a blockchain may accelerate and simplify the tracking of objects and transactions in the supply chain by an estimated 85 percent, eliminating administrative and logistics timeframes in the shipment (Laaper & Fitzgerald, 2017).

In blockchain-based supply chains, four primary entities perform roles, some of which are not evident in traditional ones. Registrars assign unique identities to network actors. Standards groups create plans for standards, such as fair trade for sustainable supply chains or blockchain policies and technology requirements. Certificates, which certify players for supply chain network involvement. To sustain the system's credibility, actors such as manufacturers, merchants, and customers must be approved by a recognized auditor or certifier (Steiner and Baker, 2015).

Information Sharing and Asymmetric Information

Information sharing is the capacity of suppliers and customers to concurrently share real-time data (Green et al., 2007). Slight modifications to a customer's order might result in an escalating increase in order variation as the order information travels upstream through the supply chain. It is known as the bullwhip effect (Jeong & Hong, 2019). When one side of a transaction has more information than the other, this is referred to as asymmetric information. A reaction produced by information asymmetry operated as an endogenous shock to supply networks, resulting in the observed bullwhip-effect demand dynamics (Udenio et al., 2015). Therefore, knowledge exchange between every party in the supply chain is the key to avoiding the bullwhip effect (Hussain et al., 2012). There are several issues in the supply chain, which are frequently attributable to the need for precise and exhaustive data (Seymour et al., 2008).

Asymmetric information refers to a circumstance in which one side of a transaction has superior knowledge; that is, one party has greater Information than the other. In a transaction, this form of asymmetry causes an imbalance. Two forms of asymmetric information exist, 1) Adverse selection: Refers to situations where buyers or sellers have access to information that the other group does not. In these instances, when these two groups are educated to varying degrees, asymmetric information is created. 2) Moral hazard: A scenario in which a party is more willing to take risks since they will not be responsible for any potential expenses. This asymmetric information problem occurs after the transaction. In general, supply chains employ two asymmetric information tactics. The first is screening, in which the less-informed party offers incentives for the more-informed side to share its knowledge. The second signifies that the knowledgeable party has conveyed its confidential information to the less-informed party in a credible manner by performing certain acts (Chen, 2003). Due to its distributed accounting structure, blockchain technology has garnered great attention and may assist in resolving information issues (Zhu & Kouhizadeh, 2019).

The foundations of the digital supply chain are information and data analysis. To construct a digital supply chain, businesses must have the appropriate information strategy. In addition to the continual increase of internal information, access to external and real-time information must also be possible. It can analyze structured and unstructured data and extract its business value. Information flow is predominated by a digital supply chain network system. Information is conveyed from bottom to top or top to bottom, and the content is complicated. To collect and maximize the use of real-time information from various sources, conduct demand awareness and management, enhance efficiency,

and reduce risk to fulfill consumer requests, information must be shared across nodes, both to receive and to offer. Blockchain technology enables dynamic, immediate information exchange and transmission and decentralized, dynamic oversight of corporate operations. This may integrate supply chain resources, increase decision precision, and eliminate the bullwhip effect of procurement and inventory in conventional management (Khan et al., 2016). Due to the blockchain's immutable information traceability and decentralized consensus authentication system, it can facilitate the development of a supply chain trust ecology, provide an information platform, and facilitate a credible group selection system for the supply chain's selection of business subjects (Yang et al., 2018).

There is an immediate need for data-sharing strategies that balance user Privacy, improved user experience, and commercial advantages (Tenopir et al., 2011). Diverse parties, such as application-providing businesses, social networking sites, and others, gather user data to enhance business models and deliver superior customer service. Various modern technologies have been employed as the backbone of recovery to gather and distribute user data, such as cloud processing services, RFID (Radio frequency identification), and several security technologies to secure obtained user data from hackers (Shrestha, 2014). A distributed digital ledger system (blockchain) holds authenticated encrypted and hashed data that is immutable, and any modifications or mistakes may be uploaded back to the source

RESEARCH METHODOLOGY

This research which mainly discussed the blockchain in supply chain management and its impact on the shipping process aims to determine what is required to make the shipping process more effective, efficient, and secure, as well as if blockchain technology may assist the shipping process. This research also analyzed what Vehgro has incorporated in the shipping process and how it may be improved. This study will collect data qualitatively to answer research questions and increase the researcher's grasp of the covered issues.

