BLOCK CHAIN TECHNOLOGY FOR USING SUPPLY CHAIN MANAGEMENT

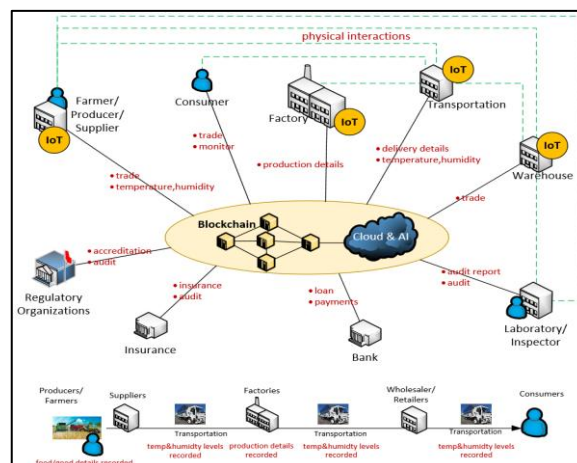## Angelpriyadharshini. V[1], Madhuvanthi. S[2]

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ABSTRACT

Supply Chain Management Using Blockchain Technology Supply Chain Management Using Blockchain TechnologySupply chain management has a lot of opportunities thanks to block chain technology. This paper seeks to provide an overview of the use of blockchain technology in the supply chain industry. Although the technology has been closely linked to cryptocurrency, it also has promising uses in the supply chain, energy, and food industries. Blockchain technology has the potential to improve product traceability, authenticity, and legality in a more efficient manner by creating a permanent, shareable, auditable record of products along their supply chain. For the instance of the agribusiness, potential blockchain technology improvement expectations were examined. Additionally, the proposed use case for a blockchain-enabled car manufacturing micro factory was presented.

1. INTRODUCTION

Before things are delivered to customers, ownership of them transfers numerous times among players in a supply chain. Supply chains serve as an aggregation mechanism by which goods are delivered by numerous Small-scale producers to bigger scale supply chain partners for further processing towards an end-product for low-added-value products like agricultural commodities and certain types of mining commodities. Current supply chain models start with the transmission of two supply chainparticipants, namely manufacturers and importers, who transfer their goods to the subsequent supply chain stage. The wholesaler, or intermediate layer, is the level after that and is where the export, processor, and supply chain process the fundamental goods that they receive. The final level includes a dining service and merchant that sells goods. The fundamental issue with this paradigm is that data is contained in supply chain components and is not exchanged as much. For instance, the consumer cannot confirm the origin of the food they are purchasing. (Vara et al., 2018).Additionally, it can be challenging for supply chain partners to maintain operations across a complex network of resources, activities, and organizations, particularly when a significant number of smallholders are involved. Sustainability challenges could be exacerbated by a lack of visibility and incentives. The ability to track the history, application, usage, and location of an item or its features using recorded identification data is referred to as traceability, according to ISO standard 9000.Participants and their functions in a typical blockchain-integrated supply chain flow are shown in Figure 1.
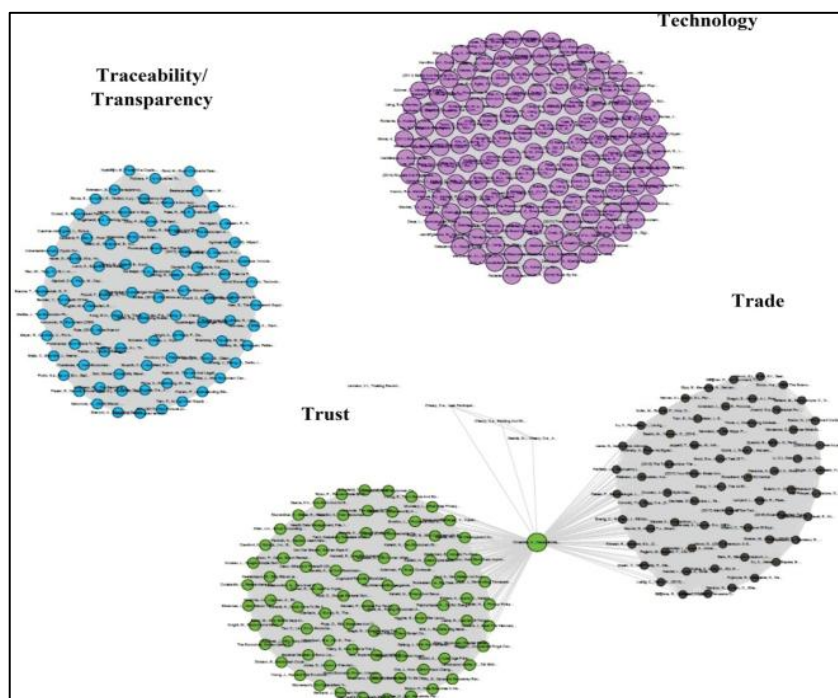

