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A Study on Challenges for the Adoption of Blockchain Technologies in Food Supply Chain- A DEMATEL Approach

Gouri Saha [a], Aditya Rana [b], Sarvesh Mishra [c], Mr. Imran [d]

[a,b,c] Student, Department of Management, Lovely professional University, Phagwara, Punjab
[d] Professor, Department of Management, Lovely professional University, Phagwara, Punjab

ABSTRACT

Blockchain technology has become more and more popular in recent years and has attracted a great deal of interest. Blockchain technology may be able to help with problems in the food supply chain management that exist outside of the financial sector. To facilitate the transfer of digital assets between enterprises in a supply chain, the technology behind cryptocurrencies creates a distributed, immutable, and transparent ledger of these assets. Of course, not every business is cut out for integrating blockchain technology into their current supply networks. The primary cause is people not being aware of the advantages of this technology. Although the use of blockchain technology in food supply chains is still in its infancy, it is already clear how useful a thematic framework that allows for the methodical examination of such topics as adoption, advantages, and problems would be. To better manage quality across the supply chain, we recommend a DEMATEL integration strategy that establishes hierarchical and methodical links between quality enablers. Over the last several years, blockchain technology has gained a lot of traction and attention. Blockchain technology may be used outside the financial industry to improve food supply chain management. The need for a more robust, trustworthy, and secure food product supply chain has led to the use of digital technologies like blockchain in an effort to improve operational efficiency. The goal of this article is to use a multi-method approach to research the obstacles that prevent firms from successfully using blockchain technology into their food supply chains. First, we do a literature search to identify integration challenges, and then we interview integrated research professionals to classify risks. Through in-depth, semi-structured interviews with professionals in the Blockchain and Food Supply Chains, we can learn how these integration hurdles impact operational efficiency and what can be done to alleviate it. Blockchain technology, experts agree, is best seen as a tool for improving existing infrastructure and streamlining internal processes rather than a universal fix. According to the study findings, the most significant challenges for blockchain adoption come from a lack of corporate understanding and familiarity with blockchain technology and what future supply chains may achieve. These obstacles make it difficult and impact the choice of a firm to create a supply chain that uses blockchain technology. Other obstacles have a role as secondary but nevertheless important aspects in the hiring process. The results reveal that quality enablers, including quality enabler strategy and leadership, information system usage and analysis, and supplier cooperation and synergy, are influential in inspiring firms to establish supply chain quality management implementation strategies. Focus is required, it seems.

Keywords: Blockchain technology, Food supply chain, DEMATEL Approach

1. Introduction

Food fraud, decreased trust among supply chain participants, and widespread consumer anxiety about food safety have all increased as a consequence of globalization of the food commerce industry. issues have surfaced, which calls for attention. It's not only about keeping things safe when it comes to managing the food supply chain; there are also difficulties with quality and fraud at the point of origin. In very intricate global supply chains, verifying the origin of components is essential. Nonetheless, there aren't any big institutions in charge of monitoring food, medicine, and consumer products at the moment, and the ones that do have significant flaws. Consequentially, there are more obstacles to ensure food safety for regulators. Businesses in the present day depend on being able to track the origins of their food products and compile complete data on their journey through the supply chain. Because it ensures everyone has access to food and helps the economy grow, the food industry is often seen as the most vital part of any economy. As a result of careful management of information flows among FSC's many stakeholders, we are able to successfully satisfy the requirements of our customers. By include all of the businesses along the supply chain from the originators of the raw materials to the final consumers, Supply Chain Management expands the scope of integrated management. Effective integration throughout supply chain management may provide businesses an edge in commercial rivalry. For an organization to be quality managed, it must adopt a quality-focused strategy in which every member of staff participates in a variety of quality activities aimed at both short- and long-term customer satisfaction and sustained success. One way to think about supply chain quality management is as an application of the ideas behind traditional quality management to the whole supply chain.

Providers and manufacturers propose blockchain as a potential future technology for businesses. According to the World Economic Forum, blockchain is one of the top computing "megatrends" that will significantly impact society over the next decade. Advanced. It demonstrates how blockchain technology has the potential to dramatically alter the way logistics are handled in the near future. At this point in time, blockchain is most well-known for its success in Bitcoin and financial applications, but its usage in supply chain management is still in its infancy. Taking use of digital scanning of

product and shipping information, as well as computerized supply chain management and enterprise resource planning, is standard practice for most businesses in the modern day. As the Internet of Things, radio frequency identification, global positioning system tags, and Industry 4.0 become more widely used, the need for more accurate, real-time supply chain monitoring data is also growing. Blockchain technology offers a solution to this problem. There has been a lot of excitement and anticipation about blockchain technology as a potentially game-changing innovation as of late. Because of its potential advantages, many businesses are thinking about using it. Potential savings, improved traceability thanks to more openness, and enhanced sustainability are just a few of the advantages that are hoped to accrue. Despite the fact that 82% of Fortune 100 businesses have looked at blockchain, the pace of investment in blockchain has declined significantly in 2019. These days, most businesses outsource their operations, which means that full accountability along the supply chain is essential.

