



# **The impact of blockchain technology in business: a focus on Organic Food Supply Chain**

By

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This Report Presented in Partial Fulfillment of the  
Requirements for the Degree of Bachelor of Science in  
Software Engineering

DEPARTMENT of SOFTWARE ENGINEERING

DAFFODIL INTERNATIONAL UNIVERSITY

FALL 2021

## **APPROVAL**

This is an analysis of the impact of blockchain technology in business: a focus on Organic Food Supply Chain thesis is submitted by Akib Al-Amin to the Department of Software Engineering, Daffodil International University, has been accepted as partial fulfillment of the requirements for the degree of Bachelor of Science and approved as to style contents.

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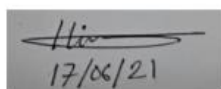
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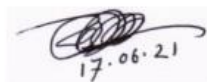
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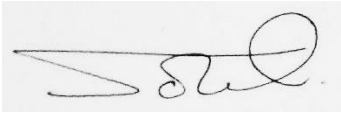
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## THESIS DECLARATION

I hereby declare that, this thesis report is done by me under the supervision of **Mr. Md. Khaled Sohel**, Assistant Professor, Department of Software Engineering, Daffodil International University, in partial fulfillment my original work. I am also declaring that neither this thesis nor any part therefore has been submitted else here for the award of

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**Supervised by**

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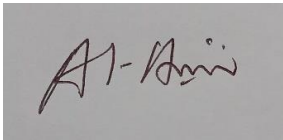
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## **ACKNOWLEDGEMENT**

Foremost, I am thankful to God for my wellbeing and that's why I am completed my research procedure. Then I am grateful to my research supervisor, Mr. Md. Khaled Sohel sir who guided me throughout the whole research activities. Besides my supervisor, I would love to thank Dr. Md. Mostafijur Rahman for his encouragement and insightful comments. After that I would like to thank Md. Nadir Bin Ali, Joint Director of IT, Daffodil International University who helped me during survey of my research. I wish to express my special thanks to Associate Professor Dr. Imran Mahmud, Head of the Faculty for providing all the necessary facilities for the research purpose. I am also thankful to all the lecturers, Department of Software Engineering who sincerely guided me at my difficulty. I am grateful to my parents for their unconditional support and encouragement. I am thankful to my friend who supported me throughout this venture

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## **ABSTRACT**

Blockchain is an internet-based innovation that's prized for its capacity to freely approve, record, and disperse exchanges in the permanent, scumbled record. In previous, a normal supply chain has no trusted members as he/she is a consumer. But the innovation of blockchain can include belief, straightforwardness, and traceability. Blockchain makes a difference in how organizations get their supply chain and lock in consumers with genuine, verified, and permanent information. Blockchain digitizes each interaction by sparing it in an arrangement of cryptographic squares. No single party can modify any records, and any alter is obvious to everybody within the arrangement. The coming about the record is tamper proof and unchanging, giving total item lifecycle history and minimizing opening for extortion. The main purpose of this research is to recognize the basic challenge which is faced by the consumer. In this paper, we are going to reduce the fraud data allocation by the 'Smart contract'.

# CHAPTER 1

## INTRODUCTION

### 1.1 Background

In Bangladesh, our economy depends on agriculture. About 70% [1] people are connected directly or indirectly with agriculture fields. For the rapid growth of the population, it must consider the proper use of the agriculture sector to fulfill our basic needs. In the whole world, Bangladesh plays an important role in agricultural products. Bangladesh is the world's largest producer [2] of Rice, Jute, Wheat, Tobacco, etc. It is possible to gain food security by boosting agricultural production. In any food factory or organization, it must ensure the food quality and nutritional issues that are a big factor for consumer's health. The whole world is trying to gain food security for its rapidly growing population. In a secured food network system when someone buys food, he must be aware of the food-producing method and must be informed about the raw materials of the food. One of the best ways to get a secured food system in our country is tracing out every product's raw materials, how it is being processed and all members of the food supply chain must share their information about products with each member of the food supply chain. In the traditional supply chain [3] a lot of issues arise like lack of traceability, Inability to maintain the safety and quality of products, lack of communication between supply chain members, inability to track the product's origin, and processing method and lack of transparency. We can eradicate our problem by using Blockchain technology. Blockchain is a recent technology that suits best in this context to solve the problem of the traditional supply chain system [4]. Blockchain technology is a decentralized database that allows transparent, secure, and auditable append-only transactions that can be used in FSC networks. The Blockchain has a cryptographic hash technology feature [5]. The information in every block is encrypted in such a way that no one can access or alter the information. The encryption of a user's information in blockchain prompts the users to rely on the Blockchain-based which helps in demand for the product. The immutability of data in the blockchain-based system ensures that no data

gets altered by the attackers. The supply chain network is made of upper stream participants like a producer, manufacturer, and distributor, and lower stream participants like retailer and consumer. In a manual supply chain system, traceability related information is not shared among participants. We focused to reduce the inappropriate data from attackers. After analyzing the entire problem related to the manual supply chain, we are going to build a blockchain-based system where all the participants will be benefited by getting authentic information. There will be a secured transaction system for all the members of the supply chain.

