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Blockchain Technology for Secure Supply Chain Management

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ABSTRACT -Supply chain management (SCM) is a core corporate activity responsible for moving commodities and services from one point to another through a variety of stakeholders. The traditional SCM is based on a centralized approach managed at the central headquarter, and all other sub-offices get instructions from the main office. Some major issues with present SCM systems are security, transactional transparency, traceability, stakeholder involvement, product counterfeiting, additional delays, fraud, an instability. Blockchain (BC) emerges as a technology that can manage the data and build trust efficiently and transparently. It can also aid in transaction authorization and verification in the supply chain or payments without a third party. To address the present SCM issues, BC technology is a feasible solution. Motivated by the aforementioned considerations, in this paper, we present a survey on the adoption of BC in SCM. Then, we have highlighted open issues and research challenges for adopting BC technology in SCM that open the doors for beginners eager to start work in this amazing area.

KEYWORDS: Supply Chain Management (SCM), Blockchain Technology (BC)

I. INTRODUCTION

The Blockchain model is a revolutionary technology for businesses, and it can be particularly useful for cross-border payments, trade arrangements, remittances. This can also allow different new business opportunities in various sectors like retail & CPG, healthcare[1] and life science and communication. Although it is a relatively technology, block chain is rapidly advancing and developing. Aside from private firms, there are various government branches which have started using blockchain for administrative purposes at small scale for various uses like land deals. The state government in Kerala has implemented a strategy to use the block chain technology to modernise purchase and supply network of vegetable, fish and various other small scale retail network. Block chain technology in yield insurance would help dodging time-lag in the valuation and delivery of compensation to farmers who suffer losses due to natural disasters. It will make the entire process, beginning from creating applications for coverage to the settlement of claims smooth and efficient. The subsequent sections will detail traditional supply chain network, features and benefits of blockchain, and how blockchain can streamline the supply chain.

With the cost of computing, storage and bandwidth plummeting sharply in the recent years. It has become increasingly easier to digitize the supply chain, making it more efficient to use. The blockchain technology has entered the world of Supply Chain to make way for better and safer transactions. It can disrupt the way we produce, market, purchase and consume our goods. Brisk execution of purchase orders, easy invoice processing, minimal need of payment reconciliation, eliminating counterfeit or loss of goods are few of the many advantages blockchain promises the supply chain industry[2]. Contracts between parties can now be made digital and automated eliminating the need for voluminous paperwork, associated errors, delays and risks of fraud. Substantial business value can be delivered by increasing transparency, reducing risks and improving efficiency and overall supply chain management using the blockchain.

Blockchain consolidates transportation as well as warehousing and offers such services to managers who wanted to reduce operation cost. It the business of managing various elements of the supply chain via contract or outsourcing. A blockchain manages all or part of a client's logistical requirements, which may include transportation, inventory optimization, warehousing, order fulfilment, or the integration of these and other functions. moreover, blockchain, providers to offer ten key services, including strategic capacity, logistics expertise, network analysis, mode and load optimization, cost-containment strategies, vendor compliance management, system support, actionable business intelligence, best practice sharing, and risk profile reduction[3]. There are many reasons to switch to blockchain:

1. Improve customer service level
2. Integrate the entire supply chain
3. Reduce conflict and reciprocate on mutual goal related matters
4. Increase efficiency, stability and flexibility
5. Increase productivity
6. Reduce risk, uncertainty and fluctuation
7. Leverage resources to the mark. No resources are
8. under or over utilized. Improve expertise, market knowledge and data
9. access Create a competitive advantage either locally or
10. globally Reduce personnel and equipment costs

II. REVIEW OF LITERATURE SURVEY

In 2008, Satoshi Nakamoto published his study on "Bitcoin: A Peer-to-Peer Electronic Cash System", in which a peer-to-peer (P2P) electronic cash system was proposed (Nakamoto, 2008). This system allowed payments to be directly initiated by one party and sent to the other without a third-party financial institution (Rana et al., 2019)[4]. In recent years, with increasing attention to digital cryptocurrencies such as Bitcoin, scholars have gradually realized the important role of blockchain, which is a crucial underlying technology of Bitcoin (Kumar et al., 2020; Nawari & Ravindran, 2019). Blockchain technology is a distribution database in which the use of cryptography technology guarantees that the distributed ledger cannot be changed, and smart contracts composed of script code enable transactions to be automatically executed (Juma et al., 2019; Kshetri, 2018). Currently, the application of blockchain technology is mainly concentrated in the financial field, but it also leads to disruptive changes in nonfinancial fields, such as e-commerce, e-government, credit evaluation and supply chains (Allen et al., 2019; Hald & Kinra, 2019; Juma et al., 2019).