However, maintaining a steady stream of information is becoming more challenging, and building trust among internal and external stakeholders is more important than ever. When it comes to partner transactions and procedures within the supply chain network, blockchain offers a shared and secure record of the flow of information. This guarantees the accuracy of the data, fosters confidence in the data's veracity, and makes the data accessible to everyone with a blockchain connection. Business logic in supply chains and transportation may be trusted thanks to blockchain. Eventually, this technology will allow for the elimination of middlemen, the autonomous validation of transactions, and the simplification of the supply chain. While blockchain has been the subject of experimentation in a number of industrial applications, there has been surprisingly little study of its potential effects on supply chains. Although blockchain has the potential to revolutionize supply chain processes, it is still not apparent whether this will be realized in reliable software. Simulation of smart contracts' dynamic behavior on the blockchain, for use in supply chain flow shops as a highly adaptable scheduling mechanism. Since blockchain is in in its infancy, it is unclear what benefits it will provide to his SCM. Schmidt and Wagner highlight the potential advantages of integrating blockchain technology into supply networks, and they suggest avenues for further study. One of them discusses the obstacles and problems with using blockchain technology. This research was prompted by the unique nature of blockchain technology and its enormous potential for supply chain applications.

The use of blockchain technology may result in significant adjustments to the management of operational and supply networks. As a distributed ledger, blockchain eliminates the need for trusted third parties to validate and authenticate transactions and records in accordance with established standards. Data stored on a blockchain cannot be altered in any way. There is a need to overcome present challenges in food supply chain management, and new blockchain technologies that enhance supply chain transparency, security, and durability show promise in doing so. By recording transactions chronologically and having all parties update their copies of the ledger in perpetuity, blockchain technology may increase openness and reliability in otherwise opaque supply chains. The number of disease outbreaks and mortality caused by these catastrophes may be reduced with the use of blockchain technology, which will enable the food vehicle that causes an epidemic to be identified. As an added bonus, blockchain technology may improve our ability to investigate the origins of epidemics and to take preventive measures in the future. Spending on food-tracking systems is expensive without guaranteeing any new business. Raw material procurement, manufacturing, distribution, and retail are all linkages in the food supply chain that lead to the final consumer. Controlling the movement of commodities and value through food supply chains is essential to achieving these goals of efficiency and economy. In the food business, this concept has grown quickly in recent years, especially in combination with the rising popularity of Green Supply Chain management and Sustainable Supply Chain Management. However, the huge number of stakeholders, the frequently worldwide spread of stakeholders across varied economies, and the complexity of interrelationships across these networks lead the information flow throughout the food supply chain to be fragmented and inefficient. Furthermore, it is argued that the centralization of the contemporary food supply chain presents a danger to the openness and promptness of information flow. Inaccurate production statistics, fraudulent transactions, and poor food quality are all possible outcomes. Also, customers' faith in food safety has been shaken by a number of occurrences over the previous several decades. Implications and hazards to food safety may be substantial if these difficulties are not appropriately controlled.

Public permissionless blockchains and private permissioned blockchains are the two most common kinds of blockchains. The former is an open kind used by several parties anonymously for the purpose of achieving a network effect, but all data is shared uniformly with all persons connected to the network. The latter is often used in industries where privacy and access control are paramount, and where cryptographic keys are used within closed groups of participants. Its decentralized structure removes the need for middlemen like banks or other organizations to transfer money and provides users with reliable data. Since 2009, Bitcoin has been effectively using this approach to transmit money digitally between parties. When compared to centralized intermediaries like banks or third-party websites, which are easy targets for hackers, a decentralized infrastructure offers several benefits.

2. Literature Review

Chen, S., Liu, X., Yan, J., Hu, G., & Shi, Y. (2021).

Characteristics of blockchain technology

Many people believe that blockchain technology will have a transformative effect on society and business, much as the internet did for the way in which digital events are organized, shared, and experienced. To put it simply, it is a decentralized database system built on the blockchain (Swan 2015; Crosby et al 2016). There are a number of important characteristics shared by blockchains, including decentralization, consensus processes, protection against tampering, transparency, and integrity (Nowiski and Kozma 2017; Lemieux 2016; lnes et al., 2017). Blockchain's decentralized nature stands out as the most notable distinction when compared to other conventional forms of digital technology. That's how P2P networks work by definition. This means that no one party has monopoly over the truth about a transaction; rather, every participant in the network has access to an identical copy of the ledger entry (Alnese et al., 2017). Additionally, a crucial notion in transactions is a "consensus mechanism" that is based on the decentralized consensus protocol

(Buterin, 2014). Every 10 minutes, a node compiles all of the most recent transactions into a single "block," which is then appended to the existing chain. As a result, the chain becomes longer as information is entered in each formal block (Buterin 2014). According to Beck and Müller-Bloch (2017), blockchains may be set up for either public or private use. Transactions in a public blockchain are visible to everyone on the network. The participants in a private blockchain, on the other hand, can only be those who have been granted access. Furthermore, Private Her Blockchain may be used by both standalone businesses and collaborative groups. It is impractical to remove collectively kept data since participants may view the records of each transaction using distributed public or private ledgers. information falsification; hence, there is no need to evaluate the credibility of intermediaries or other participants in the network, resulting in protection against information falsification; transparency; and integrity. (Nofer et al. 2017).