## **1.2 Historical background**

While the widespread of Bitcoin made Blockchain famous worldwide, its history can be traced back before 2009, the year Satoshi Nakamoto, the legendary developer (or group of developers) of Bitcoin, implemented the first public blockchain. The origins of distributed ledgers can be even found further back in time, in the region of Micronesia, where the local population, the Yap, were using Rai currencies, “doughnut shaped stones” coming in different sizes and differing from one another. Rai were generally heavy, so that Yap decided to find a way they could “virtually” move ownership of the currencies by communicating the change of ownership throughout the country. This can be considered the first example of a distributed ledger, the core system on which Blockchain operates (Vermeend & Bruin, 2017). The idea behind blockchain was described for the first time in 1991 by Stuart Haber and Scott Stornetta, who invented a system to string digital documents and avoid any backdated interference with them and thus safeguarding them. They used a cryptographically secured chain of blocks to store these documents and also suggested, as an alternative, the use of a Merkle tree. Eventually, in 2004, Hal Finney made significant step forward, introducing the Reusable Proof of Work, a system which solved the double spending problem “by keeping the ownership of tokens registered on a trusted server” (Institute, 2016). Whilst Rai were traded at least until the 19<sup>th</sup> century, Blockchain was presented together with Bitcoin two centuries later. In 2008, in the midst of the financial crisis, the publication of a white

paper released under the pseudonym Satoshi Nakamoto, established the model for a Blockchain. The following year, Nakamoto was able to implement the first Blockchain as the public ledger for transaction realized using bitcoins, being the promising trigger that could set in motion a financial revolution. Within a relatively short time, Blockchain became conceptually independent from Bitcoin and other cryptocurrencies: Blockchain 2.0 era had just started. From 2013 onwards, companies, institutes and researchers began exploring Blockchain potential applications for other financial and interorganizational transactions (Wales, 2019). During that time, Vitalik Buterin started developing a new type of blockchain, Ethereum, that would pave the way for the implementation of smart contracts and take blockchain technology to another level. Although, Blockchain is becoming part of the mainstream culture thanks to Bitcoin, whose name have reached different generations and crossed geographical and cultural barrier on a global scale, this technology is partially shrouded in a cloud of mystery. This aura is the result of a general tendency to confuse Blockchain technology with Bitcoin, merging the two into a single concept. However, Blockchain is a platform to perform transactions and exchange information and certainly it is used as the technological support to exchange Bitcoins, but it is far more than that. This paper aims to clarify the key aspects concerning Blockchain and understand what are the opportunities that it can create for companies.

### **1.3 Blockchain defined**

Blockchain as a technology belongs to the family of distributed ledger technologies or DLT, which are defined as systems based on a distributed register where all nodes in a network hold the same copy of a database that can be independently read by each individual node. However, all these nodes cannot modify the information stored in the database at their own will; database are protected by a central body or several validators, generally referred as miners. In practice, information is made unchangeable by users through consensus algorithms, which are the mechanisms through which a blockchain network reaches consensus in the best possible way. Experts and blockchain advocates, when referring to the systems which regulates consensus in a DLT, generally

mention “the Byzantine Generals’ Problem”, which is a useful analogy to illustrate how it works. The example displays a situation in which a group of generals – each one commanding a portion of the Byzantine army – have to agree on common strategy to attack a city (or retreat) and communicate it to each other in due time. The main problem is that one or more generals could trait the others and manage to communicate different decisions in order to scuttle the agreement. The sole way to avoid such a disruption within the consensus mechanism is to introduce a system able to reach an “undisputed agreement” on the strategy that has to be adopted in order to reveal the traitor and safeguard the others (Dhillon, Metcalf, & Hooper, 2017). Such scenario may be applied to DLT, where cryptographic algorithms enable users to receive public and private key that are used to run transactions or to activate smart contracts or other services supported by the technology. Hence, blockchains are distributed ledger technologies in which ledgers are designed to manage transactions or smart contracts within a list of records, called “blocks”, that are cryptographically linked to each other. These records contain all the necessary digital information that will be permanently recorded in the database (the “chain”) (Fortney, 2019). Each block is added to the chain whenever participants reach consensus, that is when all the nodes agree on validating the transaction or the smart contract run on that specific block; at the end of the process the transaction (or the smart contract) is definitely stored in the database. To give a broader definition of blockchain: “A blockchain is a tamper-evident, shared digital ledger that records transactions in a public or private peer-to-peer network. Distributed to all member nodes in the network, the ledger permanently records, in a sequential chain of cryptographic hash-linked **blocks**, the history of asset exchanges that take place between the peers in the network.” (Brakeville & Perepa, 2019). An operational definition of blockchain is a basic tool for understanding the universe behind this technology, which has been refined and explored in the last decade. However, blockchains are typically further classified into two categories, private (or permissioned) and public (or permission less) blockchains, which in turn may include other specific features and functions. An initial distinction should be made between

public blockchains, which are widely known and used for the greater part of applications, and private blockchains which may be implemented in specific contexts, mainly on an industrial level (Chiap, Ranalli, & Bianchi, 2019).

## **1.4 Public Blockchains**

Such as in the case of cloud computing, public blockchains can be accessed and updated by everyone who is registered to the network. This type of blockchain is based on a distributed architecture and does not have a central authority since everyone is able to navigate in the database and verify transactions, with respect to the set of published rules (Vaughan, 2015). The most famous examples are Bitcoin and Ethereum. These networks are generally based on consensus protocols, such as the Proof of Work or the Proof of Stake, that engage all users, usually referred to as “miners”. Such mechanisms protect networks against users who create fictional identities and try to modify transactions stored in the blocks (Vella, 2019).

## **1.5 Private blockchains vs Consortium blockchains**

Private blockchains sacrifice decentralization in return for a strict control over the access to the network and better performances. This type of blockchain is suitable for industrial and businesses applications since the network is accessible only to verified members and transactions can be edited by administrators. (Vaughan, 2015). Hyperledger and Ripple are well-known examples of private blockchains. Unlike public blockchains that operate on consensus protocols, transactions in permissioned blockchains need to be validated first and require the vote of the majority of the users to be stored in the database (Vella, 2019). Permissioned blockchains are distinguished in private blockchains and consortium (or semi-decentralized) blockchains. In the formers, a central authority is allowed to modify the blocks and retain full control of the ledger. Conversely, blockchain consortiums are based on consensus mechanism in which previously defined nodes hold control of the database.

### **1.5.1 Fast transactions**

In blockchains, transactions are based on a peer-to-peer system involving few intermediaries, eliminating the double-spending problem, while giving reliable information. Transactions are executed simultaneously on both sides of the payment and enable digital signatures, thus increasing the possibility to avoid fraudulent activities. Companies using blockchain could gain in terms of trustworthiness and accountability.

