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EXPLORING BLOCKCHAIN'S POTENTIAL IN SUPPLY CHAIN MANAGEMENT: A LITERATURE REVIEW OF SAFETY AND TRANSPARENCY

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ABSTRACT

Goal - Research like this aims to look at the way "Blockchain Technology" may affect "Supply Chain" rules & practices in the future.

Strategies, procedures, and approach - Academic and practitioner publications were both systematically reviewed. For further information, the researcher also looked at other reports of blockchain implementations in different industries.

Findings - Although still in its early stages, blockchain technologies are starting to make a splash in "Supply Chain", with the importance of trust in their acceptance. Enhanced transparency & auditability, digitalization & disintermediation of the "Supply Chain, smart contracts" & increased data security are the four main areas where these technologies contribute to the value of "Supply Chain management". This research has uncovered a number of obstacles, knowledge gaps, and potential areas for future study. From a design standpoint, the researcher has also investigated the optimal configuration of a blockchain-enabled "Supply Chain".

Careful consideration was that this systematic review's search keywords focus at dissemination of "Blockchain Technology inside supply chains". The research limitations and implications are as follows, having said that, the researcher do concede that certain blockchain publications might not have made it into the evaluation due to their wording choices.

Implications for practice - This article sheds light on the ways in which "Blockchain Technology" might shake up the "Supply Chain" by revealing both the opportunities & threats to current practices, in addition to the challenges that impede its widespread use.

Possible social and economic effects of "Blockchain Technology" are discussed in this article.

What makes this study unique is that it looks at the present situation of blockchain dissemination in "Supply Chains", which is not done very often. This establishes a solid groundwork for further studies.

KEY WORDS: Potential, Chain Management, Safety, Transparency, Blockchain

Paper Type: Literature Review

INTRODUCTION

To create decentralised digital currencies (like Bitcoin), "self-executing smart contracts, and internet-controllable intelligent assets (like smart property), and the blockchain is a peer-to-peer distributed data architecture" that facilitates production for these digital assets. According to "Kosba et al. (2016) & Wright and De Filippi (2015)", it is widely acknowledged as being among the most innovative technologies. Ever since Nakamoto first introduced the concept of "Blockchain Technology" in 2008, the majority of the attention that has been paid to blockchain research has been directed towards distributed ledger systems and financial transactions (Pilkington, 2016). Without the requirement for a reliable third party, "Blockchain Technology" makes it possible to process and settle transactions without the need for a third party. It is possible to do this through the use of computer algorithms and a shared data infrastructure that is capable of updating itself in real time. This makes it possible for transactions to be finished in a matter of minutes. It is possible that the deployment of "Blockchain Technology" at financial industry might result in the elimination of middlemen like banks from the responsibility of monitoring financial transactions. On the other hand, the "Supply Chain" is only one of the many organisational domains that "Blockchain Technology" has the potential to disrupt. "Blockchain Technology" is providing safe and decentralised data exchange, which is revolutionising business operations, "Supply Chain Management", and transaction procedures. This is an example of how "Blockchain Technology" is revolutionising these areas. When combined with other technologies, including the "Internet of Things (IoT), Blockchain Technology" has the power to document and monitor each stage of a product's transit across the "Supply Chain" in an unchangeable, distributable, and actionable manner.

There is a possibility that this may result in significant economic benefits for the entire world. The utilisation of this technology's enhanced visibility may be able to enhance the legality, authenticity, and tracking back of products. Despite the fact that there has been a lot of conjecture about the effects that "Blockchain Technology" would have on "Supply Chains", our grasp of its full potential is still lacking. Given that the development of this technological innovation and its widespread adoption are still in the early stages, academics and managers can gain valuable insights by conducting a comprehensive examination of the current state of knowledge when they first become aware of this technological invention, recognise that it has the potential to cause significant disruption, and begin to investigate it further. You have the choice of either reading the most recent edition of this publication or conducting a search within the extensive archive that contains the whole text of this publication if you are interested in determining the effectiveness of this publication. The practical advantages, disruptive consequences, and dissemination techniques of "Blockchain Technology" are not yet fully understood; thus, a systematic review can give a firm basis by fostering a thorough knowledge of "Blockchain Technology" when it is still unclear. In order to dispel misunderstandings and unearth correct facts, a thorough investigation will be conducted to investigate the possible repercussions of "Blockchain Technology" on "Supply Chains", including both good and negative effects. In addition to this, it will highlight obstacles that now stand in the way of

widespread use of "Blockchain Technology" and will suggest areas that require more exploration. This literature review is being conducted with the intention of providing an answer to the following question:

Research Question: If implemented, how will "Blockchain Technology" change the way "Supply Chains" operate in the future?

In connection with this study topic, the researcher has also established the following research objectives (ROs):

- In order to find out what's pushing supply chains to use blockchain technology
- Finding out how supply chain management may benefit most from blockchain technology
- In order to learn more about the obstacles those have prevented blockchain technology from being more widely used in the supply chain,
- Create a foundation for a supply chain blockchain research agenda for the future.

A brief overview of "Blockchain Technology's" architecture is provided at the outset of this article, after which the approach employed in our analysis is detailed. Based on our database search, the researcher were able to determine that there are four main approaches to blockchain in the existing academic literature on "Supply Chain Management". In addition, the researcher summarise recent advances in the field. After that, the researcher will go over our study goals in light of the literature's findings. Finally, the researcher discusses some of the research's shortcomings and our addition to the existing literature.