This research will use both primary and secondary data. The primary technique of data gathering will be through interviews. Secondary data will be collected from digital sources ad desk research such as journals, papers, the official company website, public literature, and prior studies on blockchain in supply chain management. This research will utilize a specific sampling technique, specifically purposive sampling. Purposive sampling is a sampling method in which the researcher determines which samples are most relevant, helpful, and relevant of a demographic (representative).

RESULTS AND DISCUSSION

Blockchain technology is presently being implemented in supply chain management to provide several substantial benefits. Blockchain provides a resilient layer of security for the data involved in supply chains due to its decentralized process, immutable data, and heightened transparency. We can confidently assert that no unauthorized manipulation has occurred, which is especially valuable when tracing the origins of products. However, the true potential of blockchain extends beyond data security. It enables the implementation of self-executing smart contracts, which simplifies and automates the construction of agreements between supply chain parties. These contracts are designed to execute automatically when certain conditions are satisfied.

In addition to impacting data security and contract execution, blockchain technology significantly affects communication and coordination among agricultural supply chain stakeholders. Individuals must be aligned for effective coordination, and one of the most effective methods to achieve alignment is by providing appropriate incentives. Here, blockchain technology genuinely excels. Large quantities of money are constantly transferred from one location to another along the supply chain. This transparency, made possible by blockchain, fosters enhanced coordination between parties. A transparent and trustworthy system, such as blockchain, is becoming increasingly important, especially in supply chains where participants reside in different jurisdictions

Blockchain technology essentially revolutionizes supply chain management by offering a decentralized approach, ensuring data immutability and nurturing transparency and trust. Blockchain

technology has emerged as a transformative force, presenting countless opportunities to revolutionize transportation and supply chain management.

Maintaining specific conditions to preserve the quality and freshness of perishable items during transportation is crucial. Consider where particular commodities must be transported at a precise temperature, such as -5 degrees Celsius. A sensor is ingeniously embedded within the cargo to meet these stringent requirements. This sensor faithfully collects temperature data at regular intervals, typically every 5 minutes, and seamlessly transmits it to a blockchain. When the shipment reaches its final destination, stakeholders can easily access the blockchain to confirm that the products were handled according to the specified conditions.

In addition to its impact on security and efficiency, blockchain technology has enormous potential to improve the traceability of shipments throughout the entire transportation process. Unlike traditional databases, the blockchain provides an immutable record of all transactions and events susceptible to illicit modification. Erroneous data cannot be removed from the blockchain, even in the face of human error or malicious intent. Instead, it is modified by adding new entries that remedy any errors. This inherent transparency and traceability empower stakeholders to quickly identify and correct errors, fostering accuracy and dependability throughout shipping.

Vehrgo, inspired by the owner's dedication to sustainability, has always had a strong desire to encourage sustainable practices. It all started with the choice to offer organic beans in order to contribute to a greener future. Vehrgo increased its product offerings to include at least 75 different organic items as the company evolved, catering to various clients. These goods cover many food industry areas and comprise varied quality organic beans, allowing alternatives to fit various tastes and preferences.

In order to address these issues, the owner began investigating the possibilities of blockchain technology four to five years ago. The goal was to develop a system to simplify data interchange and maintain transparency across the supply chain. Initially, the owner envisioned a private blockchain in which they would be the primary information holder. Other supply chain stakeholders would provide more data to the entire pool of knowledge. This strategy sought to deliver significant insights while facilitating improved communication and collaboration among the many stakeholders involved. However, as development advanced, the owner began investigating a hybrid blockchain approach to meet the complexity of international trading and disparities in credit systems between nations.

Vehrgo began to investigate the integration of cryptocurrencies into the blockchain system. However, the volatile nature of cryptocurrency values made determining which ones to utilize inside the supply chain complex. Regional preferences, preferred routes, and alignment with fiat currencies must be carefully considered to make informed judgments on the adoption of cryptocurrencies. Another finding from the study was the issue of power dynamics inside the supply chain. With various parties engaged, fairly managing and dispersing power became a significant challenge. Successful blockchain integration is critical to negotiation power, decision-making authority, and effective stakeholder engagement. Vehrgo actively handles these issues, attempting to preserve a harmonic balance of interests while minimizing opposition to change. The study outcomes demonstrate Vehrgo's dedication to sustainable practices and using blockchain technology to improve business operations. The company's evolution from supplying organic beans to various sustainable products reflects its commitment to environmental stewardship. Vehrgo hopes to establish a more efficient and transparent supply chain by integrating blockchain, which will benefit the firm and its consumers.