### **1.5.2 Versatility**

Versatility is the way to save information in a worker or capacity framework, making them continually accessible to clients, even on account of a hardware disappointment, blackout or information control (Rouse, Data Center Resiliency, 2012). In a blockchain information are put away on different hosts in which are continually confirmed and refreshed, staying away from the danger of losing them (Peter, 2018).

### **1.5.3 Traceability**

Organizations lacking apparatuses to oversee viably supply chains, experience issues to deal with request changes and improve operational effectiveness. With different entertainers being associated with the production network, firms need to confront an undeniable degree of vulnerability and need to depend on solid information. Nonetheless, organizations in inventory network change enormously and they each have their own strategy for gathering information. Blockchain innovation can guarantee changeless records of information, by running brilliant agreements, without observing solicitations and gathering installments

### **1.5.4 Cost effectiveness**

First of all, expenses can be decreased by eliminating go-betweens and authoritative uses; as indicated by McKinsey&Company investigation of 90 use cases, among the significant advantages emerging from blockchain application, cost decrease represents 70% of them (Carson, Romanelli, Walsh, & Zhumaev, 2018). Application of this technology in financial services and other fields, such as insurances or claims management, can provide an automatic system able to aggregate, amend and share data in the first ones and various advantages, such as prevention in fraud in the second one. However, blockchain may offer several additional benefits to companies and financial institutions in terms of cost efficiency (DiGregorio, 2017) but mainly in the case of permissioned blockchains that are generally more suitable to business.

### **1.5.5 Automation**

The programmable idea of blockchain permits to set up and update activities, occasions and installments. Either in the case of transactions or smart contracts, which are “computer code that can be built into the blockchain to facilitate, verify or negotiate a contract agreement” (Fortney, 2019), if certain conditions are met, the transaction or the agreement are automatically run.

## **1.6 Blockchain and beyond**

In the industrial sector, smart contracts could enable the introduction of innovative business models, significantly reducing operating costs of transactions for companies. Additionally, smart contracts could be a true revolution in B2B corporate negotiations, changing trade systems and regulations. These could result in a huge reduction in bias occurring on the business network, reducing enterprise frictions in a more trusted ecosystem. To give an example, IBM Institute for Business Value has shown in one of its

latest report, how frictions across a lender, the mortgage lending ecosystem and the housing economy respond to the blockchains characteristics (normalized on a scale of 100). This is the result.

## **1.7 Motivation of the Research**

Blockchain has immense feasibility to be applied in the safety related sector. Several supply chains are using blockchain technology. But many of the issues like trust ability, quality assurance etc. still has not been fixed yet. Traditional supply chain systems don't provide any trustworthy quality index by which one can be assured about product quality. Moreover, Consumers place the highest expectation on qualified products. So, trust ability is a big issue in the supply chain. We analyzed issues and barriers in a way to design a trustworthy system and suggested to design quality assurance-based certification of products. The quality of the products will be assessed and if the products get satisfactory index, only then the distributor will accept the products from the producer.

## **1.8 Problem Statement**

In the present scenario of block chain-based supply chain systems, traceability and secured transactions have been implemented properly. Different authors have discussed implementation of traceability of raw materials and secured transaction systems. And, a lot of supply chain systems have been designed and implemented based on the previous research outcome. But, proving the authenticity of the products is still a fantasy for supply chain members that could be used for ensuring product quality. Ample amount of research works has not been done that focuses on ensuring product's quality by using quality assurance. So, in a block chain based traditional supply chain system, inability to ensure product quality is still a key challenge that impedes to make a perfect supply chain system.

## 1.9 Research Objective

This research focuses on designing an effective blockchain based supply chain system. From the outcome of this research, we will be able to implement a fully functional blockchain based supply chain system which will ensure the product's quality. Taking after investigate goals can be accomplished from this research:

- ◆ To develop such a system that ensures the authenticity of the information provided by the producer.
- ◆ Our system will check either the information provided by the producer is trustworthy or not.
- ◆ A quality assurance index will be used to certify the quality of a farmer's product.

## 1.10 Thesis Organization

In the following, we first discussed about literature including the research gap. Second, we addressed research methodology along with hypothesis and research model. Third, we mentioned results and discussions. We then discussed the conclusions and recommendations containing findings, limitations and future directions.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

Block chain has become a buzzword and the most useful technology to be applied in safety related sectors like supply chain systems. Significant numbers of research work have been done to embed blockchain technology to supply chain systems. Blockchain technology adorned the supply chain by implementing traceability of raw materials and processes, and secures transactions systems. An effective block chain-based supply chain system should affirm the authenticity of products quality. Quality assurance of a product endorses consumers to purchase.

#### **2.2 Literature Review**

There is some summary of several research papers. So in this section we are going to discuss about those paper's method, features, and also its limitation. Such as:

Natsuki [6] considered a comprehensive report by comparing the Blockchain Technology's original goal is to propose a solution to the double-spending problem using a peer-to-peer network. The proposed solution focuses on the utilization of smart contracts and controls all the participants, fraud data, seed information, chemical composition that, none can break the system by hacking or any other ways. The author proposes Blockchain for the supply chain. In this system, the author defines the low layer, high layer, lower blockchain, and higher blockchain. In this paper, the author

combines blockchain with distributed storage and proposes a blockchain model for the supply chain. Blockchain is not fit to record a lot of information. It requires both on-chain storage of the core ledger data and off-chain storage of data required by smart contracts for verification and documentation.

Madumidhaet.al. [7] proposed a framework that improves the agricultural food supply process in Tamil Nadu. Agriculture is very essential for the living of the majority of the population in the world. Achieving food security by increasing agricultural production forms the core of the agricultural development strategy of the State. The proposed solution focuses on the utilization of smart contracts and controls all the participants, fraud data, seed information, chemical composition that, none can break the system by hacking or any other ways.