TECHNOLOGY OF BLOCKCHAIN

The term "blockchain" is used to describe either a cryptoanalytic hash function-based data recording approach or a decentralised data infrastructure. To maintain the unchangeable nature of transactions, a consensus mechanism is employed to verify their validity. Nodes in the network store a duplicate of the blockchain and interact with each other via a shared protocol, ensuring that the chain remains unchangeable (Bashir, 2022). The blockchain serves as an extra application layer atop internet protocols to streamline financial transactions between relevant parties. Utilise this system as an inventory and registration tool to monitor and manage physical, virtual, or intangible assets, as well as conduct transactions involving these assets. There are critics of "Blockchain Technology" who view it primarily as a global system for documenting and managing various types of assets (Swan, 2015). A blockchain is a decentralised system of record-keeping that employs encryption and is stored on several computers within a network, regardless of whether it is a "public or private network". "Blockchains" are composed of data records or blocks. A block is generated for each transaction as it occurs. All the blocks are interconnected. The term "blockchain" is derived from the characteristic that all transactions are recorded in an immutable chain with each block linked to the one after it. Once these blocks are connected together in a chain, no one entity has the ability to modify or delete them. Data in a blockchain is decentralised. The entire data

infrastructure is visible to everyone. In the absence of an intermediary or a decentralised consensus mechanism, all parties have the ability to independently verify each other's transaction records. The data recorded on blockchain ledgers is very secure against unauthorised access or alteration due to the rigorous verification procedure and advanced encryption methods. Users have constant access to a comprehensive audit record of operations since the present blocks in the chain are immutable (Miles, 2022). A wider blockchain network enhances the resistance of a blockchain against tampering. Distributed data storage systems have a lower probability of experiencing a single point of access failure as compared to centralised databases.

The distinguishing factor between the two main types of blockchains is in the capacity to engage in reading, writing, and contributing to the blockchain, as well as participating in the consensus mechanism. Transactions conducted on public blockchains are openly accessible to the public ("permissionless"), allowing users to choose whether or not to preserve their anonymity. Usually, the network will implement an incentive mechanism to encourage others to join. Publicly accessible blockchains include Bitcoin and Ethereum. Participation in a permissioned blockchain necessitates a specific invitation or approval. Private Blockchains are exclusively controlled by a singular organisation, whereas consortium blockchains are collectively administered by a group of members. Industries such as "financial services, insurance, food, healthcare, and government" are already investigating and possibly using the increasing adaptability of "Blockchain Technology" beyond its traditional use in monetary transactions. Multiple compelling applications of "Blockchain Technology" have been identified in the "Supply Chain". A potential use for "Blockchain Technology" is to establish a complete and detailed record of the whole history of every component of an aircraft. All manufacturers have access to these details during the manufacturing process (Gupta, 2022).

A SYSTEMATIC STRATEGY TO REVIEWING THE LITERATURE

In order to make a significant addition to the growing body of knowledge at a range of sectors about the potential of "Blockchain Technology" to revolutionise "Supply Chains", it was necessary to carry out this comprehensive and thorough literature review. The authors Bryman (2012) and Tranfield et al. (2003) say that - well-established method is doing a comprehensive review of the scholarly literature technique which creates clear record of evidence, which makes it easier to verify and replicate the findings. Analysing research in sectors that attempt to uncover therapies with distinct advantages, such as "cause & effect analysis", may be accomplished through the use of systematic reviews, as "Saunders et al. (2012) & Tranfield et al. (2003)" have indicated. Approach evaluates each study by dissecting it into its component parts, which enables systematic assessments and synthesis of research that is pertinent to the topic at hand (Bryman, 2012). Therefore, it is possible to conceptualise the elements that are being studied ("Tranfield et al., 2003"). While "Denyer and Tranfield (2015) and Rousseau et al. (2008)" provide more material, the researcher adheres to the organised methodology that was established by Tranfield et al. (2003). It is important that you are aware that our complete literature review does not contain any books that have been published. This is due to the fact that a sizeable fraction of books do not obtain complete appraisals from their

academic peers. The researcher have referenced to a number of notable publications at subject, such as "Antonopoulos (2014), Mougayar (2016), Tapscott and Tapscott (2016), Bashir (2022), and Hofmann et al. (2022)", in order to get a more in-depth comprehension of the manner in which the blockchain is depicted in well-known literary works. The slow speed of academic research is a prevalent problem that affects a number of different areas of technological advancement. This slow pace can sometimes be a barrier to the deployment of new technology in practical applications. The comprehension of the literature would be severely hindered if one were to limit themselves to journal newspapers and articles. In light of this, it is of the utmost importance to conduct an analysis of the existing state of affairs in order to provide a firm foundation for comprehending the applications of "Blockchain Technology" in the real world. Research was conducted on a wide variety of sources in order to better understand the present trajectory of blockchain development and industrial use.

