Supply Chain Management using Blockchain Technology

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ABSTRACT: ***Blockchain technology has a wide range of applications, including supply chain management (SCM), where it may replace mid-size activities in many transaction-based processes throughout the supply chain. Because blockchain technology has a disruptive impact on the creation and operation of the supply chain, it is critical to investigate future applications. The urbanization of supply networks makes management and control more difficult. As a distributed digitized leading technology, that ensures transparency, traceability, and security, blockchain technology holds the potential of simply addressing some global supply chain management problems. Distributed supply chain coordination, material and data flow coordination, online companies, agile supply chain management, supply chain management flexibility, supplier measurement, supply chain resilience, risk and reel effect, real-time controls, and supply chain-based service are all technical potential problems associated with blockchain advancement discussed in this study. This research looks at a variety of sectors, including shipping, manufacturing, and automotive, aviation, finance, technology, energy, health, food and farming, e-commerce, and education, to see how blockchain technology may help with visibility and business process management. In addition to future theoretical studies, technical and engineering research is critical for a variety of supply chain issues.***

KEYWORDS: ***Application, Blockchain, Management, Supply Chain, Transactions.***

1. INTRODUCTION

1.1. Blockchain Technology

Blockchain is a distributed database system for storing, encrypting, and regulating transaction data and other data. The mysterious person or people behind Satoshi Nakamoto White Paper created the data format in 2008, and it combines data logs in a chain called blocks. Over a computer network, the chain is an electronically distributed directory or list of entries maintained by users or members. To process and validate transactions, blockchain, in particular, use encryption. A distributed system provides the fundamental advantage of addressing issues of transparency and accountability between people and organizations that do not necessarily align the participants' interests in a corporate setting where no one entity has any power[1].

The essential data of all parties may be updated in real time, eliminating the need for long, error-prone reconciliation procedures in each party's internal registries. As a result, each network member has a far more detailed picture of the network's activities over time. OSCM experts are now paying close attention to it, since it may be a source of big data that is extremely valuable for businesses and supply chains. The encryption of data on a blockchain improves the transparency, efficiency, and trustworthiness of information transmission[2].

There are four main characteristics or qualities of a blockchain. For starters, since it was designed for networking distribution and synchronization, it promotes businesses to share data, making it ideal for multi-company commercial networks such as supply chains and financial consortia. Second, smart contracts, an upfront agreement between parties, and a blockchain agreement are all features of blockchain. A smart contract is a computer system that digitally facilitates, verifies, and enforces contract terms, allowing for trustworthy transactions without the need for automated third-party involvement[3].

These protocols may decide whether a certain activity, such as a payment, is permitted. Intelligent contracts may create functions and criteria, including the validation of assets via a succession of non-monetary element interactions, in addition to the payment itself, possibly through crypto-currency. This gives the network's many stakeholders confidence that everyone is following the rules. Finally, a blockchain is built utilizing peer-to-peer networks, and all parties involved agree that a transaction is legitimate in order to keep erroneous or potentially fraudulent transactions out of the database. Fourth, data immutability refers to the ability to record and not change agreed-upon transactions. This provides assets with information on where they are, where they have been, and what has happened to them during their lifetimes[4].

There are two types of blockchain: private and public (e.g. Bitcoin). The most important difference is who is allowed to participate in the network based on membership. Anyone may join and participate in the network at no cost. Typically, the network has a mechanism in place to encourage new members to join. Bitcoin is one of the world's biggest public blockchain networks now. One of the drawbacks of a public blockchain is the need for a large distributed leader [5].

1.2. Blockchain Architecture:

There are five modules for the different processes and for blockchain applications, it creates protocols:

- *Data Source Module:*

It helps to construct the "distributable and common database" blockchain. It assures that the retrieved data are unmodified and uncorrupted by blockchain users. Note that the fundamental characteristics of blockchain are the immutability of information, manipulation-proof storage and data ledger exchanged via data application interface [6].

- *Module of Transactions:*

The "transaction trip in blockchain," it monitors, administers, enables and facilitates. This helps validate and enable the blockchain to be added. Even if the transaction is intelligent, data is transmitted. In addition to the common visibility of transactions, the blockchain also constitutes the flow of information across SC. Transactions are grouped and sent as a block to each node. Note that once completed transactions are almost hard on blockchains to remove or turn back [7].

- *Creation Module of Blocks:*

Blocks may be seen as mineral-created data structures. They include transaction information and details which are duplicated at all network nodes. The block creation module allows new blocks to be added to an existing SC by supplying prior block hash values and links. Transaction sequences are kept in chronological blocks and blocks that readily identify and monitor incorrect transactions.

