

# Tracking of Food Products from Source to consumption, Enhancing Transparency and Food Safety using Blockchain

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**ABSTRACT:** This research discusses about the implementation of blockchain technology to enhance transparency and food safety by tracking food products from source to consumption. With growing concerns about food safety and fraud, there is a need for an efficient and secure system that can trace the journey of food products and provide accurate information to consumers. Blockchain technology offers a decentralized and immutable ledger that can record and verify every transaction in the food supply chain. By utilizing blockchain, all relevant stakeholders including farmers, suppliers, manufacturers, distributors, and retailers can input and access data at each stage, ensuring transparency and real-time visibility. This enables consumers to have access to reliable information about the origin, quality, and safety of the food they consume. Additionally, blockchain can provide a robust mechanism for detecting and preventing food fraud, as any attempt to tamper with the recorded data will be immediately detected. Implementation of blockchain technology in the food industry holds great promise for ensuring food safety and transparency, empowering consumers to make informed choices about the products they purchase and consume.

**Keywords:** Blockchain, Transparency, Food Safety, Traceability, Fraud Prevention, Supply Chain, Stakeholders, Consumers, Origin, Quality, Visibility, Informed Choices.

## I. INTRODUCTION

It is vitally important to guarantee the security and openness of our food supply chain in the fast-paced, globally connected world of today. With the growing concerns about food safety, such as contamination, fraud, and mislabeling, to address these concerns, many companies and organizations have turned to blockchain technology, a transparent and secure digital ledger, to track food products from source to

consumption, revolutionizing the way we ensure food safety. An unchangeable, decentralized platform for transaction recording and verification is context food industry, this means that every step of a product's journey can creating an indelible and traceable record. From is produced to the store shelves where it is purchased, each transaction and movement can be documented, enabling consumers and regulators to easily trace the entire journey of a food product.

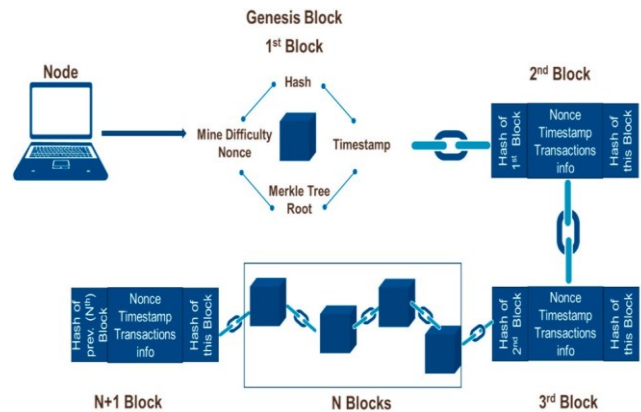


Fig 1: Blockchain Formation

An illustrative diagram of blockchain technology showing the structure and linkage of blocks from the Genesis block to subsequent blocks, with details on mining, hashing, and the Merkle tree. Businesses may give consumers immediate access to vital information about the food they eat by utilizing transparency and visibility for example, customers can instantaneously access a plethora of information about a product's origins, production processes, and even environmental impact by scanning a QR code on the box using a blockchain-enabled platform.

This degree of openness encourages ethical and sustainable practices, responsible production, and consumption by enabling customers to make knowledgeable decisions about the food they purchase.

Furthermore, maintaining food safety can be greatly aided by blockchain technology. Businesses can detect and isolate possible problems or cases of contamination rapidly by instantly documenting every stage of a product's journey on a blockchain. In the event of a food recall, blockchain facilitates the efficient and accurate removal of affected products from the supply chain, minimizing the risk to consumers and preventing widespread outbreaks. Additionally, blockchain can help tackle food fraud and counterfeiting by ensuring that each product and its associated information is securely recorded and verified, reducing the risk of bogus products entering the market.