It is possible to acquire a comprehensive overview of the current status of blockchain development projects all over the world and in Europe by consulting commercial and publicly accessible databases. Some examples of such databases include Lloyd's List insights, which focuses on maritime intelligence; reports from the foresight program of the "European Commission; and publications from the Organisation for Economic Cooperation and Development (OECD)". In light of the fact that blockchains play key roles in the process of discussing and implementing new technical advancements, several industry forums and trade associations conducted study on the technology. The "Chartered Institute of Information Technology, the Chartered Institute of Logistics and Transport, the Global Shippers' Forum, and the EU Blockchain Observatory and Forum" are some of the organisations that have been specifically cited. The publications of top "information technology service providers & consulting organisations such as IBM, Gartner, and McKinsey" were the source of the most recent findings regarding developments in "Blockchain Technology". Several well-known systems, including "Hyperledger, R3 Corda, MultiChain, and Ethereum", were consulted in order to compile the most recent knowledge on "Blockchain Technology". Attending industrial workshops, in which key participants in the blockchain business provided updates on their ongoing activities, was a helpful way to gain a better grasp of the topic. The collection of potential blockchain initiatives that are relevant to the "Supply Chain" was included in Section 5. These initiatives were developed from the several acts that the researcher investigated. Because of the data that the researcher gathered by employing this method, the researcher was able to get a more in-depth grasp of the academic literature and undertake an assessment of it. To be more specific, the researcher highlighted topics that have positive potential for further research in the future years.

Assessment of the pilot Study

Through by the utilisation of a first comprehensive literature evaluation, the scope of final literature research was determined. Our investigation covers the years 2008 through 2022, which coincides with the year when the word "blockchain" was first used for the first time (Nakamoto, 2008). A great number of studies have been published over this time period that investigates the fundamental characteristics of blockchains. As an illustration, "ABI Inform

Global" alone is responsible for producing an astounding 5,667 articles on the given topic. According to "Saunders et al. (2012) & Tranfield et al. (2003)", the criteria towards inclusion in this study were restricted to scholarly works that had been subjected to a rigorous peer review procedure. This was done to ensure that the included articles met high academic standards. Taking this method resulted in a considerable amount of items for study while simultaneously enhancing the reliability of the articles that were selected. The names "digital ledger, distributed ledger, and shared ledger" have frequently been used interchangeably with blockchain. Blockchain is now the most widely used term. For the purpose of obtaining comprehensiveness, the word "blockchain, along with synonyms such as digital ledger, distributed ledger, and shared ledger", was utilised in order to collect articles that were associated with "Blockchain Technology". It is vital to review research that has been undertaken in well-established sectors such as "engineering, innovation, information technology, and finance" in order to get a more in-depth understanding of "Blockchain Technology" in the context of "Supply Chain Management". This has occurred because "Blockchain Technology" is still considered to be a relatively new concept in the field of "Supply Chain Management". Through the use of this strategy, the researcher was able to get further comprehension about influence that "Blockchain Technology" has on the "Supply Chain industry". When it comes to abstracting from theory and making use of abductive reasoning, Holmstrom et al. (2015) highlight the importance of having the ability to move fluidly across many disciplines of study. The use of established results from other fields serves as the primary foundation for exploratory design science "research in the field of Supply Chain Management". Because of how quickly things are changing of "Blockchain Technology", the most of the researches appeared until the middle of the year 2022. Before publishing this article, the researcher carried out an extra search that lasted from December 2022 to January 2022 in order to guarantee that all relevant publications were integrated into our evaluation. In the end, in order to carry out an investigation that was more exhaustive, the researcher investigated the relevant literature that was mentioned in these works. During the course of our search, the researcher came across this item; however, our keyword search system did not record or recognise it.

Initial article selection

"ABI Inform Global, Emerald, IEEE Explore, Jstor, Science Direct, Scopus, Springer, Taylor & Francis, and Web of Science" were databases which were investigated for the purpose of retrieving articles. Some of the academic fields that are covered by these databases are rather extensive. Only papers that used the phrases "logistics, Supply Chain, demand chain & value chain" were chosen for the study. This was done so that the scope of the investigation could be limited to supply networks. Following the completion of this first evaluation, the researcher discovered a remarkable total of 227 publications.

Search for related materials and screening of contents

"Supply Chain Management" refers to a comprehensive field that includes logistics, warehousing, commodities operations, international trade, humanitarian logistics, and

integrated logistics. Articles were assessed for inclusion based on their titles, keywords, and abstracts. When deemed essential, the researcher additionally scrutinised the crucial texts of the publications. Further investigation was carried out on papers that presented specific instances of how the blockchain may be employed to bolster "Supply Chain" principles or practices (Bryman, 2012). The selection of articles also included the clear focus on the objectives of using "Blockchain Technology". This was done to identify activities or processes in the "Supply Chain" that are supported by blockchain. Publications that discussed "Bitcoins & blockchain technology" but did not focus on "Supply Chain Management" were excluded from consideration. Among the total of 227 articles, only 24 were retained by this approach. Our inaugural literature evaluation was carried out between June 2022 and December 2022. An additional five articles were discovered during a further search conducted from December 2021 to January 2022 using the same methodology.

PRESENT STATE OF BLOCKCHAIN RESEARCH & CURRENT VIEWPOINTS

Latest innovations in the academic field

The promise of "Blockchain Technology" has begun to be recognised by research on "Supply Chains", despite the fact that this technology has only just begun its journey of development. The literature described the anticipated value of the topic, offered advice for how it should be carried out, and listed several methods that may be utilised to accomplish the desired value. The majority of these studies, on the other hand, are still in the preliminary stages of comprehension and inquiry. The majority of blockchain installations are still now in the beginning stages, and there is little evidence to suggest that widespread acceptance is occurring throughout the "Supply Chain". As a consequence of this, there is a dearth of information about the degree to which traditional "Supply Chains" have been modified or improved by the implementation of "Blockchain Technology". There are four basic approaches to use "Blockchain Technology" that the researcher has discovered within the existing corpus of research on "Supply Chain Management". There is just a miniscule amount of this information that is devoted to blockchain pilot projects that have employed technology in the agricultural and pharmaceutical industries. A number of papers have conducted in-depth research on the possibilities as well as the predicted effects that "Blockchain Technology" will have on "Supply Chains". Furthermore, a number of studies have been published that identify certain shortcomings in modern "Supply Chains" and suggest the use of "Blockchain Technology" as a potential remedy to these shortcomings. The study was divided into four main sorts utilising our categorisation system: "descriptive, conceptual, predictive, and prescriptive".