- *Module for Consensus:*

Work proof and evidence of state methods are used to check and validate all transactions to prevent data corruption. Data consistency through well-developed consensus methods is maintained in the distributed network. Distributed consensus contributes to both the validity check and the establishment of links between the blocks in the blockchain system.

- *Connection Module and Interface:*

It monitors transaction tracking and assists in the provision of real-time smart contracts data. This module synchronizes all platforms, methods and software needed for blockchain applications with information technologies (IT). Depending on the uses, multifaceted ledger systems that offer consent algorithms for the blockchain system may be offered on the market irrespective of whether the blockchain is public, private, permitted or not.

1.3. Characteristics of Blockchain

The blockchain features that make it distinctive and promising for future industrial applications are:

- *Decentralized:*

System data may be viewed, monitored, saved and updated on several platforms.

- *Transparency:*

Data is captured and kept on the network and is accessible and traceable over the life of the network by consensus.

- *Unchanging:*

Blockchain offers timelines and rules for immutability determination

- *Irreversible:*

A definite and verifiable record is maintained in every blockchain for every transaction ever made.

- *Open source:*

Blockchain allows all people with a sense of hierarchy open-source access inside the network.

- *Anonymity:*

The person's identity stays anonymous as data transit takes place between nodes.

- *Ownership and Unique Nature:*

Every blockchain documents save their ownership records with a unique hash code every document transferred.

- Origin:

Every product has on the blockchain a digital document that demonstrates its origin and validity.

- *Automation of contracts (i.e. intelligent contracting):*

It is a little computerized software for contract execution. It substitutes the requirement of a common contract with improved security and cheaper transaction costs.

1.4. Blockchain-Based Supply Chain Management

Blockchains may be a disruptive tool for design, management, management and general supply chain management. Blockchain's capacity, together with smart contractual agreements for a trustless environment, to ensure the trustworthiness, traceability and validity of information all promote a fundamental rethinking of supply chains and supply chain management. In this part, we will examine in further depth the value proposition and the application and structure of the blockchain technology for products and manufacturing supply chain[8], and potential new supply chain components as shown in Figure 1.

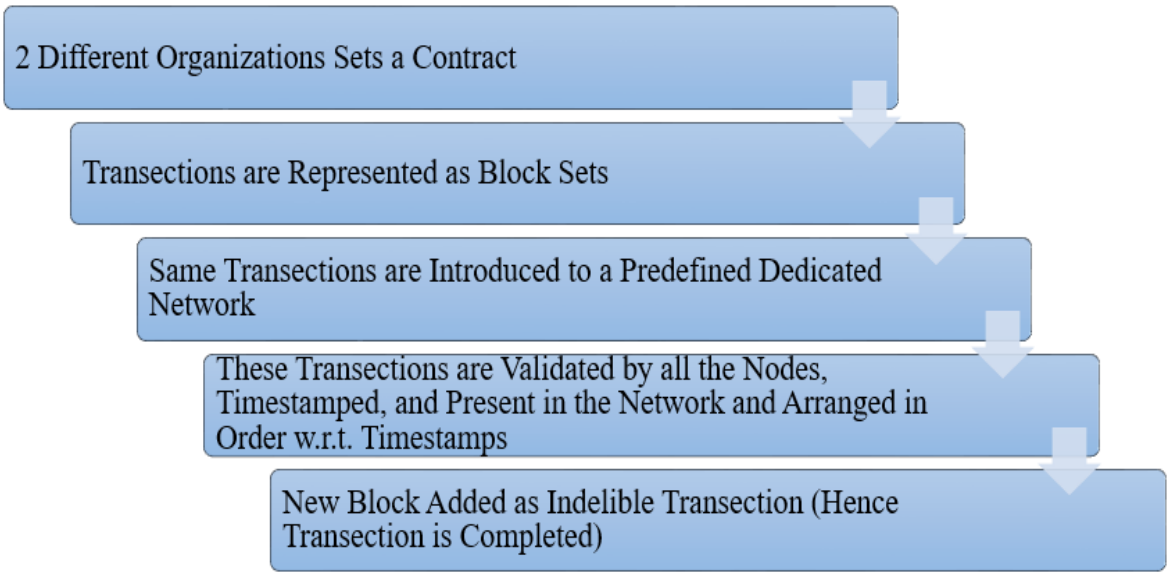

Figure 1: Blockchain over View Work Flow Diagram Showing the Networking Distribution.

1.5. Blockchain and Sustainable Supply Chains Management:

Through the dissemination, immutability, openness, and trustworthiness of community-shared datasets, blockchain may have an effect on sustainable supply chain networks. The tracking of potential social and environmental conditions that may create environmental, health, and safety issues is a major application focus point for blockchain. There are several real-life instances[9].