Customers can't rely on the accuracy of the data in the present supply chain systems. The global supply chain makes the current paradigm even more cumbersome. Without establishing trust, it is challenging, if not impossible, to create a dependable system on a global scale. The move to using blockchain technology has started to address all of these supply chain difficulties with the introduction of blockchain as a disruptive technology for the majority of procedures related to our daily life (Dylan, 2018).Figure 1 can be used to represent participants and their roles in a typical blockchain-integrated supply chain flow. By 2027, 10% of the world's GDP is anticipated to be recorded on blockchain ledgers, which will mark the tipping point for adoption. (WEF, 2015).This article surveys the opportunities, difficulties, and potential paths for further research on blockchain-based supply chain solutions. We think that this would serve as a springboard and a direction for additional research.

2. BACKGROUND ON BLOCKCHAIN

The fundamental concepts and elements of blockchain technology date back to the 1980s and are based on digital currencies. Most recently, in December 2008, a paper titled "Bitcoin: A Peer-to-Peer Electronic Cash System" by a writer going by the pseudonym Satoshi Nakamo to popularized blockchain technology. Mathematics, cryptography, computer science, and financial science are all combined in the blockchain concept. In actuality, blockchain technology is a form of distributed and parallel computer architecture. It enables the removal of trusted authorities or central servers from partner's digital interactions. As a result, it is categorised as a disruptive technology that has the potential to fundamentally alter most of the processes that we engage in every day.Simply explained, thousands of computers work together to store copies of the data, known as the ledger, and all changes to the data are made by agreement of partners. To maintain transparency, every modification to data is time-stamped and logged. The participants in the system are not required to have mutual trust. Changes to the stored data can only be made in accordance with the established rules. These changes are also recorded in a ledger whose contents are transparently open to audit and secured by cryptographic methods, and a copy of this chain is made available to all parties. Digital data can now be transferred between owners, just like physical assets can. Proof of Work (PoW), Byzantine Fault Tolerance (BFT), Proof of Stake (PoS), and Proof of Elapsed Time are the primary consensus algorithms used to maintain confidence. (PoET). The consensus mechanism's primary goal is to make sure that suggested change requests are consistent with the state of the data and the rules as they currently stand. These validations are carried out by nodes, which are blockchain computers. By organising modification history as blocks that are cryptographically related to one another, cryptography is primarily employed to secure the validity of change requests on data and the immutability of data in the ledger. Another significantn blockchain concern is privacy.Cryptography is also employed to protect each participant's privacy. Maintaining the whole ledger at the nodes rather than the centre ensures high availability of the ledger. Public and private blockchain platforms are the two main varieties. Anyone can operate a node and send change requests to the network on a public blockchain. In a private blockchain, also known as a permissioned blockchain, only a select group of players are allowed to send requests to the network and run nodes.

3. PROBLEMS OF SUPPLY CHAIN AND OPPORTUNITIES WITH BLOCKCHAIN

The cost, quality, speed, dependability, risk reduction, sustainability, and adaptability are identified as the primary goals of the supply chain. (Kshetri, 2018). Globalization of manufacturing makes well-defined supply chain management increasingly important and valuable. Due to the lack of transparency in today's supply chain networks, it is challenging for customers to determine a product's true value. Furthermore, when there is a suspicion of unlawful or unethical activity, it is typically not possible to investigate supply networks. Other significant supply chain concerns include excessive paperwork, expensive processes, and delayed processes.The supply chain sector already benefits from blockchain technology because of its four major properties, according to a literature review on the research focuses on blockchain for the supply chain area (Pournader 2020).

Supply chain participants	Current limitations	Blockchain impact
Producer	Lack of ability to prove the origin and quality metrics of products transparently	Benefits from increased trust of keep track of the production raw material and value chain from producer to consumer
Manufacturer	Limited ability to monitor the product to the final destination. Limited capabilities of checking quality measured from raw material.	Added value from shared information system with raw material suppliers and distribution networks
Distributor	Custom tracking systems with poor collaboration capabilities. Limited certification ability and trust issues.	Ability to have proof-of-location and conditions certifications registered in the ledger.
Wholesaler	Lack of trust and certification of the products' path.	Ability to check the origin of the goods and the transformation /transportation conditions.
Retailer	Lack of trust and certification of the products' path. Tracking of products between consumers and wholesalers.	Ability to handle effectively the return of malfunctioning products.
Consumer	Lack of trust regarding the compliance of the product with respect to origin, quality and compliance of the product to the specified standards and origin.	Full and transparent view on the product origin and its whole journey from raw material to final, purchased product.