Descriptive 10% - 3 Articles - To what extent has the "Supply Chain" made use of "Blockchain Technology"? This is the issue that descriptive articles seek to address. Blockchain has shown promise in pilot projects involving the pharmaceutical and Agri-food sectors for use in product traceability and provenance.

Conceptual 14% - 4 Articles - Many works in this field attempt to address the following question: "What is the impact of Blockchain Technology on the Supply Chain"? Conceptual

papers describe "Blockchain Technology", analyse its disruptive features, and explain its fundamental principles in order to help readers better grasp the technology and its probable applications at "Supply Chain Management". Additionally, they discuss the possibility that "Blockchain Technology" may introduce a fresh approach to "Supply Chain Management".

Predictive 38% - 11 Articles - A common theme in this body of work is the following: "Where will the blockchain penetrate Supply Chains"? It achieves this by thinking about where the blockchain may be useful in the "Supply Chain". Product tracing, automated processes, financial settlement, contract administration, and cross-border digital integration of several stakeholders are some of the potential use cases.

Prescriptive 38% - 11 Articles - The focus of this effort is to explore the optimal approach for integrating "Blockchain Technology" into supply networks. The primary objective of most prescriptive papers is to identify prevailing challenges in "Supply Chain" operations and subsequently provide realistic, business-focused solutions. Their primary emphasis is on the impact of information asymmetries in "Supply Chain" operations, which result in a deficiency of trust in the genuineness of items and information. A multitude of data architectures or conceptual frameworks offer potential solutions to these discrepancies. Findings from pilot tests of systems are documented in a limited number of papers; these investigations provide light on the feasibility and financial consequences of utilizing "Blockchain Technology". Prescriptive knowledge is usually focused on finding solutions and is motivated by real-world challenges in a certain sector. It involves describing and analysing different approaches to address specific difficulties connected to "Blockchain Technology".

Nevertheless, every avenue of investigation contributes to our comprehension of blockchain as a technological innovation. Adopting a design-oriented strategy improves the real-world relevance of scholarly investigations. From a practical standpoint, the use of "thoroughly tested, comprehensively understood, and extensively documented general solutions" can provide the basis for developing a "particular variation tailored to a specific situation" ("Van Aken, 2005, p. 23"). Conversely the researcher has not reached at stage where the researcher can develop comprehensive "Blockchain solutions". Currently, roughly all ongoing ingenuities are still in the experimental phase, which the researcher will discuss in more detail later.

Latest innovations in the field

In 2022, "Blockchain Technology" served as the foundation for several proof-of-concept (POC) and piloting activities. IBM is partnering with several organisations on blockchain initiatives, with the number reaching into the hundreds (IBM, 2022). "Everledger & Filament" are two instances of application-specific implementations. "Everledger specialises on tracking diamonds, while Filament focuses on connecting Internet of Things devices". The scarcity of empirical, comprehensive implementations of "Blockchain Technology" in "Supply Chains" hinders the ability to assess its true impact. Due to the high level of uncertainty around blockchain development, it is presently hard to identify particular use cases where "Blockchain Technology" might be advantageous compared to others where adoption is highly unlikely.

However, the researcher may gain valuable insights into the latest developments by examining the emerging patterns in the "Supply Chain" industry. This is further supported by our analysis of the scientific literature. Although the material's essential principles align primarily with the academic literature, there is a broader range of practical applications available. While blockchain projects focussing on social impact and trade finance are being actively explored in practice, they have received comparatively little attention in academic research. In this part, the researcher examines the occurrences and emphasise certain similarities. In the next part, the researcher explores the potential applications and experimental initiatives that might make "Blockchain Technology" well-suited for managing "Supply Chains". In the next part, the researcher will emphasise many lesser-known yet promising applications of "Blockchain Technology".

An interesting finding about the practical implementation of blockchain projects is that the majority of them utilise permissioned blockchain technologies. Unsurprisingly, because to the sensitive nature of "Supply Chain" data, this is the situation, it is unwise to disclose classified data to unknown entities at any point in the "Supply Chain", encompassing aspects such as demand, capabilities, orders, and price. Permissioned blockchains play a vital role in decision-making and excel at maintaining control over the consistency and quality of the data added to the blockchain. Centralised control is a common feature with many pilots. The consortium formed by the financing members often influences the social structure and decision-making process of a network. An orchestrator, typically a member of the finance group, serves as an intermediary for all the parties participating in a "Supply Chain" based on "Blockchain Technology", ensuring that everyone is working towards the same goal. This orchestrator facilitates the development, appropriation, and distribution of value across network participants, with a focus on future outcomes. Certain consortia have objectives that extend beyond the mere improvement of society and the economy. In August 2022, the Blockchain in Trucking Alliance was formed with the purpose of educating the freight industry and establishing standards for "Blockchain Technology". The blockchain is designed to enable direct transactions among all participants in the "Supply Chain", hence removing the necessity for intermediaries. Therefore, it is most effective when there is a problem that impacts many parties and resolving it will be advantageous for all parties concerned. Due to this shared objective, members are more inclined to actively participate and collaborate. Furthermore, competing enterprises have the ability to connect to the same network by leveraging "Blockchain Technology". Take into account IBM Food Trust, which has several retailers as its members. Hyperledger Fabric and Ethereum are the top two blockchain systems used for "Supply Chain" projects. The former refers to a versatile and accessible platform capable of executing smart contracts and facilitating financial transactions. However, it has just started offering private blockchain solutions. The second platform is a self-contained and adaptable initiative led by the Linux Foundation. It enjoys the backing of important IT firms including as IBM, Cisco, and SAP, and aims to facilitate the widespread use of "Blockchain Technology" in many industries. The consensus processes of the two systems are distinct from one other. Ethereum's "proof of work" architecture, which relies on mining, necessitates a consensus on the chronological order of transactions in order to validate them. The inherent currency, known as "ether," is utilised for the purpose of remunerating miners and covering transaction costs.

