A CONCEPTUAL FRAMEWORK FOR FOOD INDUSTRIES USING INTEGRATED BLOCKCHAIN-SUPPLY CHAIN MANAGEMENT

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Abstract

Expressing concerns about quality Cross-streaming is mostly nonexistent as a result of the difficulties in locating the source and realizing that other systems. While provenance is a clear concern in the food supply chain, transparency is a more significant challenge that is addressed properly. An issue is made worse by the cross-supply chain and a lack of transparency, which encourages each business to use localized data and work regionally. Since it approaches a global issue from a local perspective, this strategy was fundamentally incorrect. Not all sectors are well-suited for utilizing blockchain technology. Blockchain demands a sector of the economy with a convoluted, geographically dispersed supply chain and an increasing amount of different phases. The clearest illustration of this is the food sector, which is among the oldest in the world. In this paper, they propose a comprehensive blockchain-based framework for food quality advancement that allows cross-chain information sharing in close to real-time with guaranteed authenticity and precision, enabling the identification of performance faulty batches in all frameworks as soon as they are discovered in any few.

Keywords: supply chain; blockchain technology; quality improvement; defective batches

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1. Introduction

Modern supply chains are innately complicated because they include multiple tiers of geographically separated companies that compete to service customers [1-2]. It is nearly impossible to analyze data and control danger in this complex network because of globalization, a variety of regulatory rules, and a variety of cultural and human behaviors in supply chain networks [3]. Ineffective transactions, fraud, theft, and underperforming supply chains contribute to a greater lack of confidence, making better information exchange and factuality necessary.

In several supply chain businesses, including the agri-food sector, pharmaceutical, and medical items, and high-value goods, traceability is becoming an essential demand and a key distinction [4-5]. It is simple to lose or change expensive and valuable objects whose provenance would ordinarily depend on paper certifications and receipts. Lack of supply value integrity prohibits consumers and supply chain participants from confirming and authenticating the item's actual value [6]. Monitoring this accountability in the supply chain is made more difficult by the expense of dealing with intermediates and their dependability and transparency. These dangers and a lack of openness lead to competitive challenges in terms of strategy and reputation.

Present-day supply chains heavily rely on integrated, occasionally disjointed, and independent data management systems that are found within enterprises. A method such as an enterprise resource planning has its drawbacks. For one organization or broker to store its sensitive and essential data, supply chain entities must have a high level of trust [7-9]. Another drawback of centralized data systems was a single-point failure, which exposes the entire system to error, hacking, corruption, or attack [10]. Such problems raise concerns about the ability to exist supply chain information systems to provide information necessary for the prompt provenance of goods and services in a safe, transparent, and reliable way [11]. Enhancing supply chain transparency, safety, durability, and operational consistency will help solve these complex issues. Blockchain technology might have the solution to this issue. These enhancement objectives are organized, logistically, and financially possible because of new technological advancements and implementations with the notion of blockchain technology [12]. Disintermediation and decentralization among many actors in processes that are carried out on a worldwide scale are made possible by blockchain technology, which has the potential to be disruptive and resembles a decentralized, "trustless" database [13].

Related works

A new transaction in the blockchain was created by an operator and added to the blockchain. The network receives a broadcast of this new transaction for purposes of monitoring and validation [14]. This new agreement was added to the chain as a new block as soon as the majority of nodes in the chain accept it by pre-specified authorized rules [15]. For security reasons, a record of that operation was maintained on a variety of distributed servers. In the meantime, the smart contract, a key component of blockchain technology, enables the execution of reliable transactions without the involvement of third entities. The Internet was created to move information and duplicates of items, which is a key distinction between the existing Internet structure and blockchain technology [16]. The value is expressed in blockchains by operations that are recorded in a shared ledger and safeguarded by giving users access to a reliable, time-stamped record of all transactions, which offers safe and auditable data [17]. These transactions are verified by network consensus guidelines [18], making them appear. A distributed ledger of digital content, however, could be "scheduled to document practically everything of value and significance to humankind, including birth and death certificates, marriage licenses, deeds and titles of ownership, educational credentials, financial accounts, medical procedures, insurance payments, votes, the provenance of food, and anything else that can be expressed in code." This technology can include cash and currency.