Behnke et.al. [8] focused on the transparency of supply chain. Blockchain is one the best solution to this context. This literature background shows that the usage of blockchain technology requires a good understanding of the business problem and a clear definition of the goals to be achieved. The investigating blockchain technology boundary conditions and in total eighteen boundary conditions for food traceability were identified from which five directly apply to blockchain technology.

Khaled et.al. [9] developed a system that works on Soybean. The manual agricultural supply chain is quite tough for safety, quality, and the validation of some elements. The proposed solution focuses on the utilization of smart contracts and controls all the participants, fraud data, seed information, chemical composition that, none can break the system by hacking or any other ways. In this framework, all the data from a grain elevator, distributor, Seed Company, grain processor, farmer, customer, etc give their information on EVM. That is why all the data will store in it and no outsiders can alter data that makes the system secure.

George et.al. [10] implemented a system that considers the very tiny particles that can change a great result. Sometimes it is quite impossible to get an accurate result for the weather, moisture, etc. The paper is discussed about the main method of food traceability and creates a prototype for implementation using blockchain. In this paper, the author uses the Food Quality Index (FQI) algorithm. FQI algorithm helps to generate the

identification of food quality. In the FQI algorithm author create a mathematical model for calculating the food quality index under the storage time as a selected quality parameter. This model is customized farmers information, genetic information, the weather during production that measures the perfection of food and brings the consumers enhancement.

Kulkarni et.al. [11] proposed solution focuses on the utilization of smart contracts and control all the participants, fraud data, and hardware information. In this research, the author focuses on using blockchain for the supply chain process of IC manufacturing. In this paper, the author uses ‘smart contract’ approach for ensuring the security and trust of these ICs by tracking down. In the ‘smart contract’ approach code or file is kept in the contract. It is a program that stored code or data and it can’t modify by someone at any time. When the contract updates the data, it automatically updated the other entity’s data. As every entity in the supply chain has to abide by the contract and every entity has the same data, so the change would occur if the majority agrees to change it.

Daniel et.al. [12] focused on the blockchain that was used to resolve the agricultural food supply chain traceability, also tending to the issues, and to show its connection in each easy chain in the use of the process. Focusing on national states of China and Chinese market investigation, a lot of theoretical techniques were utilized to adjust to China's current condition on purpose to generate agricultural supply chain management more expert and reliable, just as the quality and wellbeing of rural items.

Korpela et.al. [13] focused on this paper about business to business (B2B) integration within the supply chain is highly focused. Some lacking of companies have collaborated to accelerate the integration Digital supply chain (DSC). DSC collaboration is a multi-stakeholder environment involving different needs and goals. In the first step- identify requirements for DSC B2Bbusiness process integration. Then it needs to identify functionalities based on these requirements. At last, its focuses group workshop was dedicated entirely to Blockchain technology. In this paper, the authors give us successful result in the business sector. When a data model could be agreed and adjusted for both B2B transactions and M2M IoT transactions, the combination of cloud integrations can build this technology into a DSC.

Chandra et.al. [14] implemented a system of blockchain in the supply chain of halal food products, highlighted in this paper. In order to generate trust in these initiatives, blockchain can be used to record the movement of the halal product with information like origin, destination, temperature, location in the supply chain. The supply chain initiates with first selecting the Valuator Nodes, which would include members of the regulatory bodies who will approve new transactions on the Blockchain from producers and logistics providers only once their quality assurance has been validated. In this paper, the authors analyzed how Blockchain technology could be a transformational force that raises the status of halal regulation.

H. Hayati and I. G. B. B. Nugraha [15] create a system Traceability system used aggregated information architecture. This research investigates the chance of another kind of design, which is the blockchain-based framework to happen without outside by appropriating all information. Blockchain estimating the nourishment quality Blockchain discovered a more preferred position of scaling, unwavering quality, steadfastness, and viability. This prototype can be customized to address future requirements. The author creates a prototype that captures data from various stakeholders FQI value identifying food consumption.

Martin et.al. [16] provided traceability of token recipes model manufacturing should ideally be operated by multiple businesses. They currently do not capture the transformation of goods in manufacturing processes. They create a blockchain-based supply chain traceability system using smart tracking across and multiple entities. The proposed arrangement centers storing records, data, all types of information suppliers, and customers. The creator proposed a nonexclusive structure presence blockchain to follow, follow, and perform business exchanges expelling mediators and essential issues of preparing for token plans model assembling.

Raj et.al. [17] created a system of the supply chain, identifying counterfeiting in pharmaceutical. That's why many manufactories company fall in so much loss. They could not sales their product in the developed country for the supply chain. The proposed protocol was implemented on Hyper Ledger Fabric. Here a manufacturing company or country creates drugs and packaged drugs. In distribution center divided the all

counterfeiting drugs, and they have no idea that where and how drugs are used. At a place, all sellers come and brought drugs by huge money and also put their life danger. After crossing these steps then counterfeiting drugs reached the pharmacist before the customer.

Moschus et.al. [18] focused on a blockchain-based supply chain system that will be secured for transactions. The objective of this paper is to discuss a solution so that the participants in the Food Supply chain system can do secure transactions, can get the evidentiary information about the products' raw materials. An IoT based data collection system is being used here by the authors to ensure that data inputted in TOC (table of contents) is genuine and trustworthy. This data collection process is automated. Finally, this paper aims to build such a system that is blockchain-based, fully decentralized, and traceable by the members of the food supply chain system. The authors used a smart contract for secure transactions. A fully functional model made of the Blockchain is demonstrated in this paper. And finally, the performance of this model has been calculated by the authors.

Qu et.al. [19] discussed the applicability of blockchain in business to consumer supply chain systems. The authors have discussed different types of transaction architecture. A fully functional blockchain-based business to communication model was developed by the authors. The customers will place orders via a smart contract. The information is then sent to the Ethereum based blockchain system. All participants of the blockchain receive the notification of order. Each checks the order's trust ability. Only then the order is processed. This is how smart contract-based businesses to consumer system verifies each participant and notify them. Thus, the efficiency of the system gets improved and security issues are removed by the implementation of blockchain in the supply chain.