Nevertheless, when utilising Hyperledger, it is just necessary for the parties participating in a transaction to reach a consensus, and the management of access is more detailed and precise.

DISCUSSION & FINDINGS

RO1: In order to find out what's pushing "Supply Chains" to use "Blockchain Technology" - Out of the 29 papers related to "Supply Chain Management", 26 (or 90%) specifically emphasise the significance of trust as a key factor driving interest in "Blockchain Technology". Trust entails placing confidence in the reliability of data maintained by a central authority or in the precision of information provided by business associates. When discussing events and transactions, trust is commonly described as the characteristic that faithfully represents all dimensions of truth. This truth has been characterised as a "shared source of truth" (Michelman, 2022, p. 18), "one data" (Nakasumi, 2022, p. 144), or "one trusted source of data" (Hull et al., 2022, p. 2). Collomb and Sok (2016) and Patel et al. (2022) have addressed the issue of trust that arises from data security. Geographically dispersed facilities and trade partners can occasionally lead to disconnections and complexity among "Supply Chain" stakeholders, as suggested by certain experts. Therefore, it is crucial to get and maintain precise data. The blockchain in this context serves the objective of providing decentralised, transparent, and symmetrical information to all parties involved, while also enabling smooth networks (Bonino and Vergori, 2022; Wang et al., 2022; Xu et al., 2022). Dependable and easy communication is also required by business ethics and social responsibility. Concerns regarding the legitimacy and authenticity of products have risen among customers due to heightened anxieties about food safety, exemplified by incidents such as the horsemeat scandal in the UK and toxic milk powder in China (Tian, 2016, 2022). Additionally, sustainability issues such as child labour, fair trade, and organic products have also contributed to this increased attention from customers (Abeyratne and Monfared, 2016). They are growing increasingly curious about the source, duration of processing, and whereabouts of objects. Blockchain adoption is also driven by the need to enhance public safety and security. Engelenburg et al. (2022) proposed the implementation of customs systems utilising "Blockchain Technology" as a means to prevent antisocial activities, such as terrorist attacks on ships and maritime goods. Mackey and Nayyar (2022) argue that "Blockchain Technology" should be employed to address the issue of the grey market, which involves the sale of counterfeit products. Fraud and corruption pose significant challenges in several emerging countries. To tackle these legal difficulties, Guo and Liang (2016) and Kshetri (2022b) contend that "Blockchain Technology" is indispensable due to its inherent transparency.

RO2: Finding out how "Supply Chain Management" may benefit most from "Blockchain Technology" - The primary advantage that "Supply Chains" may expect from "Blockchain Technology" is the enhanced transparency and product tracing it offers. Consequently, the broad adoption of "Blockchain Technology" is expected to be prevalent in the tracking and tracing of products. Centralised IT platforms and systems often gather and validate all data points along a "Supply Chain" in an inefficient manner. Participating companies are provided with transparency through blockchain-enabled transactions, which are a series of transactions required to convey a product. Patel et al. (2022) suggest that a block might be created for each

stage of a product's digital trail, encompassing manufacture, delivery, and ultimate sale. Casey and Wong (2022), Lu and Xu (2022), and Mansfield (2022) argue that a high level of transparency and exposure is essential for ensuring the traceability, validity, and authenticity of items. By integrating field sensor agents with the blockchain, it becomes possible to track in real-time (Li et al., 2022). In addition, time-stamping enhances the comprehensiveness of the data. Beyratne and Monfared (2016) define time-stamping as the process of providing a chronological order to sets of events. Engelenburg et al. (2022) state that each node in the chain, which is a block header, contains a field that records the timing of the event, consequently, it can offer proof of the existence of certain data at a precise point in time. Time-stamping assists in the management of time-sensitive situations by recording the chronological order of events (Yuan and Wang, 2016; Lee and Pilkington, 2022). Furthermore, the capacity of a blockchain system to manage a wide range of data enhances the comprehensiveness of information; Beyratne and Monfared (2016) state that blockchain data can include details regarding ownership (a sequential record of owners), location (past and current whereabouts of the material), product characteristics and performance, and environmental consequences (energy usage, CO_2 emissions, etc.). Lee and Pilkington (2022) state that data can also encompass information such as product status, date, quality, and pricing. The system is integrated into a blockchain "Supply Chain" to ensure full auditability. Industries with a strong concern for the origin of their products and resources might gain advantages from the enhanced traceability offered by "Blockchain Technology". "Blockchain Technology" has been suggested as a potential tool for monitoring the origin and production of food ingredients (Foerst et al., 2022; Tian, 2016) and luxury clothes (Toyoda et al., 2022). Some individuals are exploring the use of "Blockchain Technology" as a means to regulate counterfeit pharmaceuticals. According to Mackey and Nayyar (2022), "Blockchain Technology" enables the tracking of medical components and finished goods, facilitating the identification of counterfeits. Users of this system may verify the authenticity of data. Due to this rationale, the pharmaceutical "Supply Chain" may find "Blockchain Technology" beneficial as a universally accepted method for merging datasets and involving various participants. The food, diamond, and pharmaceutical sectors are highly engaged in blockchain initiatives because to the criticality of their supply networks. Reliable product origin and tracking are urgently required in these supply networks. Understanding the origin and journey of things in the "Supply Chain" has significant safety concerns and economic advantages. This knowledge enhances customer confidence in the brand. Previously, typical monitoring methods required around seven days. However, a recent research conducted by Wal-Mart shown that by utilising blockchain-enabled tracking, sliced mangoes could be returned from US stores to their Mexican fields in a little 2.2 seconds (McKenzie, 2022). This blockchain-based monitoring system enables retailers and producers to promptly respond to recalls and other food safety concerns, therefore mitigating the transmission of food borne diseases.