In conclusion, blockchain technology can be advantageous in the supply chain in many ways, just as it is in many other application areas.Blockchain technology allows for decentralized, transparent, safe, quick, and inexpensive transactions. Digital systems save paper effort by getting rid of extraneous parties and covering more daily tasks. Trading partners can create confidence thanks to blockchain. The capacity to monitor and secure the supply chain is improved by making more precise data available in blockchain. This lowers the risk for insurance. A game changer are automated payments and smart contracts. In particular, they decrease traceability and enhance efficiency while enhancing bureaucracy. They also permit escrow payments by holding funds until the conditions of the agreement are met, at which point they automatically release them. to achieve cutting-edge supply-chain systems. The recent coronavirus pandemic event demonstrated the significance of supply chain infrastructures for interacting with various ecosystems. Interoperability and compatibility appear to be essential for the global supply chain following this pandemic since Covid-19 has had a significant impact on the network of supply chains that are now in place. Blockchain technology makes it possible for separated supply chain systems to interoperate securely at minimal cost and with optimal efficiency. (Liao, 2020)Despite all of its advantages, blockchain technology is not a universally applicable solution. To implement initiatives in the supply chain arena, new issues with blockchain and other helping technologies must also be addressed. Supply chain systems based on blockchain require a number of new legal restrictions.Supply chain systems require a high level of transaction throughput, which current blockchain platforms are unable to exactly provide. Supply chains bring together a variety of participants with different priorities. Therefore, it is necessary to offer incentives to all parties, such as increased efficiency, better liquidity, and data security. The considerations of security and privacy are also crucial. Lack of widely acknowledged baseline protocol standards for IoT interaction and data security issues with IoT.IoT devices are discovered, connected, and validated using a single model that serves as the foundation of the present IoT ecosystem. As a result, transformation is required for blockchain adaption.

4. IMPACT OF BLOCKCHAIN ON LOGISTICS INDUSTRY

Tracking assets from miners to customers is   crucial for the mining and jewellerysectors.The ability to trace an asset's history makes it easier to establish ownership in theft cases and to verify validity. Due to the high value of diamonds, insurance fraud costs the industry $45 billion yearly, and 65% of false claims go unreported. Blockchain is used by EverLedger and De Beers Jewelry Company to track assets over time in order to reassure customers that they are purchasing authentic goods.The largest mining company in the world, BHP Billiton, intends to use blockchaintechnology to bettertrack and record data during the mining process. This section showcases supply chain innovations built on the blockchain that are more focused on the logistics sector. Blockchain-based supply chain solutions are the focus of supply chain actors and entrepreneurs looking to boost productivity and cut costs. Numerous projects are still in progress.For instance, the ocean shipping and logistics industries will have access to the Global Shipping Business Network (GSBN), which was developed by nine ocean carriers and terminal operators, and the global cross-border supply chain constructed by IBM and Maersk. In order to improve the real-time matching of loads and empty trucks, United Parcel Service (UPS) uses block chain in conjunction with the truckload price futures market.

5. IMPACT OF BLOCKCHAIN ON AGRICULTURAL AND FOOD INDUSTRIES

The agriculture and food industries already use blockchain technology to improve several supply chain features like traceability, insurance, finance, transaction, and optimization, as shown in the summary in Figure 3.
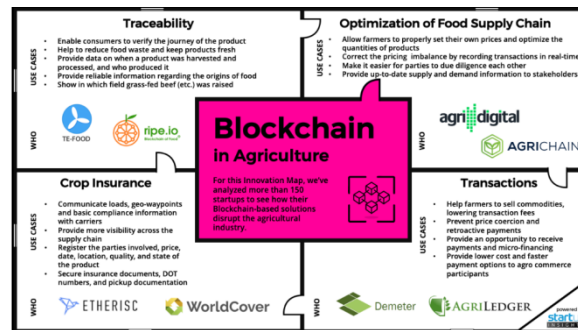

Fig. 3. The areas within the agricultural sector improved by blockchain (StartusInsights, 2018)

The blockchain-based initiatives and solutions are mentioned below, organised by category (CTA GIZ, 2019), (UN FAO and ITU, 2019), and more. (StartusInsights, 2018).

6. TRADE AND COMMERCE IN AGRICULTURE

- AgriChain is a blockchain business that specialises in eliminating intermediaries and end-to-end agricultural processes.
- AgriDigital, a blockchain-based, cloud-based, and IoT-based solution for the worldwide grains business. Through a single platform, it links farmers, buyers, site operators, and funders. They are permitted to contract, deliver, and make payments in real time while maintaining security.
- AgriLedger, a British social entrepreneurship project that supports farmers' access to financing, the storage of transaction data, and the origins of their food.
- Farming cooperatives managed by and for regional farmers, such as AgUnity, FAO, Gates Foundation, and International Finance Corporation (IFC). Collective bargaining, the development of a network of farmers in which they can decide to pool resources and equipment, and assistance in helping farmers choose more lucrative crops to sow.
- Agroxy, a trade platform for agricultural products founded in Ukraine.
- Demeter - A central hub for renting and maintaining micro domains anywhere in the world without the need for middlemen or the complexity or weight of a sizable organisation.