Bhalerao et.al. [20] discussed about the applicability of blockchain in dairy products supply chain. The authors analyzed some existing supply chain system-based block chain. After analyzing some existing system, the authors developed a hyper ledger-based block chain system. At first the raw materials are sent by suppliers to the factory. Smart contracts compare temperature humidity of dairy products with standard value and provides grade. Temperature and humidity are measured by sensors. After valuation the

products get shipped and price is calculated automatically. The whole information of a process is recorded in chain of blocks. No one can alter the information.

### **2.3 Problem Analysis**

Blockchain has resolved numerous issues related to the conventional supply chain system. Blockchain is emerging as a new technology that works in the context of a secured, distributed, interoperable system. The process of detecting quality is highly expected due to a lack of transparency in the traditional Blockchain system. The motive of this research is to create a system that is decentralized and Blockchain-based to verify the quality of the product and the source of the product. We are going to develop a certification-based supply chain system to ensure the genuineness of the product. In the background [9] as the data is passed by the traditional supply chain. It is possible to change data and also outsiders can alter the data. That's why the author creates a solution that secures data from an outsider by using a smart contract. But there is no possibility that the producer actually gives real information. So, we are going to create a new system that ensures the producer gives information and this information must be certified by quality assurance. The proposed solution disposes of the requirement for a trusted centralized specialist, middle people provide exchanges records, improving productivity and security with high judgment, reliability, and security.

### **2.4 Summary**

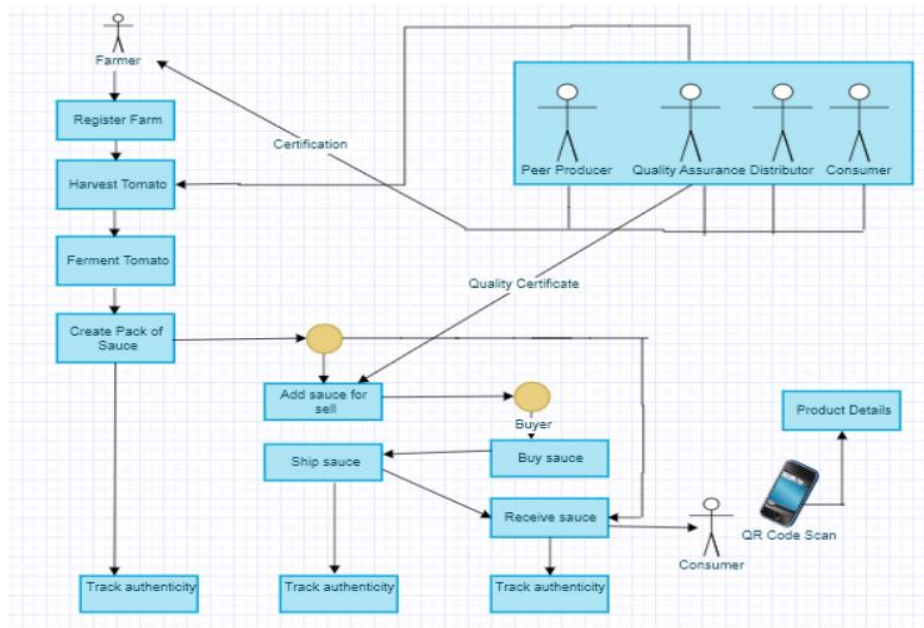
Finally, we have discussed many issues and barriers of the traditional blockchain-based supply chain system. We have proposed a solution to the problem of the traditional blockchain-based supply chain system. Our proposed solution will ensure the authenticity of a product by providing a quality index. This index is trustworthy because only after assessing the quality of products by quality Assurance Company, the quality index will be provided. This way, our system will be helpful to the consumers by providing their most expected organic and pure products.

## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

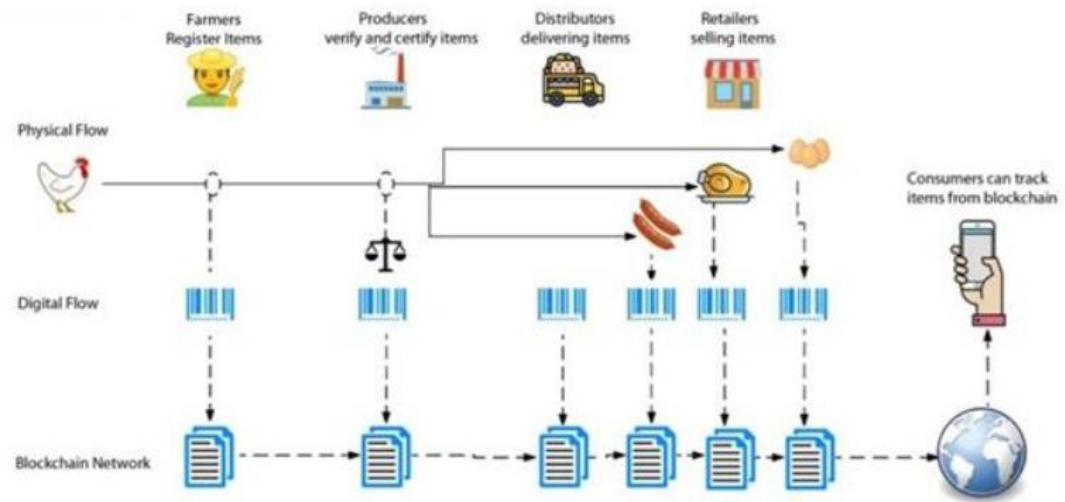
#### **3.1 Methodology**

This research aims to develop a Blockchain-based decentralized system. This system facilitates the members to perform a secured transaction, ensures products authentic, share vivid and genuine information among the participants. Our proposed system will work as follows. At first, the farmer needs to register his farm to the system. Suppose, the farmer produced tomato. He will get a quality index by quality assurance co. based on the quality of harvested tomatoes. Harvested tomato then will be fermented. Packets of sauce will be made from the harvested tomato. All these steps will be tractable by the members of the supply chain. The sauce packs will be ready for selling. Consumers can watch the sauce's information through QR code scanning and track the status of ordered products. All the information on every transaction will be kept in the chain of blocks. Thus, no information will be altered or hacked. Also, the consumer will get an organic product because of the certification of products based on quality.