RO3: In order to learn more about the obstacles those have prevented "Blockchain Technology" from being more widely used in the "Supply Chain" - Despite the consensus in the literature that "Blockchain Technology" will disrupt and enhance "Supply Chain" operations, there are other challenges that need to be addressed. Those who may oppose change are often individuals who would experience financial losses as a consequence of the change

(Michelman, 2022). According to Zhao et al. (2016), banks may be reluctant to assist commercial transactions that are made possible by "Blockchain Technology". Additional intermediaries may also exhibit resistance towards its implementation due to apprehensions about being excluded from "Supply Chains". Certain parties throughout the "Supply Chain" may exhibit hesitancy in adopting the inherent unchangeability that "Blockchain Technology" provides. A recognised cause of inefficient "Supply Chain" performance is the absence of willingness to exchange useful information (Fawcett et al., 2007; Kembro et al., 2014). Many individuals struggle to comprehend, embrace, and have faith in the participation of blockchain due to its intricate technological nature. Blockchains are sometimes regarded with distrust by certain individuals due to the criminal use of Bitcoin (Hoy, 2022; Kshetri, 2022b). Every transaction is publicly viewable on the blockchain, but it does not have a direct link to any specific individuals or organisations due to the pseudonymity it offers. However, the ability to remain anonymous may be at risk, since it is possible to establish connections between certain transactions and individuals involved. Suppliers located further up in the "Supply Chain" may not be affected by this. For instance, this transparency facilitates marketing and branding efforts for specific food manufacturers. However, clients who are farther down the "Supply Chain" face the potential danger of their privacy being violated and their private, intricate information being revealed (Boucher et al., 2022). Blockchains pose environmental concerns due to their substantial energy usage (Hoy, 2022; Kshetri, 2022b). Despite the Blockchain's image as a highly secure and decentralised data platform, it remains possible to successfully hack into it. Yuan and Wang (2016) and Zhao et al. (2016) both define this phenomenon as the temporary dominance of a small group of miners who control over 50% of the mining hash-rate in a network. Permissioned blockchains may be more susceptible to cyber-attacks compared to public (permissionless) blockchains, as breaching the latter requires significant computational and financial resources (Patel et al., 2022). Each time a block of transactions is confirmed and added to the ledger, there is a delay, resulting in latency (Wang et al., 2022). Ream et al. (2016) reported that this occurrence takes place "roughly every 17 seconds" on Ethereum, a well-known blockchain for smart contracts. The speed of this is considerably lower compared to the milliseconds utilised by databases that do not employ "Blockchain Technology". In order to enhance the functioning of the system, miners require efficient incentive mechanisms (Nakasumi, 2022). Weber et al. (2016) found that private customisable blockchains are the most efficient in high-speed scenarios. Although the blockchain provides protection against manipulation by individuals with vested interests, it can also give rise to potential problems. Mistakes are irreversible (Patel et al., 2022). The books might be rectified by transactions that are similar in magnitude but opposite in kind. In order to ensure smooth data transfer, it is essential to address the compatibility and integration of blockchain with existing IT systems (Collomb and Sok, 2016; Korpela et al., 2022; Patel et al., 2022; Wang et al., 2022). In order for the blockchain to operate effectively, it is necessary for all pertinent entities along the "Supply Chain" to be in agreement and actively involved (Kshetri, 2022). Blockchain-enabled global "Supply Chains" need players to adhere to a variety of laws, regulations, and institutions. Implementing a blockchain in this particular scenario is a highly challenging task (Casey and Wong, 2022). Although "Blockchain Technology" effectively ensures the immutability of digital transactions, it has not yet been able to accurately reproduce the physical movement of commodities across the "Supply Chain" (Shireesh and Petrovsky, 2016). Nevertheless, there is

a potential for occurrences such as corruption, hostile assaults, conflicts of interest, and unintended mistakes to take place (Boucher et al., 2022; Kshetri, 2022). Chen et al. (2022) highlighted enquiries regarding the suitable data to be stored in blockchains, the most effective method of collecting and inputting this data into the system, and the responsibility of those participating in data input and supply. The level of technical and specialised expertise required to engage in a blockchain system might be a possible worry in terms of the cost of adopting or participating in the system (Patel et al., 2022; Wang et al., 2022). Small and medium-sized "Supply Chain" enterprises may encounter more challenges in participating due to limited resources and a lack of specialised knowledge. Blockchains represent a significant divergence from traditional "Supply Chain Management" approaches by decentralising trust and authority. Many individuals participating in the "Supply Chain" may have apprehension around the loss of authority. However, cultural opposition and established business practices will significantly impede transformation (Patel et al., 2022; Wang et al., 2022).