Supply chain management is a comprehensive management problem involving information flow, capital flow, logistics and business flow that establishes a dynamic collaborative relationship between suppliers, manufacturers, retailers and end users (Mou et al., 2018). There are several problems with current supply chain management. First, supply chain information is isolated within an enterprise, which leads to information silos (Jiang & Ke, 2019). Upstream and downstream enterprises expand the information, causing a bullwhip effect (Jeong & Hong, 2019). Second, the opacity of information in the supply chain reduces the trust between parties and hinders the exchange of real information (Jia et al., 6 2020). Third, product tracking is difficult, and particular difficulties arise in finding the source of the problem when counterfeit and inferior products appear (Zhang & Guin, 2020). Blockchain technology is very suitable for solving these challenges faced by the supply chain since it can ensure the authenticity and traceability of information during transmission and the security of transactions in a distrusted environment (Helo & Hao, 2019; Tijan et al., 2019)[5]. These characteristics have a substantial impact on supply chain management and affect the design, organization, and operations of the supply chain (Hald & Kinra, 2019; S. Kamble et al., 2019) Some scholars conducted studies on the blockchain-based supply chain to explore the potential of blockchain. For example, Y. L. Wang et al. (2019) conducted a literature review to determine the value of blockchain for supply chain management in four areas that encompassed: extended visibility and traceability, supply chain digitalization and disintermediation, improved data security and smart contracts. Philipp et al. (2019) identified potential applications of smart contracts in multinational and multi-mode supply chains through expert interviews and case studies. Even if there are some related studies, it

should be clearly recognized that these types of studies are still in the early stages, and related academic articles are not fruitful (Pournader et al., 2020). In addition to academic publications, industry is also exploring the application of blockchain in supply chains. In the food industry, Wal-Mart has established a traceability system for mangoes that improves food traceability and shortens the traceability time of mangoes from farm to store from the original seven days to the current two seconds (Wong et al., 2020)[6]. In the trade industry, Maersk and IBM cooperated to use blockchain technology to solve problems in cross-border supply chains because it increases information transparency and realizes information sharing among trading partners (Y. L. Chang 7 et al., 2020). Despite the aforementioned academic and practical concerns, the understanding of the impact of blockchain technology on supply chains is still limited. To better understand the value of blockchain, identify the current research content, and determine a research agenda for the future, this article reviews publications related to blockchain-based supply chains

Some articles have carried out literature reviews about blockchain-based supply chains, and the articles reviewed here are presented in Table 1: five articles focused on food supply chains (Antonucci et al., 2019; S. Chen et al., 2020; Duan et al., 2020; H. H. Feng et al., 2020; Zhao et al., 2019), two articles reviewed the transportation field (Astarita et al., 2020; Pournader et al., 2020), and the remaining four articles did not have a specific application background (Gurtu & Johny, 2019; Queiroz et al., 2019; Wamba & Queiroz, 2020; Y. L. Wang et al., 2019). These articles analyzed the value, current trends and future opportunities from the perspective of the impact of blockchain on supply chains[7]. To the best of our knowledge, no literature review has been carried out that considers the four aspects proposed in this article, including supply chain themes, research methodologies, illustration types and industries addressed. In addition, this article also discusses the value that blockchain will bring to the supply chains through the content of the existing research works, which has great significance for the technology at its early stage of development.