Introducing blockchain technology into the food supply chain

The primary objectives of supply chain management may be affected by blockchain in the following ways: cost, quality, speed, dependability, risk reduction, sustainability, and flexibility (Kshetri 2018). The food supply chain will be profoundly affected by blockchain because of its capacity to guarantee reliability, traceability, and information authenticity in a trustless setting via the use of smart contractual partnerships (2018). To be more precise, blockchain technology is actively attempting to replace conventional supply networks with blockchain-based supply chains. The material flow and his finished goods are impacted by this disruption in the supply chain. Information tags on all products serve as unique identifiers that may be linked to a digital identity stored in a distributed ledger (Abeyratne and Monfared 2016). This allows for direct access to product profiles for anybody who has been verified or authenticated by a registered verifier or authenticator, including producers, retailers, and end users (Baker and Steiner 2015; Tian 2017). The parties may fulfill the smart contract's prerequisites to approve the transfer before the product is actually transferred. When the ownership of a product changes depending on specified parameters agreed upon by the parties, a smart contract may automatically trade the goods, monitor its temperature and logistics in real time (Ndraha et al. 2018; Reyna et al. 2018). Some fascinating case studies have been conducted, and there have been a number of theoretical investigations of blockchain-based food supply chains (see, for example, Brenig et al., 2016). Tian (2016) analyzed the present security vulnerabilities in China's food logistics industry and used that information to create a food supply chain traceability system using RFID & blockchain technology.

Pandey, V., Pant, M., & Snasel, V. (2022).

In order to undertake a literature study on food traceability concerns, Bosona and Gebresenbet defined and spoke about definitions, drivers, advantages, challenges, improvements, and results of food traceability systems (FTS). Traceability technologies, including RFID, have been implemented in Thailand, and we looked at their impact on the country's food business as it is now in East Asian nations. Due to their immaturity and lack of expertise, many writers in recent years have investigated the possibility of adopting blockchain technology in a variety of sectors from the standpoint of supply chain management. Using HACCP, Blockchain, and the Internet of Things, Alfred Taudes and Tian developed a method to trace the origin of food in real time. Future difficulties in implementing blockchain technology into food supply chain traceability systems were also mentioned. In their talk, Helo and Hao provided a taxonomy of blockchain's possible uses in supply chain management and used an Ethereum-based monitoring system to show how the technology works. They draw the conclusion that blockchain has the potential to further simplify supply chains while also maintaining the worldwide trust and security of data and information. choral music, etc. We demonstrated an Ethereum and Hiperledger Sawtooth-based blockchain traceability system for food supply chains and compared and contrasted their relative merits. Digital data production and consumption were optimized by the solution's network integration of Internet of Things devices. Despite all of blockchain's potential benefits, many smaller companies still view its implementation with fear. The storage capacity and scalability, privacy, leakage, high cost and regulatory concerns, throughput and latency issues, and lack of functionality were recognized as the six main problems with the blockchain. When it comes to analyzing and making long-term decisions on dynamic industrial management challenges, Forrester was the first business to use system dynamics (SD) as a modeling and simulation approach in the early 1960s. presented the first Beer Distribution Game, which became a staple of the Proceedings 2019 (Vol. 39, No. 14, Page 3 of 5). Forrester's SD role models in his supply chain are the basis for this teaching project. To better comprehend the complicated logistical behavior of the integrated food business, Minegishi and Thiel employed SD..

Sara Saberi, Mahtab Kouhizadeh, Joseph Sarkis & Lejia Shen (2018)

The study program was based on a set of overarching research proposals concerned with the use of blockchain technology in the management of supply chains. Questions around outreach and participant recruitment are also worth investigating. They provide special attention to post-adoption concerns and challenges when it is warranted. In conclusion, we catalog a number of studies that aim to foresee the fallout from this game-changing technology's widespread adoption. The supply chain, its connections, and its efficiency are the main points of interest. This part expands upon the foundation laid in the preceding section and the fundamental theory presented in the literature on supply chain management. starts with a fundamental tenet of supply chain management theory that is going to be profoundly impacted by blockchain. As such, it is connected to the realm of long-term agreements and partnerships. To begin, we focus on the framework of opportunism. Most supply chain experts agree that this number should be lower for strategic and collaborative initiatives to succeed (Ketchen and Hult 2007). The theory of transaction costs relies heavily on the concept of opportunism (TCE). Opportunism is the pursuit of one's own financial gain at the expense of others in commercial transactions (Williamson 1985). In the context of supply chain management, one form of corporate opportunism is the attempt to increase suppliers' reliance on the company so that the company may exert more control over the suppliers (Ketchen and Hult 2007). The supply chain is more vulnerable to power abuse and unfair advantage because of the existence of middlemen and agents. Fraud and deceitful dealings are addressed in section B. To wit: (Grover & Malhotra, 2003; Ketchen & Hult, 2007). When it comes to making supply-chain-related strategic choices, environmental uncertainty and opportunism based on the projected effect of certain assets are also crucial factors to consider (Handley and Benton 2012; Wang, Ye and Tan 2014). Companies need to be on guard against opportunistic conduct on the part of third

parties since opportunism is a reality. Due to the need for expensive auditing and monitoring, this adds a cost to doing business for organizations. B. Legal Commitments, Governmental Requirements, and Record-Keeping (Carter and Rogers 2008).