RO4: Create a foundation for a "Supply Chain" blockchain research agenda for the future - The majority of the research the researcher examined had a limited focus in terms of its theoretical and methodological viewpoints. None of the studies in this evaluation utilised a theoretical framework. Alarmingly, the majority of the pieces were of a technical or intellectual nature. The study of technological advancements and their integration into supply networks mainly rely on theoretical frameworks. There is an urgent need for investigations into blockchains from many academic disciplines. Thoroughly developed theoretical and practical knowledge will enhance our understanding of this emerging technological phenomenon and its impact on "Supply Chains", enterprises, and society as a whole. Due to its early stage of development, "Blockchain Technology" offers several intriguing opportunities for additional research. There is an urgent need for research on the possible impacts of Bitcoin on "Supply Chain" financing. "Supply Chain" finance refers to a diverse set of financial instruments that enable the flow of monies across different points and physical locations (Pfohl and Gomm, 2015). "Supply Chain" players can initiate trading and settle payments using Bitcoin, which is the most well-established implementation of blockchains. Bitcoin has the potential to serve as a platform for trading data produced by Internet of Things devices. The widespread use of Internet of Things (IoT) devices throughout "Supply Chains" generates vast quantities of data that have the potential to provide valuable business intelligence. Big data has become a separate and very valuable asset class in the field of "Supply Chain Management". To learn about how organisations may effectively employ distributed ledger technology, such as alternatives to blockchain, to securely store, trade, and retrieve data streams generated by the "Internet of Things (IoT), visit IOTA.org". Bowman (2022) states that this coin will serve as payment for several network nodes that retain duplicates of "Supply Chain" transaction data. This might expedite cash-flow transfers and address the issue of exorbitant blockchain transaction fees. Smart contract-enabled transactions have the potential to facilitate immediate payment from buyers to sellers. This decreases the duration required to receive cash payment, but, it does not solve the issue of suppliers or purchasers requiring upfront capital to sustain production or service operations. A pilot program has been conducted to evaluate financial service solutions that are based on the blockchain with the aim of addressing this issue. Chained Finance, collaboration between Foxconn's financial services division & Dianrong, a Chinese e-

commerce site, positions itself as the leading blockchain platform for "Supply Chain" finance. The two businesses recently obtained funding for small and medium enterprises (SMEs) in China who were previously unable to obtain the requisite funds. This funding was gained as part of a successful pilot and proof of concept. Chained Finance facilitated loans amounting to $6.5 million (equivalent to RMB45 million) for the SME "Supply Chain" operators throughout the pilot program (Sawers, 2022). In April 2022, IBM and the Chinese company Sichuan Hejia Co., Ltd. announced the development of a financial services platform for pharmaceutical procurement, which is based on "Blockchain Technology" (IBM, 2022b). The platform seeks to improve the effectiveness, clarity, and functioning of "Supply Chain" finance. This platform is particularly advantageous for small and medium-sized firms (SMEs) because to their increased likelihood of securing the necessary capital, despite their less established and solid credit systems. The platform aims to streamline the process for banks to authenticate the validity of "Supply Chain" transactions, hence facilitating access to finance for small and medium-sized pharmacy stores. The Blockchain's ability to provide decentralised and irreversible ownership tracking features may enable the development of innovative peer-to-peer lending and crowdfunding services (Collomb and Sok, 2016). "Blockchain Technology" can give rise to comparable circumstances in monetary transactions. Caniatto et al. (2016) and Carter et al. (2015) have noted a lack of study on "Supply Chain" financing. There is a scarcity of research that integrates "Blockchain Technology" with "Supply Chain" financing. Hence, there exists ample potential for expansion in the realm of blockchain research as it permeates the "Supply Chain". Examining this emerging phenomenon would shed information on how blockchain enables financial collaboration across different "Supply Chains", beyond the scope of bilateral financial settlements. Primarily, it will enable us to evaluate the financial value of the blockchain and determine its influence on the company's profitability.

CONCLUSION

This study examined the potential impact of "Blockchain Technology" on rules and processes in future "Supply Chain" operations. Based on a thorough examination of academic and practitioner literature, the researcher has identified the main factors that drive the adoption of "Blockchain Technology" in "Supply Chains". Additionally, the researcher has determined the specific areas within "Supply Chain Management" where this emerging technology may provide the greatest value. The researcher have collaborated with many ongoing blockchain initiatives to demonstrate the practical applications of this technology and to emphasise certain technological, organisational, and operational challenges that are likely to impede its wider acceptance. The "Supply Chain" literature has shown significant interest in "Blockchain Technology" due to its capacity to provide decentralised transaction processing and verification. The potential of this feature to address issues related to interorganisational trust and facilitate the adoption of digitalisation and disintermediation in the "Supply Chain" is very captivating. Although "Blockchain Technology" does provide solutions to certain issues, it also presents additional challenges when used to the construction of distributed ledgers and smart contracts. Through our literature assessment, the researcher has found several issues regarding the potential socio-economic impacts of blockchains. Additionally, the researcher has suggested several intriguing avenues for future research in this area. To the best of our