7. FINANCE AND INSURANCE FOR AGRICULTURE

- Worldcovr - Creating a system of product insurance to guard against loss of yield by using satellites to monitor precipitation and immediately initiate payments.
- Trado - A group thatfor a cutting-edge blockchain supply chain financing system
- Etherisc - A blockchain business that uses decentralised insurance methods to provide farmers with product insurance.
- FARMS, a platform for managing financial and agricultural risks that includes satellite sensing for smallholders supply chains for food
- Walmart, one of the largest retailers in the world, is creating a blockchain-based traceability system for lettuce participation.
- Walmart is utilising a blockchain platform created by IBM to attempt and trace fresh and leafy greens items all the way back to the farm. Walmart tracks the meat it imports from China using blockchain technology. Data like cold chain procedures and sales dates are recorded in the blockchain for this reason
- .• Major multinational corporations like Unilever, Nestle, and Dole also utiliseblockchain for related objectives.
- A blockchain-based application case for cold chain logistics is IBM Food Trust. Transparency and accountability in the food supply chain are goals of Food Trust.
- Customers may follow their food all the way to their tables with the public permissioned blockchain platform TE-FOOD, which was founded in Germany in 2016.
- A 2018 UK startup called Provenance traces food. Customers can learn more about the origins of their products and determine whether a product is actually safe or harmful to the environment.
- The firm Ripe uses high-quality food data to build the Food Blockchain, which charts the travel of food, with the goal of creating a transparent digital food supply chain.

8. IMPACT OF BLOCKCHAIN ON AUTOMOTIVE INDUSTRY AND MICROFACTORY CONCEPT

The global supply chain's engine has traditionally been regarded as being the automotive sector. There are many blockchain-related supply chain use cases in the automotive industry. The potential use cases for blockchain technology in the automotive industry are outlined in Figure 4
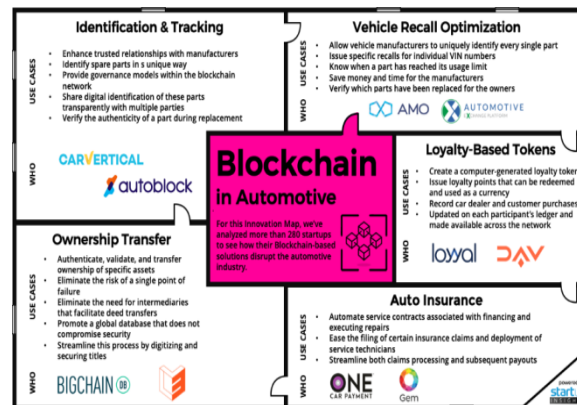

Fig. 4. The areas within the automotive sector improved by blockchain (StartusInsights, 2019)

Small-scale manufacturing facilities may actually have a competitive advantage to produce specialised goods for particular local demands, at a local scale, because smart factories enable rapid retooling. In this study, the microfactory concept is proposed as an innovative production facility to produce new-generation electric automobiles.To integrate and empower communities of international designers, engineers, manufacturers, and automotive fans, Local Motors created automobile-building micro-factories around Phoenix, Las Vegas, and Knoxville. They also provide an open library of car ideas. As everyone now has access to information thanks to the Internet, it can be argued that distributed manufacturing, which uses decentralised production, has the potential to democratise the manufacturing function. Designing and manufacturing would also be easier for everyone to access. But a shoddy infrastructure for the supply chain might raise the price of distribution. For microfactory networks, supply chain security is essential. It is necessary to have a clearly defined supply chain for parts such the motor/inverter, tubular SHSS, electronic board, lighting, seats, battery cells, etc. For upcoming research, it can be enhanced by adding blockchain technology to the supply chain.Since there is no "central authority," using a blockchain is a straightforward way to send information in an automated, secure manner without the need for intermediaries. In addition, it offers transparency, speed, accessibility, and consistency, which makes blockchain logic compatible with the microfactory networks' business model.

9. DISCUSSION AND CONCLUSION

According to this report, blockchain technology will undoubtedly play a significant role in improving and fundamentally altering supply chains across a wide range of businesses. It will be expected to produce more environmentally friendly solutions for the supply chain bottlenecks that are currently present in many industries, including logistics, agriculture, and the car industry. The transactions will become quicker and more safe by cutting out the middlemen with blockchain-based transformations, owing to cryptography. In order to enable blockchain-based supply-chain management systems, infrastructures are growing alongside regulatory changes, technological breakthroughs, and new financial mechanisms.

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