Agarwal, U., Rishiwal, V., Tanwar, S., Chaudhary, R., Sharma, G., Bokoro, P. N., & Sharma, R. (2022).

One of the most often stated uses of BC is in the supply chain. Given the supply chain's high potential for BC implementation due to its complex network structure of stakeholders 4464, the need to exchange information 4484 between stakeholders, 4484 the difficulties and risks in communicating documents, and the lack of trust between parties, it is important to note that there are some caveats to this. The truth is concealed. As a means of protecting transactions and ensuring the authenticity of users in untrusted contexts, BC relies on authentication and traceability. It has been proposed that BC may be utilized to strengthen supply chain resilience, increase supply chain transparency, and enhance product traceability. The mean time to complete tasks in the system was decreased, the volume of work was decreased, the traceability of orders was confirmed, and communication between all parties in the supply chain was improved thanks to BC. There are therefore several ways in which SCM might be enhanced. It's all about B. : Buying, Making, Moving, and Keeping Stock.

Jraisat, L., Jreissat, M., Upadhyay, A., & Kumar, A. (2022, June).

Distributed Ledger Technology (Blockchain) (BCT) To put it simply, BCT is a database that keeps track of records based on transactions and logs all completed transactions in batches. More crucially, a digital ledger is a database system that operates as a chain inside a network of linked peer-to-peer nodes (Bai and Sarkis 2020; Haque and Rahman, 2020). A digital ledger may communicate with a massive, networked, and encrypted spreadsheet. Each successful purchase requires you to record a corresponding transaction. The whole supply chain is laid bare for public inspection, revealing every step taken to get the product into the hands of the customer. BCT is fundamental to the whole procedure (Bai and Sarkis 2020; Abu-elezz et al., 2020). This method improves the openness and trackability of collective information. Distributed to promote reliability between buyers and sellers. This breakthrough in technology is an innovative part of the value chain, as it has resulted in the digitalization of the proven traceability system and the security of communications and data in. Problems with commercial transactions are now easier to resolve because to blockchain technology. (Demestichas et al., 2020; George et al. 2019; Mesquita et al. 2021; Rehman et al., 2021)

Kayikci, Y., Subramanian, N., Dora, M., & Bhatia, M. S. (2022).

CHALLENGES IN THE FOOD SUPPLY CHAIN

Failure to develop comprehensive monitoring and traceability mechanisms may lead to organizational disease and significant reputational harm, especially given the growing importance of food quality and safety. Yes (Aung & Chang, 2014). A number of supermarkets have recently been hit by food-safety disasters including the horsemeat scare and the salmonella scare in peanut butter (Crossey, 2017). Companies' bottom lines might take a serious hit if customers don't trust that the products they buy are free of harmful substances and are authentic. I have. Keeping food safe and giving people what they need in terms of quality is a major concern. The quality of food components may change significantly between production and consumption, setting food supply chains apart from other supply chains (Apaiah et al., 2005). Food must be tracked back through its whole supply chain to address concerns of transparency, traceability, and provenance. In fact, technological, administrative, and environmental concerns all need to be addressed to guarantee food supply chain traceability (Aung & Chang, 2014). Accurate and efficient information transmission in a consistent format with all stakeholders engaged in the supply chain is a significant obstacle in food traceability (Moe, 1998; Aung & Chang, 2014). Many businesses, both big and small, still rely on paper-based methods for tracking purposes. Investments in time and money are necessary to run and maintain digital systems, which are quite costly (Karippacheril et al., 2017). It's true that the paper-based method has its drawbacks. The expense of adopting traceability systems, particularly for small producers in poor nations, is a further barrier to tracking the origin of food. (Kelepouris et al., 2007; Aung & Chang, 2014).

3. Problem Statement

Lack of information on blockchain

Information fraud is a major problem in food supply chains with low transparency and deception. Organizations can delete or alter history to avoid commitment or obscure reality. Through the blockchain, each time an exchange is approved and added to the blockchain, the original record is permanently stored and can be restored.

Insufficient Knowledge of blockchain in food supply chain management

Results show that technical and organizational barriers predominate among the identified barriers to blockchain implementation. Supply chain collaboration, effective research and development of blockchain technology, and increased technical proficiency will help break down these barriers.

Blockchain is one such technology, but its use in India is still in its infancy. This is what drives us to investigate the major obstacles standing in the way of widespread use of blockchain technology for managing supply chains in India. The expected return on investment is the biggest hurdle in implementing blockchain in supply chains. When adopting new technology, it is always difficult to prove that the cost of moving to blockchain justifies the investment. The modern food supply chain industry demands modern IT solutions as their business demands transparency, efficiency and operational efficiency. A significant step forward in contemporary cryptography, blockchain technology enables us to safely solve the issue of information flow in supply chains. Blockchain is an open, distributed ledger that can be set up to operate automatically and so record exchanges among entities in a way that can be verified

and tracked at any time. These qualities make blockchain technology a good fit for parts of food supply chain which are undergoing the circular economy revolution.