knowledge, this research is the first attempt to examine the implementation of "Blockchain Technology" in "Supply Chains". Given the uncertainties surrounding the benefits, drawbacks, and distribution process of this technology, our work is timely in establishing the foundation for evaluating it. Our efforts have facilitated the integration of many fragmented blockchain-related research, enabling a clearer understanding of their relevance to the domain of "Supply Chain Management". This research provides insights on the present and forthcoming advancements in the "Blockchain Technology" ecosystem, which will be valuable for scholars. This paper offers a comprehensive analysis of "Blockchain Technology" and a methodical investigation of blockchain research relevant to "Supply Chain Management". It is specifically tailored for novice academics in the field. Management may utilise the findings of this study to get a deeper understanding of the potential advantages and challenges that "Blockchain Technology" presents to "Supply Chains". Additionally, they can develop and implement strategies to effectively address and minimise these challenges. This study not only outlines several domains where "Blockchain Technology" may disrupt the "Supply Chain", but it also highlights some of the challenges that may come from its implementation. Hence, managers ought to utilise our study as a point of reference when making decisions on the development and implementation of "Supply Chain" initiatives that utilise "Blockchain Technology". This study offers valuable insights for both researchers and practitioners. It provides design-focused guidance on identifying a use case that effectively addresses "Supply Chain" issues, implementing an optimal blockchain "Supply Chain" model, and ensuring the model's sustainability by carefully considering governance and legal factors. Our findings should act as a cautionary message to managers, especially the network orchestrator, on the significance of fostering network connections among members and establishing mutual advantages for all parties involved. Finally, the researcher acknowledge that certain blockchain articles may have been excluded from this review because of the precise phrasing of the search terms used in our analysis. The future research potential of blockchain development is primarily considered in a conceptual manner due to its present early stage of development. It is important for future research to closely observe the progress of "Blockchain Technology" and gather additional empirical evidence to support the many research opportunities the researcher have discussed. Although conceptualisation is a crucial step, it alone is insufficient for comprehending significant blockchain findings. After the "Blockchain Technology" has reached a state of full development as a "Supply Chain" technology, it would be beneficial to reconsider this topic and conduct another round of research.

FUTURE RESEARCH DIRECTION

Exploration of blockchain technology in supply chain management is a developing topic that offers several intriguing prospects, particularly in terms of security and transparency. Potential avenues for further research in this field include:

- Inheritance or historical significance: Analyse the suitability of Blockchain's possible integration with existing supply chain management systems by evaluating interoperability, data transfer, and doing a cost-benefit analysis.

- Examine the possible collaboration between blockchain technology and Internet of Things (IoT) devices to enhance supply chain security, ensure precise data, and enable real-time tracking.
- Adherence to Regulations: Examine the feasibility of utilising smart contracts for the automated implementation of supply chain rules, specifically focussing on quality control and safety measures.
- Analyse the capability of blockchain-enabled smart contracts to automate real-time auditing and compliance checks, hence enhancing transparency in audits and reducing reliance on human intervention.
- Research methods for securely managing confidential information on blockchain, while striking a balance between transparency and the need for secrecy in supply chain activities.
- Analyse potential Cybersecurity vulnerabilities in supply chains that depend on blockchain technology and develop strategies to mitigate their effects.
- Examine the capacity of blockchain technology to scrutinise and document ethical sourcing protocols, including those related to equitable labour practices and environmental sustainability, in order to furnish purchasers with enhanced knowledge.
- Examine how blockchain technology might contribute to the development of eco-friendly supply chains by enhancing the transparency of data related to carbon footprints, waste management, and resource utilisation.
- Examine possible remedies for the scalability challenges that arise in blockchain networks when used to intricate supply chains involving a large number of participants.
- Optimal Energy Utilisation: Investigate suitable substitutes for blockchain technology or more energy-efficient consensus mechanisms for supply chain blockchain systems.
- Discover how blockchain technology may enhance transparency in the supply chain by enabling decentralised real-time data exchange among all stakeholders, hence overcoming information barriers.
- Examine the implementation of decentralised, collaborative supply chain networks as a method for stakeholders to share information and collaborate on projects related to transparency and safety.
- Supply chain trust: Examine the impact of Blockchain's openness on customer confidence in supply chains, particularly in industries such as electronics, food, and pharmaceuticals where safety is of utmost importance.
- Behavioural Modifications: Examine the impact of blockchain deployment on the behaviour of supply chain participants; including manufacturers, suppliers, and retailers, with a particular focus on their adherence to safety requirements.
- Cost-Benefit Analysis: Analyse the prospective benefits and drawbacks of employing blockchain technology in supply chains, including the possible impact on security and transparency in both the short and long term.
- Operational challenges in using blockchain in supply chains include issues related to training, change management, and stakeholder acceptance.
- Explore the capacity of blockchain technology to enhance the global supply chain's compliance with safety and transparency regulations.

- Trade Facilitation: Examine the potential of blockchain technology to enhance transparency and streamline international trade processes by reducing bureaucratic obstacles and ensuring the security of transactions.
- Legal frameworks refer to the system of laws and regulations that govern a certain jurisdiction or industry. Conduct an investigation on the possible ramifications of employing blockchain technology in supply chains from a legal perspective, specifically with issues of liability, copyright, and contract enforcement.
- Ethics: Examine the ethical dilemmas posed by the transparency of blockchain technology, such as the potential for data exploitation, infringement of privacy, and the impact on disadvantaged communities and small-scale vendors.

There is significant potential for expansion in these domains for research endeavours that employ blockchain technology to enhance transparency and safety in supply chain management.

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