### 3.2 SYSTEM ARCHITECTURE

The Supply chain exercises are cultivating, refining, planning, producing, bundling, transportation. The model virus chain framework that is decentralized and distributive in nature, and utilizations the Internet of things for gathering and moving data on the blockchain innovation. For putting away and dealing with all significant information of items in the short-lived inventory network, the unchanging blockchain innovation and the use of savvy contracts for computerized handling of predefined agreements with most extreme legitimacy. Every one of the gatherings from makers to fabricates in the proposed blockchain. Every one of these individuals is equipped for adding, refreshing and checking the creation data. RFID labels appended to every one of the chilly chain items are one of a kind computerized cryptographic identifier, which interface these actual things with a virtual character put away on the circulated record. Each product“ data profile is addressed as a virtual personality on the blockchain.



**Fig. 3.** Proposed System

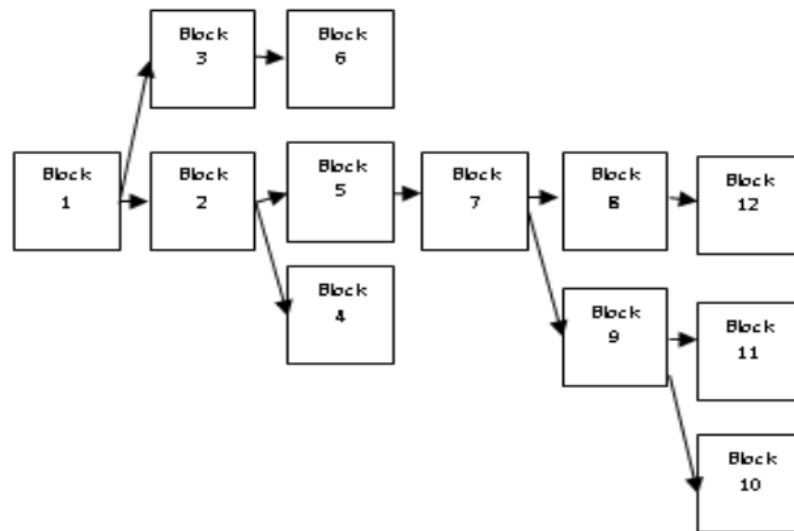
## **CHAPTER 4 HYPOTHESIS**

### **4.1 Blockchain protect the recognizability and dependability of every exchange in the food store network**

There is still horrible goal for accomplishing the recognizability and dependability in food inventory network framework. Building partner Agri-food give chain discernibility framework is treated as an imperative mission once antiquated rationale of the board and recognizability hence the transformation of obtrusive food market. In any case, the utilization of Blockchain in the store network may have been the ideal decision as of not long ago. Checking validness of the record should be possible by utilizing Blockchain and disposes of the requirement for brought together position. each exchange requires confirming the last exchange, in this way ensuring the discernibility of every exchange.

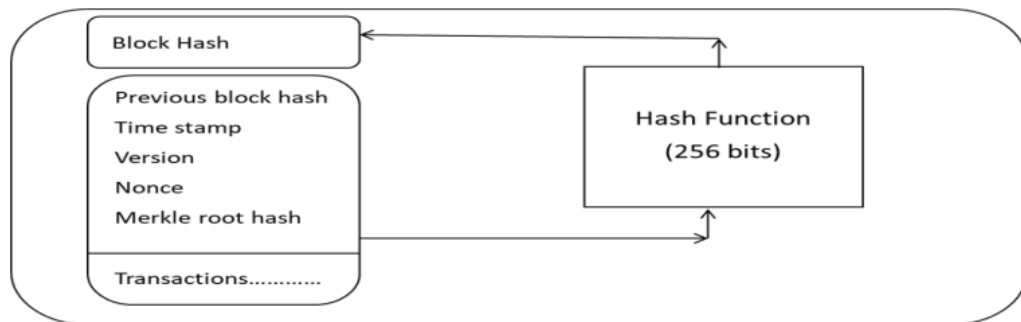
### **4.2 Blockchain can satisfy the interest of governments, undertakings and customers**

In the event that the main speculation is set up, applying the innovation of Blockchain can fulfill with the need of governments, undertakings and shoppers. The specialized benefits of the Blockchain carry new administrative plans to the public authority, improving the current administration imperfections of the public authority. For undertakings, the utilization of the Blockchain can guarantee stock quality and giving fast reaction to the Changing business sector. Indeed, the utilization of the Blockchain can secure the privileges of shoppers.



**Fig. 1.** The Blocks in the blockchain

The square chain can be affixed with the current blockchain dependent on the agreement component. The Consensus calculation can be applied in two model for example authorization less model and permissioned model. The square approval is finished utilizing agreement calculation followed if the square is approved and guaranteed that square is included the current blockchain without framing fork.