Lack of understanding about blockchain

In fact, there is not enough public information about blockchain, and even many people working in the Supply Chain Management field struggle to fully understand the potential of blockchain. Researchers suggest that many companies generally choose blockchain as the answer before diagnosing problems, demonstrating a deep understanding of blockchain's true potential. increase. Companies should hire more trainers and experts to do this work to educate their employees about blockchain. It is convenient for inquiries about ingredients, short delivery times, and manufacturing.

Expense and Difficulties to Adopt Blockchain Technology

Supply chains include hundreds of stages, multiple locations, multiple stakeholders and facilities, multiple payments and invoices, depending on the type of product. Because of lack of transparency in the supply chain, blockchain might revolutionize the logistics and supply chain business. The elimination of middlemen in the supply chain makes possible the real-time monitoring of items through blockchain, which in turn reduces transportation expenses. By cutting out the intermediaries, you save money and prevent the production of duplicate or fake items..

Food Traceability Issues

The growing prevalence of fake food items is a major cause for worry among producers, academics, policymakers, public servants, shoppers, and other interested parties because of the damage it does to the economy and the health of the general public. damaging their credibility and making them distrustful.

Blockchain-related technical security concerns

Blockchain technology is highly democratic. To reach consensus, they vote in a variety of ways. In this scenario each node receives her one vote. Consensus algorithm issues for proof of identity include minority exclusion and manipulation of small blockchain networks. Blockchain is redundant and difficult to scale. Every device on the network needs a copy of every transaction, from the genesis block to the last transaction. This is hundreds of different copies of the same data. A blockchain's security is only as good as its weakest link. Like, only one node on an exclusive blockchain is required to access shared data. This shows that the entire blockchain privacy is being compromised by the most hackable devices. Unfortunately, this is a blockchain-only issue.

4. Objectives of Implementing A Blockchain In A Food Supply Chain Management

Although blockchain technology has been around for a while, it is just now making an impact on the food supply chain. Blockchain technology may soon be used to address some of the most pressing problems in the food supply chain. For data pertaining to food, the benefits of blockchain technology include its transparency, security, and decentralization. Blockchain is immutable because of a special property. Since all modifications are recorded and made public to everyone in the network, it is impossible to tamper with or conceal any financial dealings.

It uses a decentralized storage system as well. This implies that data is not stored in a centralized location. Instead, data is replicated across numerous nodes (computers) so that everyone may read the most recent version. With blockchain, there is such a high level of transparency that there is no longer any need for a third party to settle disputes or verify transactions.

Unique purposes of blockchain technology are mainly helpful with:

The Indian food sector is undergoing major changes. With increasing demand for quality and safety standards, increased efficiency, and the integration of smallholder farmers into value chains, an integrated view of the supply chain is required. Primary goals of supply chain management are to reduce costs, improve organizational performance, and keep consumers satisfied.

Competition in the food industry requires high quality and efficient supply chain systems.

Consumers today want detailed descriptions of the products they consume. Therefore, managing this kind of data is very important. To do that, we need to introduce something new to the field: blockchain technology.

Leveraging blockchain technology presents an prospect for bringing transparency, responsibility & trust to food supply chain.

Blockchain Technologies supports enterprises with blockchain-enabled solutions such as STAMP Supply, a platform that improves transparency, auditability, and performance of Supply Chain.

- Main objectives to handle the Diseases and outbreaks are a concern and recall systems need to be efficient.
- The first step is to find the right sources of information and the right procurement methods. Quality and safety should be ensured when choosing a source. Proper audits and contracts must be completed with the parties for smooth functioning.
- Transparency across the supply chain is important, and transparency breeds trust. This allows stakeholders to work together with a common goal in mind.

- Distribution and inventory are her two main aspects of post-production. Choosing the right logistics method and meeting delivery deadlines can only be achieved through proper inventory management.
- Preventing Food Forgery, Fraud, and Misleading Labeling
- Supporting Mass Recalls of Contaminated Items
- Identifying Waste in the Food Supply Chain
- Reducing Potential for Food Spoilage Enable proof of origin for traded products

Reduce Order time:-Order time refers to the time that the supply chain takes from procurement of raw materials to the final product reaching the consumer, excluding the time taken to deliver the product. In short, it's the time that the organization takes to manufacture a finished product. This time taken to produce is Key Performance Indicator to determine the efficiency of the organization's responsiveness to consumer demands. These can be improved by setting up constant time monitors, protocols and time limits It is the time from when a product is manufactured until it reaches the consumer. This post-production journey is largely managed by distribution channels. Choosing the right and effective distribution method plays a key role in faster delivery. Inventory management, blockchain technology, automation, delivery

Blockchain's inherent honesty and openness are geared at streamlining the transfer of goods and data throughout the supply chain. It is necessary to implement automatic rules of governance. As a result of this change, we may see a more widespread transition from an industrial goods and products economy to an information and customization based one.

Knowledge, communication, and information, rather than material attributes, will be the determining factors in future production.

For instance, consumers may monitor order status updates. With this, consumers are more certain that the product will perform as advertised. We use the example of sustainable supply chains to show how blockchain technology may be put to use in the real world. Progress is predicated on long-term strategies. There is increasing pressure on businesses and their supply chains from regulators, consumers, and communities to make their operations and products more sustainable. Due to these reasons, it is necessary to investigate the effect of blockchain technology on eco-friendly supply chains in more depth to determine the implications for the future of the supply chain.