To sum up, blockchain technology offers a revolutionary chance to improve the safety and transparency of our food supply chain. Businesses and organizations can create a comprehensive and verifiable record of a product's path from source to consumption by employing blockchain-enabled platforms. This will empower consumers to make educated decisions and ensure the safety and integrity of our food supply. Blockchain has the ability to completely change how we monitor and verify food goods, which would ultimately result in a safer and more open global food system, as it continues to develop and become more widely used.

## II. RELATED WORKS

[1] A review of the literature indicates that the monitoring of food products from their origins to the point of consumption might be completely transformed by the application of blockchain technology. Blockchain ensures food safety and increases transparency by providing a transparent and secure platform for tracking and validating each stage in the supply chain.

[2] The use of blockchain technology in food tracking can aid in the detection and correction of problems related to food safety. It facilitates prompt identification of the contamination source, cutting down on response time and limiting the spread of foodborne illnesses by offering an immutable and decentralized ledger.

[3] Blockchain makes it easier for food goods to be traced, giving customers more information about the source and caliber of the food they eat. By decreasing cases of fraud and mislabeling, this can boost consumer confidence in the food sector.

[4] The implementation of blockchain technology in food tracking has promise for optimizing supply chain processes. It is simpler to find supply chain bottlenecks and inefficiencies with a transparent, tamper-evident solution, which improves logistics and lowers waste.

[5] Studies show that the food business can improve its regulatory compliance by implementing blockchain technology. Because blockchain technology is decentralized, it may be used to effectively monitor and audit compliance, ensuring that safety standards and regulations are followed.

[6] The integration of different food supply chain participants, such as farmers, suppliers, manufacturers, distributors, and retailers, can also be facilitated by blockchain technology. It facilitates effective information exchange, which enhances coordination and collaboration by offering a common platform.

[7] Research indicates that blockchain technology has the ability to improve the authenticity and quality of food. Because blockchain records are immutable, consumers have access to a trustworthy and verifiable source of information on the origin, production, and handling of food.

[8] Smart contracts can help automate and streamline procedures, lowering the need for manual involvement and increasing efficiency in blockchain-based food monitoring systems. By enforcing predetermined guidelines and conditions, smart contracts can ensure that quality standards are met and do away with the need for middlemen.

[9] Since blockchain technology enhances transparency and accountability in the supply chain, it can help reduce food waste. It enables the timely transportation and distribution of food goods, limiting spoilage and waste, by identifying inefficiencies and eliminating delays.

[10] Lastly, research indicates that blockchain-based food tracking systems may also offer a means of encouraging moral and sustainable behavior in the food sector. Enabling the open documentation of sustainability metrics empowers customers to make decisions in line with their principles, resulting in a more conscientious and sustainable food industry..

## III. EXISTING SYSTEM

There are various issues with the current food product

tracking system, from the point of origin to the point of consumption. First of all, there is a high degree of human error, delays, and fraud in the current system due to its reliance on paper-based records and manual processes. The time and resources needed to manage these manual processes add up, driving up costs for both producers and consumers. Furthermore, it is challenging to track the origin of food products due to the opaque nature of the current system, which impedes attempts to guarantee food safety and quality management.

Furthermore, there is a lack of interoperability amongst the various food supply chain players in the current system. It is difficult to combine and validate the data since it is frequently dispersed and kept in disparate databases that are held by several organizations. This fragmentation makes it difficult to share and access critical information in real-time, leading to inefficiencies and delays in identifying and addressing potential food safety issues.

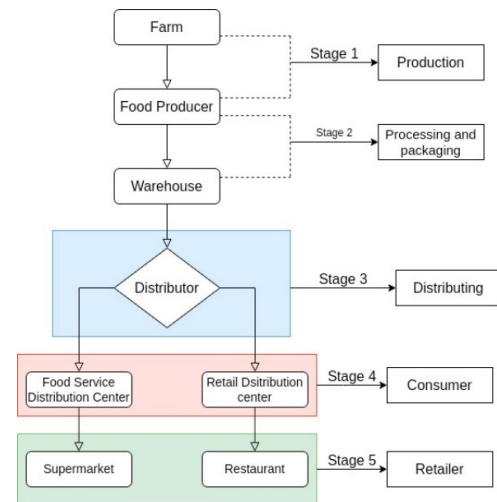
Furthermore, the existing system is not equipped to deal with the complexities of global supply chains. With food products being sourced from various countries and transported through different intermediaries, it becomes challenging to track and monitor the movement of goods effectively. Food safety and consumer confidence are put at risk by this lack of visibility, which also raises the possibility of contamination, counterfeiting, and illegal substitutes.