Blockchain technology, In technical terms, blockchain refers to a distributed ledger composed of a series of data blocks that are linked through cryptographic methods (Zachariadis et al., 2019)[8]. Each block records a batch of network transaction information; the structure of a block is shown. A block consists of a block header and a block body(Z. Y. Liu & Li, 2020)[9]. The block header holds information used to connect to the previous block and information used for verification, including the version number, the hash value of the previous block, the timestamp of the current block writing time, the nonce and difficulty target used to prove the difficulty of the workload, and a total hash of Merkle tree root for verifying the block body transaction (Azzi et al., 2019).

III. EXISTING SYSTEM

Several industries outside of finance, such as the supply chain, are among the most extensively discussed BC applications. BC technology is ideal for addressing supply chain concerns[10].The possibility of adopting BC technology in SCM has been a topic of investigation, and several reviews have been published so far that gives an overview of the current situation and a research path forward.

Disadvantages Of Existing System

- One of the main disadvantages of blockchain technology is the **immutability of data**.
- It benefits financial and supplies chain systems. Immutability can only exist if network nodes are fairly,distributed.
- A blockchain network is vulnerable if one entity owns at least half the nodes.

IV. PROPOSED SYSTEM

Highlights their primary objective, key contributions, and limitations, which can be useful insight for beginners who want to start research in this emerging area.

Advantages Of Proposed System

- Increased Supply Chain Transparency
- Enhancing Traceability
- Increasing Efficiency and Speed and Reducing Disruptions
- Improving Financing, Contracting, and International Transactions
- Streamlined Supplier Onboarding

V. SYSTEM ARCHITECTURE

The users of this application are admin and users which stands as UI for the system. The authentication process is common for all users and the admin of the website. After successful login the user views the products which are marketed by the particular organization[11]. The user can able to sort the items and view it based on the user requirement provided then the user selects the particular model and then purchase the product by providing necessary details. After usage of the products if any problem occurs in the product, then the user register complaint about the product. The admin maintains and manages the website by updating the new products details and analyses the complaints. The deployment is performed as per the requirements of Hardware and software specified in the requirements phase.

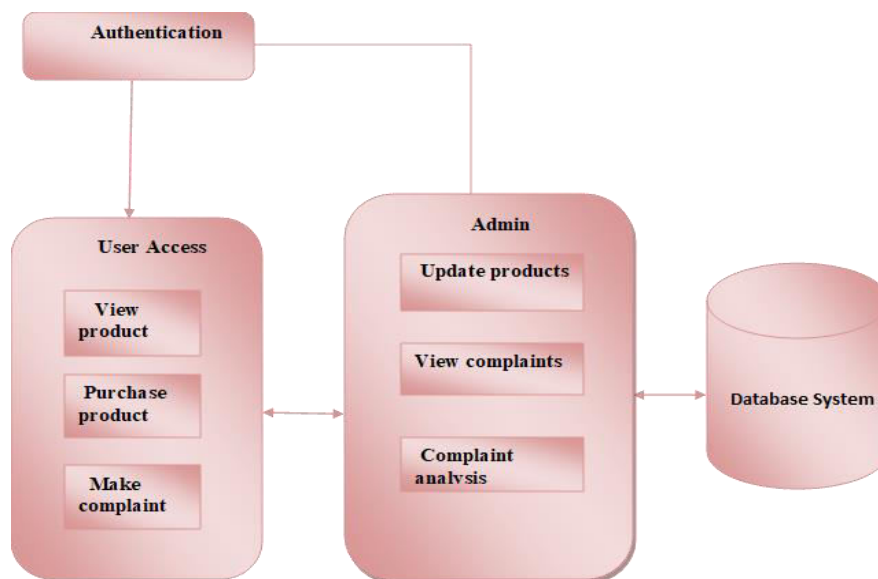


Fig 1 System Architecture

VI. SYSTEM IMPLEMENTATION

MODULES

Customer

1. Authentication
2. View Products
3. Purchase
4. Complaints



Admin

1. Updating product data
2. View complaints

MODULE DESCRIPTION

AUTHENTICATION-If you are the new user going to access the make request or process request then they have to register first by providing necessary details. After successful completion of sign-up process, the user has to login into the application by providing username and exact password. The user has to provide exact username and password which was provided at the time of registration, if login success means it will take up to main page else it will remain in the login page itself.