If an organization desires a sustainable supply chain supported by new information technologies adopted throughout the supply chain network, Its goals and objectives must reflect an emphasis on environmental responsibility. Sustainability must be actively planned for and implemented at all levels of a company and across the whole supply chain. However, some businesses struggle to adopt and assess sustainability practices in the blockchain ecosystem due to a lack of industry-standard tools, processes, and KPIs. Even supply chains that have adopted blockchain technology are still struggling to adopt truly sustainable procedures.

5. Challenges

This section describes the difficulties involved in integrating blockchain into food supply management. Supply his chain manager faces this problem when considering the benefits of adopting blockchain technology.

The supply chain continues to be dynamic. It's easy to point out the benefits of this technology, but it's hard to envision a complete overhaul of the supply chain. This is like asking runners to change shoes without dropping places in a race. Even if supply chain managers were able to build a parallel infrastructure without sacrificing productivity, there are still obstacles to overcome. Most small business owners will be intimidated by the cost of implementing blockchain-based supply chain management tools.

Think about how long it took for the Internet to become a success. Note that cars were essentially a less safe alternative to horse-drawn carriages.Individuals and businesses alike had to change their ways and start a unique trend. If supply chain managers want to use blockchain technology to eliminate product loss and industry disruption, they must embrace this visionary thinking.

- Incorporating BC into the supply chain process is not as easy as expected due to some recognized obstacles and limitations. In 2017, ABI Study surveyed business leaders from nine different sectors and discovered that 93% of them had never heard of BC, while just 7% had done any kind of preliminary research upon technology. The largest challenge to integrating BC into the supply chain is the perception that it would increase costs. Many people wrongly believe that BC is synonymous with Bitcoin and other cryptocurrencies owing to the negative image that both have earned via their usage in criminal activities. Therefore, people are hesitant to accept it. Many companies are unaware of BC and its potential impact. Lack of interoperability between multiple BC networks is the second major problem. The ability to work, exchange data, and conduct transactions across multiple BC platforms is known as interoperability. Lacking a common standard, organizations develop and work with their own BCs and apps. Various BC systems are currently deployed in thousands of projects, most of which are standalone. Consensus methods, protocols, programming languages and privacy guarantees are all used by them. The problem is that there are so many different networks that the BC sector is chaotic. The lack of skilled developers is also a big problem.

As a result, the company cannot connect to his BC Rollout feature pool. Significant regulatory and legal hurdles hinder widespread adoption of BC in global supply chains

- The price tag of a BC-driven SCM system is a major deterrent for most SMB owners. A BC system has substantial ongoing expenditures in addition to the initial investment. Adoption of BC is hampered by the requirement to move and integrate people, processes, and technology. Cybersecurity threats tend to be a major additional barrier to widespread use of BC. The Ethereum DAO hack in 2016 and the restructuring of several BC records in Ethereum Classic in early 2019 are just two examples of the vulnerabilities in BC code or encryption techniques that have caused businesses to forsake BC solutions in favor of more conventional approaches. It's quite probable. The security of BC technology is imperiled by prospect of a quantum computer breaking the underlying cryptographic methods. A kind of cryptography based on keys is used. Using Shor's quantum computing method, bigger prime numbers may be primed in polynomial time, which makes RSA algorithm simpler to break. Thus, in the post-quantum era, digital signature systems like DSA, ECDSA, & EdDSA no longer work.
- Small and medium-sized business owners often hesitate to use an SCM system that is BC-enabled due to concerns about the associated costs. A BC system has substantial ongoing expenditures in addition to the initial investment. Adoption of BC is hampered by the requirement to move and integrate people, processes, and technology. Cybersecurity threats tend to be a major additional barrier to widespread use of BC. Because of security flaws in BC codes or encryption algorithms, like hack of Ethereum DAO in 2016 & restructuring of many BC records by Ethereum Classic in early 2019, many businesses have opted out of using BC solutions in favor of more conventional approaches. Now The possibility exists. Threatening the safety of BC technology is the prospect that quantum computers may be able to decipher the underlying encryption algorithms. The cryptography of keys is used in BC technology. In order to break the RSA encryption technique, it may be utilized to generate random numbers. Consequently, in the post-quantum era, digital signature systems like DSA, ECDSA, and EdDSA would be rendered obsolete. The rate of transactions per second is sometimes used as a yardstick to compare the different BC models. TPS refers to the maximum number of transactions that may be processed in a given time period. The scalability of the BC model is affected by a variety of factors, including the architecture and configuration of the BC platform, the block size limit, the consensus & transaction validation mechanism, the processing capability, network bandwidth, file system, & data storage requirements, and the size of the blocks. I was. In order for the BC architecture to function, the TPS must be massive. However, his TPS using the existing BC model falls short of the mark.
- Some sizable companies and businesses, such as finance, require hundreds of TPS. His TPS at this level cannot be reached with the current BC system. Another major obstacle to SCM implementation, the problem of false or incorrect data entry, cannot be solved by BC technology. C.BC-based solutions include a variety of methods to verify item authenticity, including secure tags, seals, and sensors.
- When designing a complex smart contact, there is a lot of code that needs to be considered, so the developer has to be very careful and the smart contact becomes cumbersome.
- Finding situations where blockchain-based solutions offer measurable advantages over existing systems and solutions is a major obstacle to blockchain adoption in supply chain scenarios. Blockchain-based solutions promise greater traceability and more efficient commerce across supply chains, but there are currently few examples of these benefits being implemented. Adopting new technologies is risky, and the supply chain industry is already processing massive amounts of data and transactions in real time. For blockchain to be widely adopted in this space, it needs to see clear advantages over existing technologies and approaches, which have yet to be realized.
- Issues such as interoperability, scalability and performance should not be underestimated. Blockchain technology is still in its early stages. The competitive paradox is difficult, especially in supply chains with many competing stakeholders. Initiatives that start small and grow incrementally are most likely to succeed.
- Finding a way for blockchain solutions to reach critical mass quickly is a major obstacle. I think many niche applications with few users will lose momentum before they get big. However, there are some newer applications with significant funding and sizable user bases. Blockchain applications that can be brought to market with sizable customer sponsorships or user bases have important advantages.
- “Like any new technology, blockchain is still figuring out the best use cases and messages to support its value proposition. Blockchain is no exception, as the rest of the supply chain market will need a small number of early adopters to see a significant return on investment.
- The biggest obstacle in supply chain management is the focus on private, standalone blockchain networks rather than public networks. In its early stages of learning, Private He Blockchain has emerged as a leader in enterprise use cases. Private networks provide a more secure environment for companies, trading partners, and other organizations to test blockchain solutions, potentially reducing the impact of early setbacks. However, private chains pose a significant obstacle to widespread adoption if they continue after litigation. The industry's goal is to enable integration and interoperability on an open source platform that, beyond experimentation, can connect to an infinite number of supply chain networks.
- Blockchain adoption is sporadic at best. The headlines about Bitcoin didn't help how much we needed to learn.However, many industries have launched proof-of-concept initiatives, some of them working with regulators and founders to develop blockchain technology. Some have been successful in influencing the adoption of Understanding the technical structure, data schemas, and security protocols of blockchain technology is challenging for all industries due to its highly customized nature. Security issues faced by some companies and the accompanying publicity are another secondary factor hindering blockchain adoption. Adoption is slowed by many myths that can only be dispelled through practice and experimentation.