**Fig. 2.** Block Structure

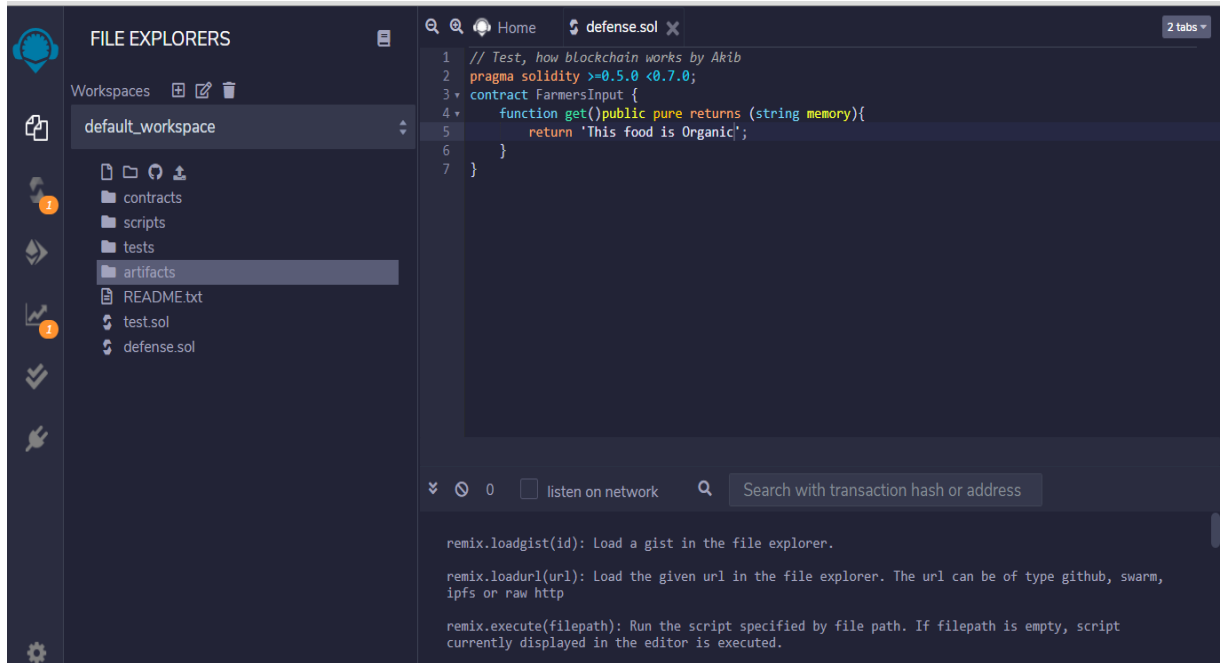
Each square as demonstrated in Fig. 2 comprises of square header, for example, past block hash, Time stamp, variant, nonce, Merkle root hash. Aside from blockheaded there is n number exchange are put away.

## **CHAPTER 5**




### **RESULTS AND DISCUSSION**

#### **5.1 RESULTS AND DISCUSSION**

In this paper, we utilize the strategies for data science, the board science, framework science and different speculations and observational examination techniques, essentially utilizing the PEST investigation to dissect, differentiate and show contemplating the utilization of Blockchain in the food inventory network. Irritation is a logical model that examines the large-scale climate area of the business. All pieces of the PEST are the outside climate of the business that can't be constrained without help from anyone else. The paper likewise carries on the interest investigation of the Blockchain framework foundation of the food inventory network. Right off the bat, this paper subjectively examines the current circumstance of food security. The second is the interest investigation of the food store network detectability framework stage, dissecting the food store network can be followed back to the main drivers and the requirement for advancement. Thirdly, it examines the customary discernibility arrangement of food inventory network. Fourthly, focusing on the issues existing in the food inventory network framework, applying the square chain innovation to fabricate an inventory network framework stage for creation processors, intermediaries and buyers.



**FILE EXPLORERS**

Workspaces   

default\_workspace

- contracts
- scripts
- tests
- artifacts
- README.txt
- test.sol
- defense.sol

**defense.sol**

```

1 // Test, how blockchain works by Akib
2 pragma solidity >=0.5.0 <0.7.0;
3 contract FarmersInput {
4     function get() public pure returns (string memory){
5         return 'This food is Organic';
6     }
7 }

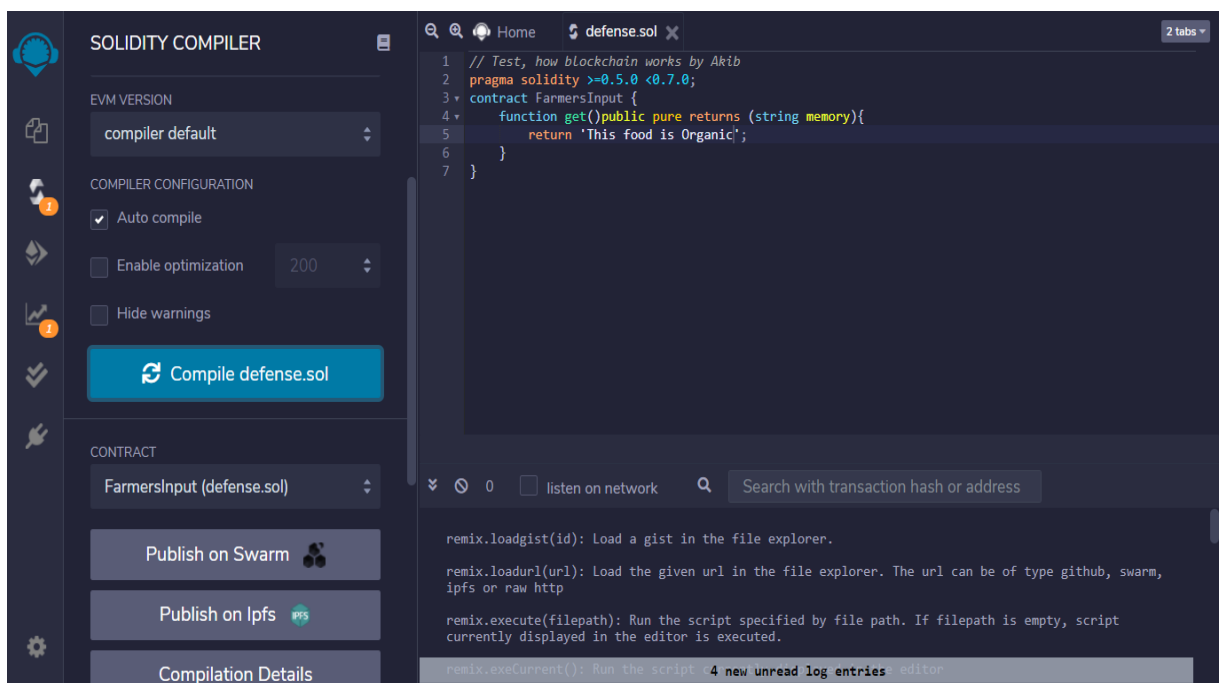
```

0 ☐ listen on network

remix.loadgist(id): Load a gist in the file explorer.

remix.loadurl(url): Load the given url in the file explorer. The url can be of type github, swarm, ipfs or raw http

remix.execute(filepath): Run the script specified by file path. If filepath is empty, script currently displayed in the editor is executed.