On the other hand, there are a number of benefits that blockchain technology provides to improve food safety and transparency in the food supply chain. Blockchain technology offers a decentralized, unchangeable ledger that facilitates transparent recording and verification of food product transactions and data. By doing away with the necessity for manual record-keeping, this lowers the possibility of fraud and human error

Transparency and trust may be ensured in the supply chain by employing blockchain to provide growers, processors, distributors, retailers, and consumers with access to a common database. Blockchain's traceability and transparency make it possible to track food goods in real time, from their origin to their consumption., enabling rapid identification and response to any safety concerns or quality issues. Additionally, blockchain can facilitate the integration and interoperability of various systems, enabling seamless information sharing and collaboration between different parties.

Overall, the existing system for tracking food

products have several disadvantages, including manual procedures, a dearth of transparency, and problems with interoperability. By offering a transparent, safe, and effective platform for tracking and tracing food goods, blockchain technology has the ability to address these issues and improve food safety and transparency in the process.



**Fig 2: Traditional Food Supply Chain**

## IV. PROPOSED SYSTEM

The overall objectives of the proposed research are to improve the food supply chain's dependability, transparency, and efficiency by using blockchain technology to trace food goods from their point of origin to point of consumption. Blockchain provides a unique answer to the problems the food business has, such as uneven information exchange, difficulty confirming the authenticity of products, and ineffective traceability solutions. Blockchain is a decentralized, immutable digital record.

At every point of the supply chain, strict data validation and authentication procedures will be put in place to achieve reliability. This entails making sure that only authentic and reliable data is added to the blockchain, maybe by using digital signatures or participant consensus techniques. The integrity of the data recorded on the blockchain will also be upheld by routine audits and verification procedures.

Enhancing transparency is essential, and efforts will be undertaken to ensure that all pertinent stakeholders have easy access to the data stored on the blockchain. User-friendly interfaces, including web platforms or mobile apps, will be created so that participants and customers can quickly access and confirm the information about a particular food product.

Education efforts and uniform and unambiguous labeling systems will aid in making customers aware of the value of the data that blockchain tracking provides.

Using blockchain to track food more efficiently means that data entry and retrieval procedures can be streamlined across the whole supply chain. Blockchain platforms will be connected with automation technologies like RFID tags and Internet of Things sensors to automatically record and capture pertinent data points like location and temperature without human interaction. Additionally, smart contracts will be used to automate compliance checks and payment processing, which will cut down on administrative work and error-proneness.

By investigating the creation of reliable data validation procedures, user-friendly interfaces, and automation technologies, the project seeks to enhance safe and sustainable food systems. The goal of the research is to offer insightful information that will be useful to industry stakeholders and consumers alike by solving important issues related to maintaining the accuracy of food information, enhancing consumers' and stakeholders' access to transparent data, and streamlining supply chain operations.