6. Methodology Used

Based on the research questions, The purpose of this research was to analyze previous work on the topic of food supply chain management. Many academic articles have been written upon challenges of managing food supply chain and the potential benefits of blockchain technology for ensuring food is secure. Blockchain technology encounters several challenges in the food supply chain management. The food supply chain has expanded rapidly over the past few decades, and consumers now expect exotic foods to be available fresh throughout the year. The supply chain becomes longer and more complicated than ever as a result of this geographic expansion and the addition of additional parties.

As if things weren't already complicated enough, the global shutdowns that will occur in 2020 as a result of the multi-year COVID pandemic will put even more stress on supply chains. These shutdowns will result in the closure of numerous supply chains for restaurants and foodservice, as well as a slowdown in retail sales. Direct food marketing and delivery chains are under increasing pressure. Food supply chains have been more directly affected by the war in Ukraine and subsequent economic sanctions, posing a threat to wheat exports, fertilizer supplies, and essential energy resources that power agriculture and food supply chains.

Aims of the Study The issue of food safety in the context of managing the food supply chain has been the subject of several academic investigations. In order to highlight these issues, this article will consolidate a large number of studies and compile statistics on food supply chain management. Key objectives of this study include the following: Volume 4 597 RQ1 of Atlantis' Highlights in the Field of Computer Science. There are no publications pertaining to supply chain management included since it is not the major subject of this study. Blockchain technology was used for food supply management. There are still several problems and challenges that must be overcome when using blockchain in the food supply chain. Planned Methods of Looking A systematic literature review paper's main goal is to compile information from many sources and provide an individual assessment of these research. In this research paper, we will examine the existing research on blockchain-based food supply chains.

7. Analysis

ABBREBRIATION	CRITERIA
A	Lack of information Block Chain Technology
B	Insufficient Knowledge of BCT
C	Lack of understanding about BCT
D	Expense and Difficulties to Adopt BCT
E	Food Traceability Issues
F	Blockchain-related technical security concerns
G	ROI of using block chain technology

	A	B	C	D	E	F	G		
A	0	2	4	2	3	4	2		
B	2	0	1	4	2	2	2		
C	2	3	0	3	2	1	1	0	no influence
D	4	2	4	0	4	4	3	1	more influence
E	2	4	2	4	0	1	4	2	medium influenc
F	2	4	4	2	4	0	1	3	high influence
G	2	2	4	3	1	2	0	4	highest impact

NORMALISED DIRECT RELATION MATRIX(D)

A	0	0.1214538462	0.1578923077	0.1376538462	0.1740923(	0.1538461538	0.1012153846
B	0.1174076923	0	0.1578923077	0.1821846154	0.1812953(	0.1578923077	0.1255076923
C	0.1498	0.1498	0	0.1578923077	0.1862384(	0.1943307692	0.1498
D	0.1052615385	0.1740769231	0.1619461538	0	0.1700384(	0.1700384615	0.1214538462
E	0.1417230769	0.1538461538	0.1619461538	0.1373769231	0	0.1740923077	0.1133615385
F	0.1578923077	0.1417	0.1659923077	0.1417	0.1700384(	0	0.1295538462
G	0.08096923077	0.1336	0.1417	0.1255076923	0.1174076(	0.1336	0