VIEW PRODUCT-In this module the user can view the list of products, product models, brief description about the products such as product type, product series, product model, hard-disk size, hard-disk brand, RAM, Video-card, OS, Processor and the cost of 28 product which is available in online for purchase of the products of the particular company and its brands. These Products are updated by the admin where the user can view and select the product for purchase.

PURCHASE-In this module after the user's login the user views the list of products and its cost in home page[12]. The user provides the selected product type and the product series then they view the result in which they can view the products which are available for purchase. On viewing this product, the user selects the product which is needed by them and then conform the purchase of the product by providing necessary details such as name, location and account details to purchase the selected product and to get delivered.

COMPLAINTS-On purchasing the product, the user uses the products and if any complaint arises then the user make complaint about the particular product and the fault details as such as product type, product name, complaint nature and also providing personal details of the customer in our website to get solution to their complaint. On providing the complaint in the website the complaint is stored in the database for analysing the complaint and to provide solution to the complaint internally.

UPDATING PRODUCT DATA-The admin is the person going to manage and maintain the website by updating the details of the product such as products type, product series, product models, hard-disk size, hard-disk brand, RAM, OS, Video-card, processor brand, monitor size and the cost of the product. The image of the particular model is browsed and then selected and uploaded to database; on successful completion of updating the 29 product details the users can view the products by browsing and selecting the particular products.

VIEW COMPLAINTS-After admin get login they can view the list of complaints made by the all the customers of the product. On viewing the overall complaints made by the customers, the admin will evaluate the each and every product manually by analyzing which product has received major faults by providing product type, product series, product model and complaints on the parts of the products to improve the quality of the product and make the product as best based on customer complaints Blockchain