**SOLIDITY COMPILER**

EVM VERSION


compiler default

COMPILER CONFIGURATION

☒ Auto compile

☐ Enable optimization 200

☐ Hide warnings

 **Compile defense.sol**

CONTRACT

FarmersInput (defense.sol)

**Publish on Swarm**

**Publish on Ipfs**

**Compilation Details**

**defense.sol**

```

1 // Test, how blockchain works by Akib
2 pragma solidity >=0.5.0 <0.7.0;
3 contract FarmersInput {
4     function get() public pure returns (string memory){
5         return 'This food is Organic';
6     }
7 }

```

0 ☐ listen on network

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remix.execute(filepath): Run the script specified by file path. If filepath is empty, script currently displayed in the editor is executed.

remix.executeCurrent(): Run the script **4 new unread log entries** editor

## DEPLOY & RUN TRANSACTIONS

ENVIRONMENT

JavaScript VM

ACCOUNT

0x5B3...eddC4 (99.999999%)

GAS LIMIT

3000000

VALUE

0

wei

CONTRACT

FarmersInput - defense.sol

Deploy

☐ Publish to IPFS

OR

At Address

Load contract from Address

Home

defense.sol

2 tabs

```

1 // Test, how blockchain works by Akib
2 pragma solidity >=0.5.0 <0.7.0;
3 contract FarmersInput {
4     function get() public pure returns (string memory){
5         return 'This food is Organic';
6     }
7 }

```

0

☐ listen on network

Search with transaction hash or address

remix.loadgist(id): Load a gist in the file explorer.

remix.loadurl(url): Load the given url in the file explorer. The url can be of type github, swarm, ipfs or raw http

remix.execute(filepath): Run the script specified by file path. If filepath is empty, script currently displayed in the editor is executed.

remix.executeCurrent(): Run the script

6 new unread log entries

editor

## DEPLOY & RUN TRANSACTIONS

CONTRACT

FarmersInput - defense.sol

Deploy

☐ Publish to IPFS

OR

At Address

Load contract from Address

Transactions recorded

2

Deployed Contracts

FARMERSINPUT AT 0XD91...39138 (ME)

get

0: string: This food is Organic

Low level interactions

CALLDATA

Home

defense.sol

2 tabs

```

1 // Test, how blockchain works by Akib
2 pragma solidity >=0.5.0 <0.7.0;
3 contract FarmersInput {
4     function get() public pure returns (string memory){
5         return 'This food is Organic';
6     }
7 }

```

0

☐ listen on network

Search with transaction hash or address

remix.loadgist(id): Load a gist in the file explorer.

remix.loadurl(url): Load the given url in the file explorer. The url can be of type github, swarm, ipfs or raw http

remix.execute(filepath): Run the script specified by file path. If filepath is empty, script currently displayed in the editor is executed.

remix.executeCurrent(): Run the script

8 new unread log entries

editor

## **A. Blockchain Application Theory**

The Blockchain stores the food data as an exchange. All the exchange is put away in the blockchain are dispersed and straightforward different members. Anybody in the blockchain organization can approve the exchange in the interim every one of the hubs are permitted to follow food data, which accomplishes the straightforwardness and recognizability for food handling. Because of the trait of the blockchain, every one of the exchanges will be pressed in one or a few squares. Every one of the hubs additionally update the book on local when another square is checked and recorded on the fundamental chain, which implies every one of the hubs have same exchange that records every one of the exchanges. In the event that somebody need to transform one of the exchange records, an assailant who has a high phony validity score can prevail in a 51% assault [21]. Be that as it may, such cycle may unfathomably devour processing ability to alter over portion of the hub's chain and figure the qualified hash to repack the square. The blockchain exchange got cryptographically utilizing Hashing calculation Double SHA 256 [22]. The blockchain can guard the data without control.

## **B. Decentralized Food Supply Chain Authentication Model**

In Blockchain circulated framework each progression of exchanges is recorded in the record [23]. The passage in the record are permanent so individual can't alter or modify the exchanges. The members in the organizations according to the figure 1. Ranchers, makers, merchants, conveyance accomplices, Retailers and clients. The ranchers register the thing in the record as an underlying exchange, a few exchanges approved and substantial exchanges are included the record [24]. The maker checks the exchange dependent on schedule, quality and numerous components. The merchant ships the thing from once source to somewhere else these exchanges like beginning spot and objective are considered as exchange additionally put away in record like some other exchange [25]. Any imperfection in the exchange among rancher and purchaser through parties as maker, carrier, and retailer can be handily distinguished continuously. Here exchange

allude as computerized record caught by IoT gadget [26] [27]. The blockchain advancements accomplishes diverse endeavor of the food supply is the public authority interest, through the arrangement of food market exchange record. This can resolve the issues of food routineness and authority measure. A portion of the food administrative power prerequisites are

- (1) Accurately gather the information on all perspectives of the food inventory network.
- (2) Information procuring and capacity of the planting to the entire cycle
- (3) Transferred to the public authority through blockchain. In this way, exchanges are cryptographically gotten utilizing twofold SHA 256 Bit calculation likewise guarantees permanence, straightforwardness, disseminated and simple to upkeep.

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