## V.SYSTEM ARCHITECTURE

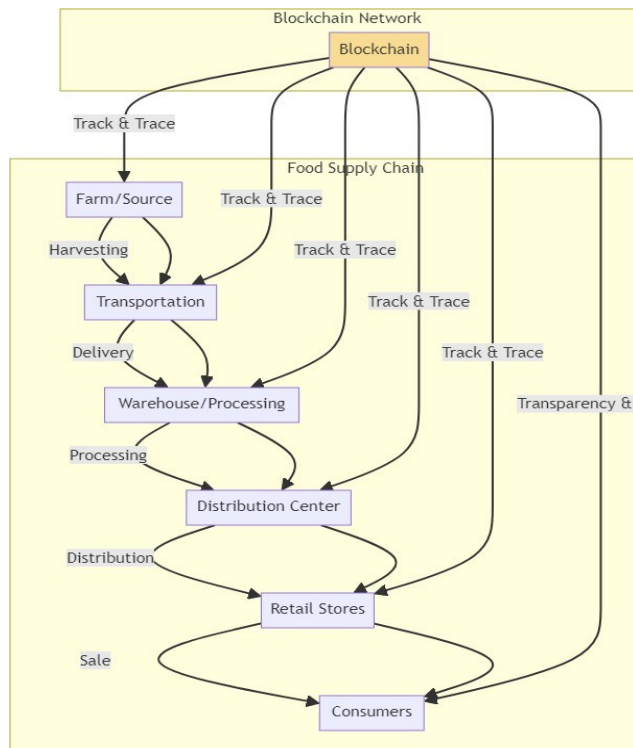


Fig. 3. System Architecture

## VI. METHODOLOGY

### 1. Source Tracking Module:

The blockchain-based system for monitoring food goods from the point of origin to the point of consumption is not complete without the source tracking module. The purpose of this module is to offer reliable and transparent information regarding the food products' place of origin. Every link in the food supply chain, from the producer or farm to the distributor and retailer, may be tracked and recorded by utilizing blockchain technology.

To monitor food goods effectively, a combination of technologies such as IoT sensors and methodologies such as RFID tags can be employed. These technologies, when integrated with blockchain, enable real-time tracking of food products' movement and conditions throughout the supply chain. IoT sensors can monitor parameters like temperature and humidity during storage and transportation, while RFID tags provide precise identification and tracking capabilities. Through blockchain integration, this data is securely recorded and transparently accessible to authorized stakeholders, ensuring that food goods are monitored comprehensively for safety and quality.

2. The quality and safety monitoring module is an additional essential component of the food tracking system that is based on blockchain technology. The goal of this module is to guarantee food items' quality and safety along their whole supply chain. Making use of the transparency and immutability of blockchain, it becomes easier to monitor and track relevant data related to food safety measures and quality standards.

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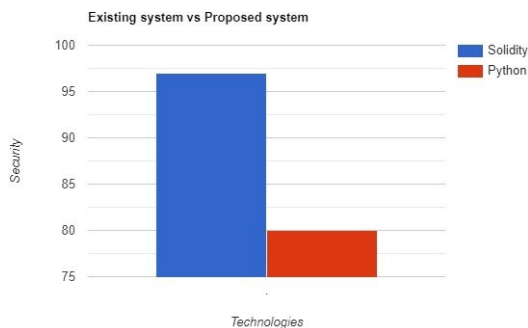
### 3. Certification and Compliance Module:

The purpose of the certification and compliance module is to make sure that the food products follow all applicable laws and certifications. Food safety regulations and organic certificates are only two examples of the certification documents that blockchain technology can be used to safely maintain and store. reports on compliance. This module enables easy verification and authentication of the certifications, providing consumers with confidence that they are purchasing safe and compliant products achieving safety in the food supply chain involves rigorous adherence to quality standards and regulatory requirements. The certification and compliance module ensure that food products follow all applicable laws and certifications. Food safety regulations and organic certificates are examples of certification documents that blockchain technology can securely maintain and store. This module enables easy verification and authentication of the certifications, providing consumers with confidence that they are purchasing safe and compliant products.