Crietria		Ri	Ci	Ri+Ci	Ri-Ci	Identity
A	Lack of information Block Chain Technology	7.712909	7.00701	14.7199	0.7059	cause
B	Insufficient Knowledge of BCT	8.31352	7.92379	16.2373	0.38937	cause
C	Lack of understanding about BCT	8.782435	8.54721	17.3296	0.23522	cause
D	Expense and Difficulties to Adopt BCT	8.199892	7.97088	16.1708	0.22902	effect
E	Food Traceability Issues	8.037554	8.90863	16.9462	-0.87107	effect
F	Blockchain-related technical security concerns	8.167054	8.79044	16.9575	-0.62338	effect
G	ROI of using block chain technology	6.77638	6.4818	13.6182	-0.654	effect
INTERPRETATION	in this the highest value of ri+ci indicates that this particular value of the criteria that is to be improved to overcome the challeneges of blockchian technology implementation.in this it is c point lac in this it is c option that is lack of undrstanding about block chain technology which effect the blockchain related technical issues					

here I have taken the average of all matrix

	A	B	C	D	E	F	G	SUM
A	0	1.5789	2.0526	1.7895	2.2632	2	1.3158	11
B	1.5263	0	2.0526	2.3684	2.35684	2.0526	1.6316	11.9999
C	1.9474	1.9474	0	2.0526	2.4211	2.5263	1.9474	12.842
D	1.3684	2.263	2.1053	0	2.2105	2.2105	1.5789	11.7859
E	1.8424	2	2.1053	1.7859	0	2.2632	1.4737	11.5263
F	2.0526	1.8421	2.1579	1.8421	2.2105	0	1.6842	11.7894
G	1.0526	1.7368	1.8421	1.6316	1.5263	1.7368	0	9.5262
SUM	9.7894	11.3684	12.421	11.4737	13	12.7894	9.6316	

8. Discussion

Some difficulties arise when considering how blockchain technology impacts people, workflow, and output. ERP installations are costly solutions that may teach a lot about how to tailor blockchain technology to a company's specific needs. In the food industry, where there are so many distinct goods and where the same commodity (like tomatoes) may have varying quality criteria, adapting an ERP deployment is a significant problem. Depending on the specifics of the product, a different order fulfillment module is used for each. Batch traceability, both backward and forward, is another difficulty. In order to move data to the input system, the ICT infrastructure must link blockchain technology with the ERP system. Web and mobile apps are necessary for the application layer. To ensure the integrity of smart contracts and digital signatures, the data access layer's mining pools, consensus mechanisms, and hashing algorithms must be situated in the same place. Quality assurance requirements may be automatically implemented with the use of smart contracts.

Integrating blockchain technology with ERP systems is valuable because it allows for the precise identification of which parties should have access to which data already present in corporate systems. because it gives you command Without a doubt, blockchain technology will develop into a supplementary offering to ERP programs. Many challenges are related with the human-technology approach, which are highlighted by four viewpoints in our study. The strategic use of PPT models has increased the quality of performance across several domains. There is evidence, in particular, that a combination of the three may enhance data quality (Monterio, 2016).

Our results through SLR and in-depth interviews highlight the importance of human-machine interactions enabled by blockchain technology for enhancing the efficiency of the food supply chain. increase. Overall, the evidence in his favor of the human-technology balance is rather compelling. Combining procedural and technological aspects in the food supply chain has a similar effect, reducing the likelihood of mistakes while increasing efficiency. The connection between human effort and process needs, as well as between those needs and anticipated results, will be significantly altered by technological interventions. Our study's proposed research procedures are as follows.:

P1: The efficiency of food distribution networks may be enhanced by combining blockchain technology with human-process linkages.

P2: The efficiency of the food distribution network is enhanced by the interplay of blockchain technology with procedures and performance linkages.

A PowerPoint model of the efficiency of the food supply chain built on the blockchain is shown in. Empirical data scaling. Also, blockchain technology offers enormous potential to enhance traceability, transparency, and trust in the food business, but there are numerous technical challenges and impediments that need to be thoroughly researched. In the commercial world, more and more connections are being codified by technology (law). Blockchain technology is an opportunity that the industry leader must seize by incorporating it into the digitalization agenda now impacting the whole food business. There has to be strict enforcement of laws on a global scale. The food business has to become more open, productive, competitive, and environmentally friendly. Choosing the correct application for technology in the food supply chain is crucial. Nonetheless, studies should investigate how blockchain solutions supported by evidence might be developed for the whole food supply chain.

9. Conclusion

The outdated lack of visibility across the supply chain from beginning to finish has a contemporary answer in the form of blockchain technology. However, there is a dearth of research relating blockchain technology to his OSCM. Therefore, Büyüközkan and Göçer's recently released study about digital supply chains utilizing blockchain technology serves as a broad appeal to OSCM scholars to perform additional research on the potential that blockchains offer to OSCM. This year's findings (2018) bolster the investigation into omitted. This study set a research agenda for experts in the discipline by identifying major areas wherein blockchain technology may enhance his OSCM methods.

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