VII. RESULTS AND DISCUSSION

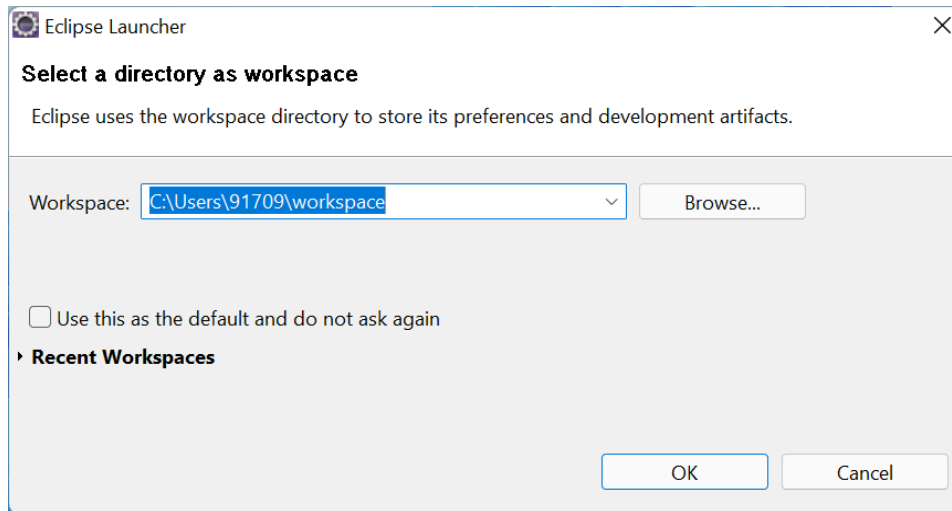


Fig 2 Eclipse Launcher

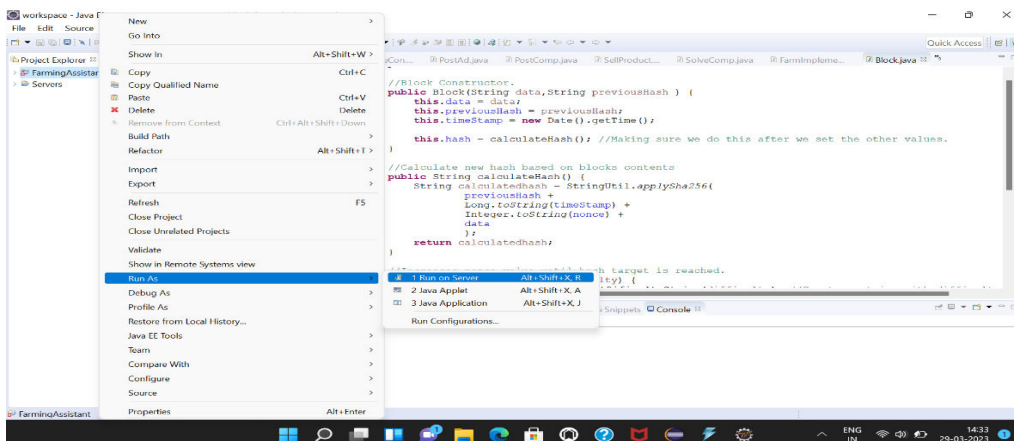


Fig 3 Running the file in Eclipse Launcher

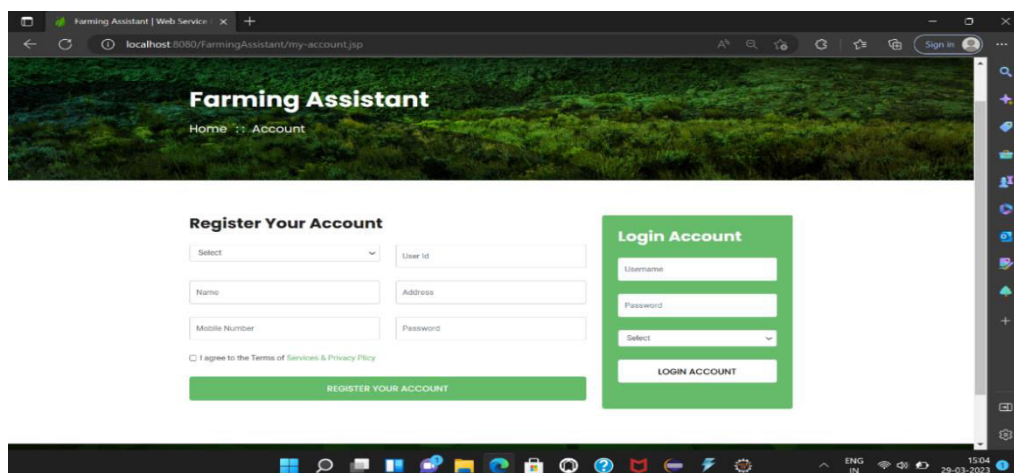


Fig 4 Webpage home

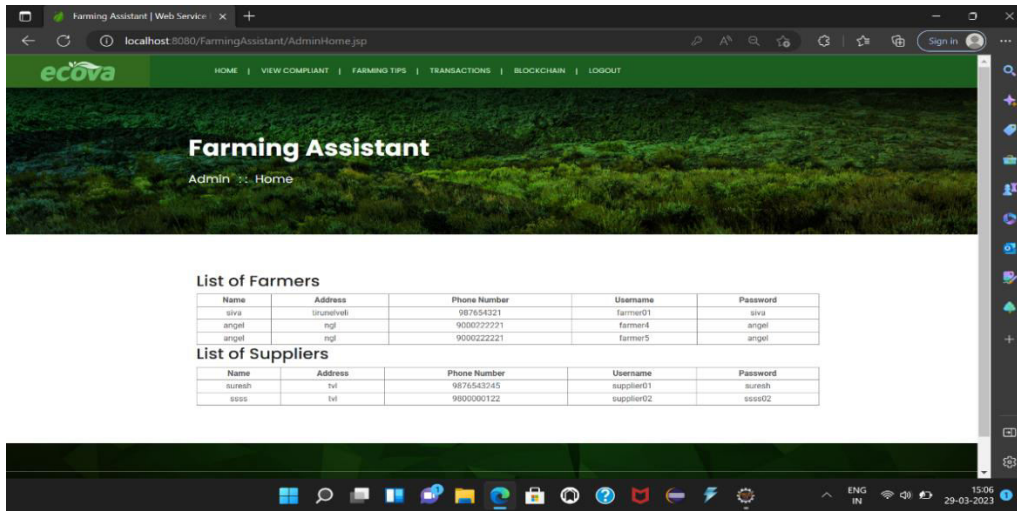


Fig 5 Admin page

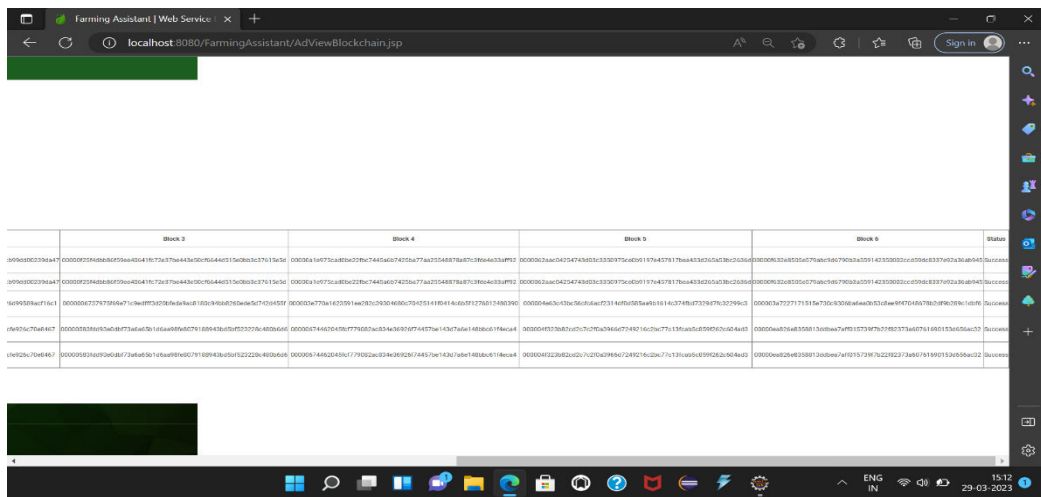


Fig 6&7 Blocks of Transaction

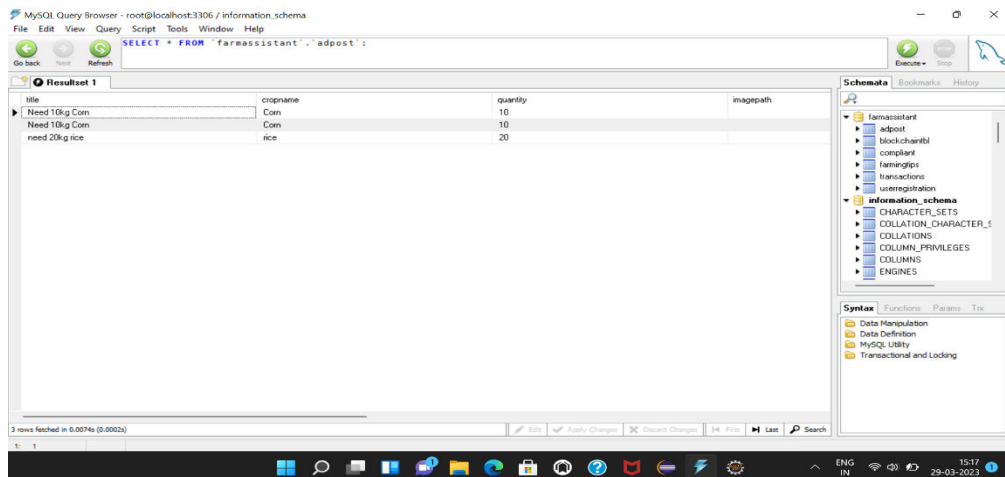


Fig 8 SQL Database

VIII. CONCLUSION AND FUTURE ENHANCEMENTS

This Project attempts to investigate briefly how BC technology works and when it should be utilized to address supply chain challenges. BC technology is employed in SCM in a variety of sectors. The present state of use of BC and Smart Contracts in numerous major industrial domains is studied in this project. The survey delivers academically sound data on the overall state of BC deployment for various supply chains. The study's endings and conclusions show that research on BC-based supply chains is a growing topic garnering a lot of attention. Most of the reviewed papers that were evaluated agreed on the prospective benefits that BC may offer to the supply chain.

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