Proposed Framework

In this book, they address a vast and in-depth subject. It focuses on a sector of the economy that has existed since people began living in huge groups. We'll go over the key elements of the issue with the food supply chain in the parts that follow. According to Fig. 1, the supply chains for the food and textile industries are a variety of separate activities. It is set up as an entire manufacturing network where each activity was situated where it may provide the most value for the product. The manufacturing was divided into specialized tasks. Expenses, quality, delivery dependability, accessibility to high-quality inputs, and transit and transaction costs are significant factors when deciding where to locate each activity. Walmart requested that suppliers establish standards for product labeling and resource management techniques and computer technologies for the interchange of sales data. This guarantee prompts replenishment of the clothing, which in turn enables the merchant to offer a wide selection of fashionable clothing without maintaining a sizable inventory. Enterprise in the US and worldwide has adopted this strategy, changing the competitive advantage of suppliers from primarily being a question of production costs to one of the costs combined with lead time, flexibility, and quality [19]. A company's ability to manage every aspect and impact of its supply chain would be a target rather than a given because the number of suppliers for any essential commodity rose almost dramatically along the chain. The actuality of monitoring and controlling providers was explained clearly, as seen in Figure 1. High levels of accessibility were necessary throughout the supply chain. In light of this, the enterprise's performance was reliant on openness and confidence among its suppliers.

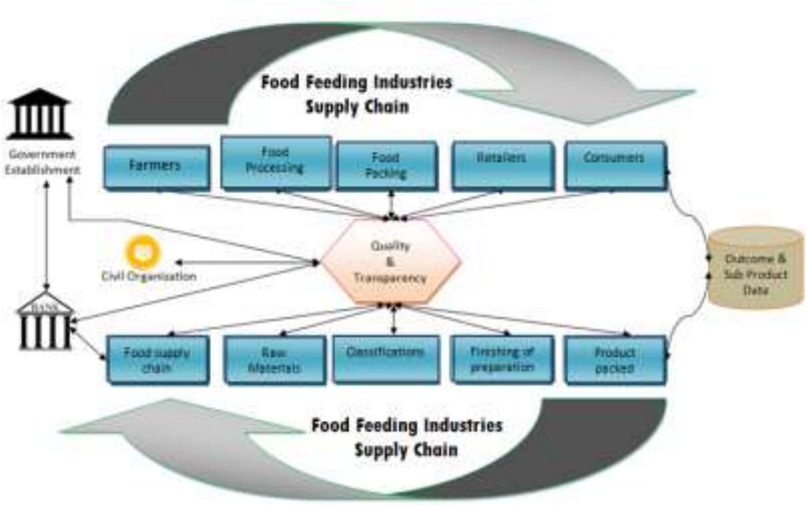

Figure 1: Conceptual representation

Surprisingly little is known about the majority of the items we utilize daily. Even though commodities pass through a frequently extensive network of retailers, distributors, transporters, storage areas, and suppliers before they get to the final consumer, their journeys are nearly always an unnoticed aspect of our assets. Although the supply chain industry generates billions of dollars in income for businesses, it is also rife with losses and inefficiencies brought on by risk, fraud, or antiquated manual paperwork delays [20]. Setting up technology so that producers, field workers, and others can gather data and a blockchain would be the critical element. Field employees will be able to submit pertinent data using cutting-edge data entry tools that operate on widely utilized cellphones and have cloud-based backends, making information accessible "in minutes, rather than days" increasing supply chain efficiency, spotting bottlenecks, and cutting waste. At each stage of the supply chain journey, the food materials data in our proposed architecture are added to the blockchain. As shown in Figure 2, each atomic unit of raw material would have a distinct identity. At the farm, recognizing the used seeds is the first step in the procedure. The initial step in the production process should be to assign a special number to the resulting crop bales. Every time a production process uses a raw material, the finished product would be tracked as a transaction on the blockchain. The transactions could be traced back to the earlier manufacturing phase and can identify the procedures and equipment used. Each equipment or production facility could be immediately connected to the blockchain and access previously recorded information about the raw materials the producer has purchased. Only the material that the maker has purchased is subject to new data being updated by the machinery. The machine would examine the documented history by verified owners of the same material batch before it began processing the material. The device would automatically submit the outcomes to the blockchain after digesting the information. When deciding whether to designate a batch as defective, a consensus mechanism was employed. The architecture enables the machine to make use of the knowledge offered by others to immediately halt operations and demand human intervention. Figure 3 illustrates the proposed structure working process.