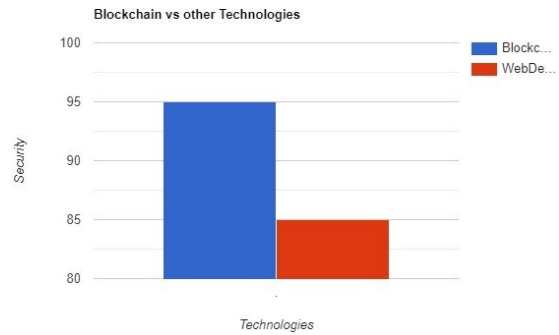
Moreover, the module for certification and compliance has the potential to streamline the auditing procedures for regulatory bodies and additional food sector participants. The blockchain's immutability and transparency make it possible for auditors to quickly access and examine pertinent documents, which cuts down on the time and effort needed for compliance audits and inspections.

To sum up, the three main modules of the suggested blockchain-based system for tracking food products from production to consumption are certification and compliance, quality and safety monitoring, and source tracing. Together, these modules improve food safety and transparency by giving customers reliable and accurate information on the source, caliber, and compliance of the food items they eat.

## VII. RESULTS AND DISCUSSION



**Fig.4.Existing System Vs Proposed System**



**Fig.5.Blockchain Vs Other Technologies**

Blockchain technology-powered food product monitoring systems have completely changed how we guarantee food safety and transparency across the board in the supply chain. The decentralized and unchangeable database known as blockchain makes it possible to document each and every movement, change, and transaction that takes place throughout a food product's lifecycle. This system offers a comprehensive and transparent view of the product's origin, processing, handling, and distribution.

Starting at the source, blockchain allows for the seamless recording of information concerning the farming methods, food product certifications, and production processes. Because information is safely maintained within the blockchain network, customers, retailers, and authorities who are worried about the product's quality and safety may readily access this data.

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Throughout the supply chain, each movement and transformation of the food product is recorded as a unique transaction on the blockchain. This includes information such as transportation, storage conditions, packaging, and any processing steps undertaken. With this knowledge at their disposal, buyers are better equipped to make informed selections regarding the goods they select, based on factors such as sustainability, fair trade, and ethical sourcing.

Moreover, blockchain technology enhances food safety by enabling faster and more accurate traceability of goods in case of contamination or



recall. When a foodborne illness outbreak occurs, officials are able to locate the source immediately and take the necessary precautions to lessen the risks. This tracking system significantly reduces the time and effort required to identify and remove contaminated products from the market, protecting the health and well-being of consumers.

In conclusion, the system for tracking food products from source to consumption, leveraging blockchain technology, provides increased transparency and improved food safety. A safer and more reliable food supply chain can result from consumers making educated decisions about the items they use and authorities acting quickly to resolve any potential problems.

### VIII. CONCLUSION

In conclusion, by greatly enhancing transparency and food safety, the blockchain-enhanced system for tracking food goods from production to consumption has the potential to completely transform the food sector. Blockchain makes guarantee that every stage of the food supply chain is tracked and readily available by enabling an immutable, secure ledger of data. Customers may now get real-time information about the provenance, caliber, and safety of the food they eat thanks to this enhanced openness. Moreover, the decentralized characteristic of blockchain lowers the possibility of fraud and manipulation, improving food safety in general. In the end, putting this system in place might help rebuild consumer confidence in the food sector, which would lead to a safer and more sustainable future.

### IX. FUTURE WORK

Blockchain technology will be used to track food goods from their source to consumption, increasing transparency and improving overall safety. This is where food safety is headed. Every stage of the food supply chain will be tracked and made available to all parties, including farmers, suppliers, manufacturers, distributors, retailers, and consumers, through the use of a blockchain-based system. The transparent nature of blockchain ensures that every transaction, certification, and inspection is securely recorded, creating an immutable and auditable ledger. This transparency not only facilitates trust among stakeholders but also allows for the quick identification and resolution of any issues or recalls. Additionally, blockchain enables the implementation of smart contracts, automating compliance with regulations and standards, reducing paperwork, and eliminating human error. The blockchain's decentralized information structure guarantees that no

one entity may control or modify data, making it possible to track food products in a safe and reliable manner. The implementation of blockchain technology has the potential to drastically enhance food safety and safeguard consumer health in the future, given its enormous potential to transform the food sector.

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