Sustainable supply chains have piqued the attention of academics and practitioners alike. The emphasis on environmental and social dimensions has made the supply chain more broad-based and comprehensive, in addition to being critical for sustainable supply chains for economic elements. The potential features of

blockchain technology may be a remedy for such complexity in three areas of sustainable development: economic, social, and environmental issues. The breadth of Blockchain technology may be shown through the selection and identification of examples for sustainable supply chains. Data collection, storage, and administration are made easier using blockchain technology, which supports critical information in the product and supply chain[10].

Transparency, impartiality, and safety may be accessible to all supply chain agents and stakeholders in this technological context. Concerns around supply chain sustainability plague the food and beverage industry. The intersection of radio-frequency identification and blockchain technology is interesting to employ in the context of an exciting application to equip a food supply chain with a traceability system for real-time food tracking based on risk analysis and control point rules. It can record occurrences in a farmer's supply chain. Because only authorized stakeholders may gather complete information, which might result in significant social damage to them, blockchain can help provider chains identify unscrupulous suppliers and fraudulent goods[11].

Economically, the adoption of blockchain technology may benefit a business and its supply chain in a variety of ways that affect economic performance. We provide many examples, many of which demonstrate the economic rationale for blockchain in the supply chain. Blockchain have the potential to break up the supply chain by decreasing transaction costs and speeding up the process. Blockchain technology solutions can instantly transmit data changes, allowing products and processes to be implemented rapidly while reducing human errors and transaction delays.

Blockchain technology ensures data security and authenticity, lowering the cost of protecting data against arbitrary and intentional modifications that raise supply chain risks and undermine business dependability. Customers and government agencies are increasingly demanding transparency in the supply chain. Pioneering businesses gained the competitive advantage of openness by increasing customer trust in purchasing more and benefitting enterprises financially.

Blockchain can prevent unfair seizure of people's assets by unscrupulous individuals, governments, or agencies since information cannot be altered without consent from authorized parties. Blockchain technology may deter bad actors by making corrupt individuals and society accountable for their actions. Through increased human rights protection and fair and safe work practices, blockchain traceability helps to sustainability. Detailed product history records, for example, allow consumers to trust the ethical origins of the goods they are buying.

2. DISCUSSION

Through the extraction of the articles needed to connect the above-mentioned blockchain characteristics to supply chain management issues, a general reference framework is developed to address the suitability of blockchain applications for supply chain management phases. Based on the above discussion of various proposed strategies for resolving supply chain management problems relating to distrust, undertaking, transparency, information exchange, and mitigation efforts in the BWE, most proposals still require an established trust basis, cooperation, and centralization of computer technology as well as common information. Blockchain technology, on the other hand, solves all of the aforementioned issues as well as the flaws in the current solutions.

On all levels of the supply chain, the challenges related to the need for trust and decentralized structures to qualify for the blockchain implementation leading to the framework were studied in literature. We will conduct a formal systematic study as part of our future effort to provide a complete framework for academics to design and evaluate if blockchain implementation technology will fit industrial supply networks. We will undertake a thorough evaluation as part of our review.

Many of these impediments are based on disruptive technology concepts. These are the first articles to identify and classify blockchain roadblocks as they relate to the adoption of technology for supply chain goals. The barriers to blockchain adoption in the supply chain may be seen of as a series of issues that affect not just the relationship between supply chain partners, but also the relationship between partners' employees and stakeholders.

3. CONCLUSION

The application of blockchain technology in supply chain networks was introduced and explored in this article. The blockchain supply chain management system allows for the creation of shared, safe, decentralized books,

digital autonomous agreements (smart contracts), and trustworthy and secure networks. Furthermore, it enables peer-to-peer transactions by reducing the role of intermediaries in the network.

Beyond conventional information systems, such as web-based connection in supply chains, there is a lot of opportunity to understand and apply this technology. Transdisciplinary efforts are needed to properly comprehend the effect of blockchain technology on the supply chain. Practical performance measures should be made accessible to professional organizations, and standards should be developed in collaboration with such academies. There is certainly a significant amount of work in the field of future research.

There are considerable possibilities of better understanding this technology and application than conventional information systems and online supply chain integration. We encourage institutions to review and build on research ideas. We assist supply chain studies and growing digitalization. Transdisciplinary efforts will be required to fully comprehend the implications of blockchain technology on the supply chain. Industry experts must engage as well as collaborate with academics to develop emission criteria and provide actual measurements of blockchain efficacy. There is certainly a significant amount of work in the field of future research.

In addition to future theoretical research, technical and engineering research on a variety of supply chain issues is also required. Distributed supply chain coordination, material and data flow coordination, virtual companies, agile supply chain management, supply chain flexibility, supply chain performance measurement, supply chain resilience, risk and reel effect, real-time controls, and supply chain-oriented service are all technical issues that could arise as a result of blockchain advancement.

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