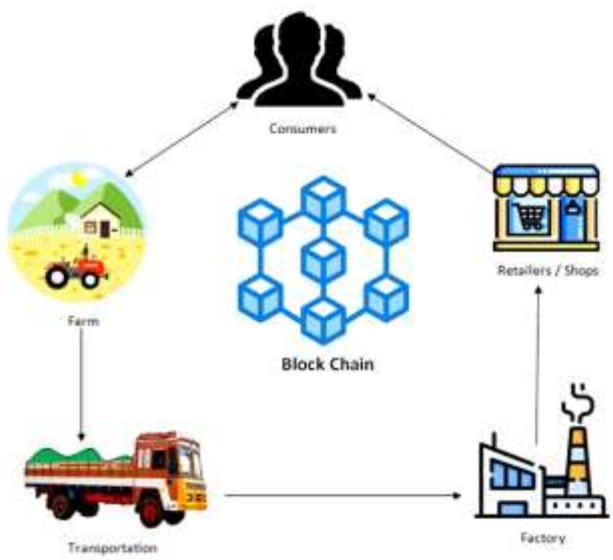

Figure 2 The presentation's matrix

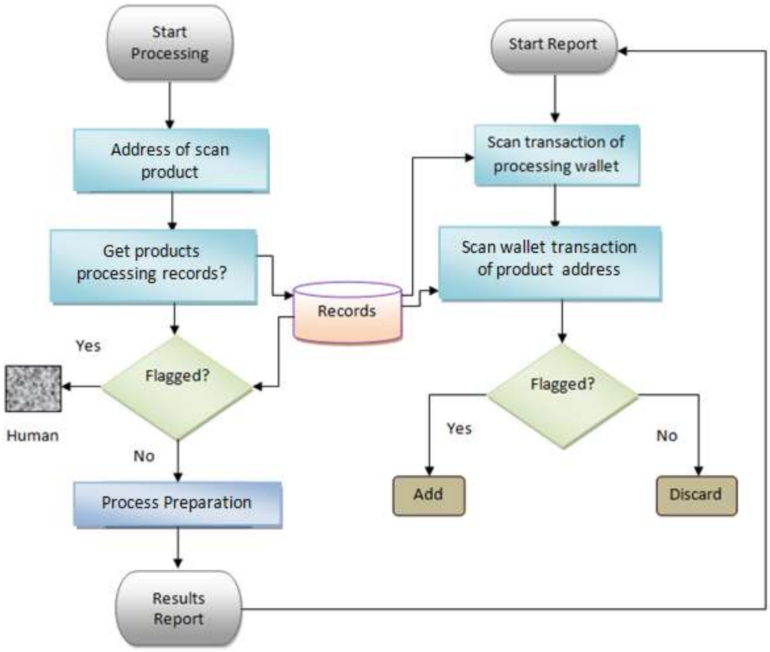

Figure 3: The proposed framework

Generally, the food chain's flaw is addressed after it has already occurred. By introducing the idea of automatic safety, if the equipment checks the chain and discovers that the batch it is about to process was marked as a poor batch for this procedure, that would halt the operation and alert the attendant would be able to decide based on the chain data presented.

Evaluation

The research was obvious that our proposed work frame offers possibilities that exist in the present status from an accountability and transparency point of view.