Adopting blockchain technology into Vehrgo's operations is a huge step forward for the organization. Vehrgo uses blockchain technology, putting it at the forefront of shipping sector innovation. Vehrgo can secure data security and accuracy by exploiting the blockchain's decentralized and irreversible characteristics. Vehrgo's usage of blockchain allows them to create a shared ledger where all essential documents and information are securely maintained, eliminating the need for physical document transfers and lowering shipping costs and administrative responsibilities. However, there are issues with information exchange among the numerous

stakeholders engaged in the supply chain. One of the significant challenges is a lack of continuous updates and precise information, which results in an asymmetry of knowledge among the stakeholders.

Applying blockchain technology in Vehrgo's operations presents a substantial difficulty in obtaining consensus among all parties involved. The hesitation to adopt this new technology originates from a fear of adaptation and a perceived danger linked with its deployment. Furthermore, certain players must be more apprehensive about losing their power dynamics within the supply chain. These obstacles must be overcome for blockchain to integrate successfully into Vehrgo's shipping process. The potential benefits of introducing blockchain into the transportation process are significant. Vehrgo may create a shared ledger where all essential documents and information are securely saved, assuring data security and accuracy by exploiting the blockchain's decentralized and irreversible nature. Furthermore, the adoption of blockchain gives prospects for considerable cost reductions. Implementing smart contracts and eliminating physical document mailings may drastically reduce administrative costs. However, the respondent emphasized the difficulty in gaining consensus among all stakeholders in using blockchain technology. Cooperation and cooperation from all stakeholders are critical for the effective adoption and use of blockchain in the shipping process. The potential benefits of blockchain deployment in Vehrgo's shipping operations include improved information sharing, security, and efficiency. Despite these potential benefits, the problem is convincing all parties to adopt blockchain deployment. Significant challenges are overcoming opposition to change and reaching a collective agreement among the people concerned. Examining blockchain applications in Vehrgo's shipping processes demonstrates its potential to improve information sharing, security, and efficiency. Overcoming obstacles linked to stakeholder consensus and reluctance to change is critical for effective blockchain deployment. By embracing blockchain technology, Vehrgo might improve the transparency and dependability of information in the supply chain.

CONCLUSION

Blockchain technology has the ability to transform supply chain management, particularly in agriculture. Companies like Vehrgo may enhance data security, traceability, administrative procedures, and stakeholder communication by incorporating blockchain into their supply chain. One of blockchain's primary advantages is its decentralized structure, which means that information is distributed among several computers rather than being held in a single spot. In the case of Vehrgo, blockchain may aid in ensuring that the information about their products is reliable, particularly when identifying where the items come from. The usage of smart contracts is another benefit of blockchain. These are self-executing contracts that take effect automatically if specific circumstances are satisfied. Smart contracts can streamline administrative operations in supply chain management by automating duties such as contract administration. Blockchain technology also improves stakeholder communication and cooperation. Participants can trace the movement of goods and verify essential features such as the transportation of products and payment transfers due to the transparency afforded by blockchain. Blockchain can address unique transportation and logistics difficulties, particularly in the shipment of perishable agricultural products. Companies like Vehrgo can monitor and record the status of things during their journey by storing all updated information from every party with blockchain. This assures compliance with particular regulations while improving logistics operations' security, efficacy, and traceability.

A hybrid blockchain approach to supply chain management might be examined. Hybrid blockchains combine aspects of public and private blockchains to achieve a balance of openness and control. Ultimately, Vehrgo's use of blockchain technology in its supply chain operations may increase information sharing, transparency, and efficiency. Overcoming stakeholder agreement and opposition to change problems is critical for effective implementation. Vehrgo can improve its agriculture shipping process's transparency, dependability, and sustainability by integrating blockchain technology and resolving problems. This, in turn, helps to create a more efficient and robust supply chain, which supports their commitment to a more sustainable future.

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