Researchers must consider the possible cost waste caused by the decline in customer satisfaction as a consequence of information quality while evaluating our planned work frame from the perspective of quality [21]. They expand on the proposed strategy by applying it to various supply chain stages, as shown in Figure 4. According to Equation (1), the effect at each phase was calculated and added to the phase after it.

$$Quality\ Impact = 1 - \sum_{x=1}^{x=n} \left(\frac{Sx_x}{Ax_x}\right) \quad (1)$$

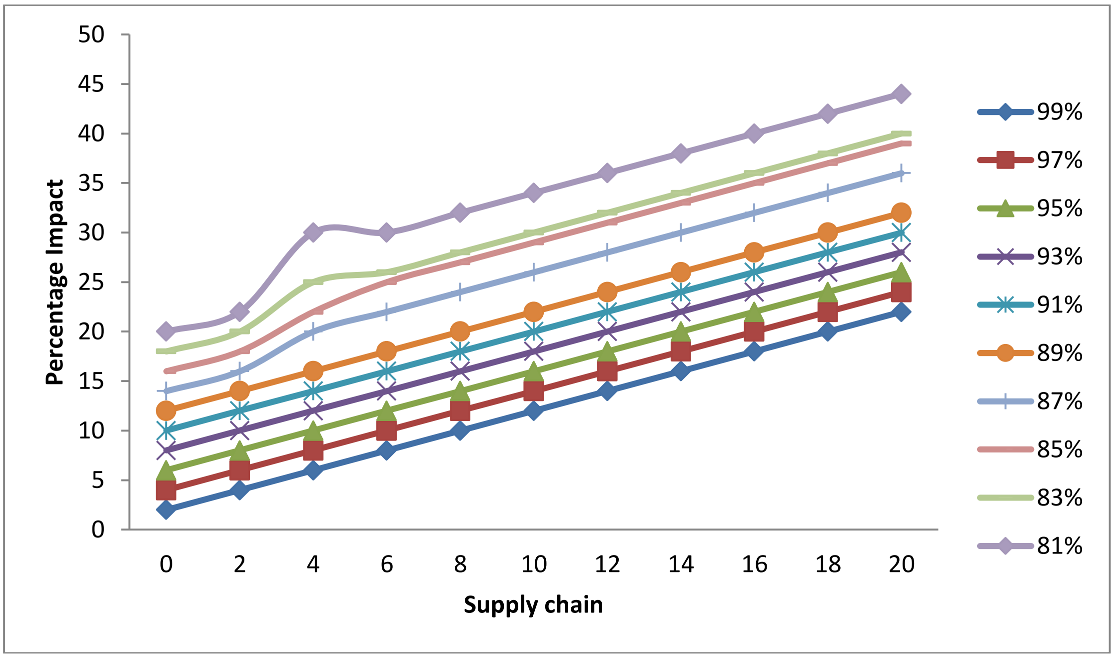

Figure 4: The phases of Food SCM

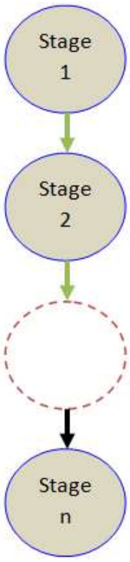

Figure 5: Supply chain effects

A lack of knowledge has an impact on downstream phases and the quality of the current stage at every stage shown in Figure 5. Our simulation demonstrates how incomplete data could have a significant impact on the process's general quality. By the tenth stage, a persistent 20% quality deficit might result in a quality decline of more than 98%. The knowledge transfer in a local garment manufacturing line, on the other hand, was plotted out, and necessary fabric information was delivered at each level. Researchers observed sales of lower-quality goods fell by 26.5%.

2. Conclusion

A majority of agroindustrial firms think that emerging blockchain technology would revolutionize the cotton sector by making commodities trading safer and simpler. In this paper, they proposed a new strategy to address a significant issue in the food supply chain. Consumers discussed this strategy would engage with the status quo and it could result in a significant enhancement in the quality, traceability, and accessibility of food production and final products. In our work, we integrate two of the most cutting-edge innovations ever created. Researchers should investigate the precise requirements for this approach's adoption in our next research, as the impact on the customer and how it might alter the customer's social sensibility.

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