Applying Blockchain in Agriculture: A Study on Blockchain Technology, Benefits, and Challenges

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1 Introduction

1.1 Agriculture Revolution in Blockchain

Agriculture is the primary innovation of human development. During the 1700s, the British agricultural revolution triggered the industrial revolution that provides us cities and towns [1]. It is mostly a stable growth by working with the development and help of plants and animals. For instance, Australian commercial agriculture focused on crop and animal species taken from outside. However, technology is still deployed in agriculture. Potts and Kastelle (2017) enhanced agricultural productivity [2]. They developed farming inputs like seeds, assets, supplies to agricultural and output like wheat, wool, cotton, and so on. Advances in technology are new inputs or new ways to turn them into outcomes by improving technology for security and expertise. In view of this, agricultural technological progress is focused on the farm and its potential productivity. However, farms provide crops, livestock, and also generate possible information. Those data comprise the information records that create value to the products which leave the farm. Such data are valuable for all those who contract, process, transport and be the intermediary or primary customers of every farm product. Data should not only be generated and connected but also required to be trustworthy to have significance. Blockchain is an invention that integrates the farm closer to the world. It contributes by reducing the cost of transferring data generated on-farm for off-farm storage and usage [3, 4].

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167

Agriculture is still one of the world's least digitized sectors. Most of the on-farm data are problematic to transfer to off-farm as it is not generated or analyzed in a way that supports trustworthy, economical, and transmission. The low levels of digitalization in several modern agriculture have a significant constraint on the agriculture development and efficiency to acquire value from information. In all industries, data is collected, and the information technologies can promote better agricultural management process that leads to productivity increase and better outcomes on farms. Moreover, digitalization and information technology have added into the value equation of the specific quality of agricultural commodities [4]. Commodity grade, quantity and quality measures, compliance with standards and rules, safety information, legal properties, provenance, and authenticity are the characteristics of a certain quality. Those information characteristics and features of all input on the price of the agricultural commodity. The lack of transparency allow a product to market at full information price, as does ambiguity about data quality. It is expensive to create and attach data and information. However, it is financially beneficial to the level that data are useful for downstream users and gradually for customers to identify product attributes. It is too expensive to build trust or show the nature of the data. The quantity of data generated, confidence in the data given in proportion to the cost of processing the data on the field, and the desire to pay for downstream customers.

Agrarian supply chains are the most difficult and complicated with a few exceptions like the local farmer's market. Agriculture is a competitive field; most of the production takes place over an industrial level. It is sold into the market around the world due to various rationality and seasonality. Agriculture is often processed and combined, which needs to be treated carefully. It is mostly produced from different locations with significant variations in quality due to changes in small producers. The majority of agricultural products may be price variant in ways that are hard to analyze. For this kind of cause, the information about food products, traceability, transparency of all addressing and processing, as well as compliance with the set of rules and regulations in the supply chain at all stages it is essential to certify the quality, safety, and value of agronomic yields. These value criteria progressively minimize the problem of digital information, formation, and trust. Then blockchain technology could be a critical infrastructure element in the forthcoming agricultural supply chain.

2   Use Case of Blockchain in Agriculture

2.1   Crop and Food Production

The catering demands in a growing population, food with limited assets, while reducing the impact on the environment, maximization of consumer service, accountability in the supply chain, and promising farmers reasonable profits. Although, controlling climate complexities presents many difficulties in enhancing
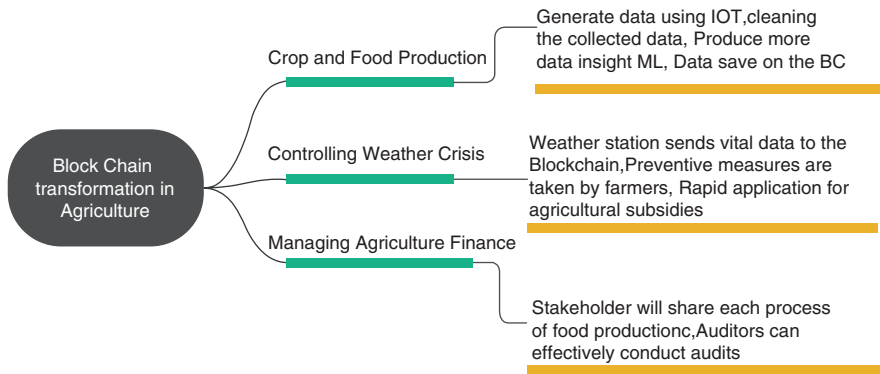
Crop and Food Production — Generate data using IOT,cleaning the collected data, Produce more data insight ML, Data save on the BC

Block Chain transformation in Agriculture

Controlling Weather Crisis — Weather station sends vital data to the Blockchain,Preventive measures are taken by farmers, Rapid application for agricultural subsidies

Managing Agriculture Finance — Stakeholder will share each process of food productionc,Auditors can effectively conduct audits

Fig. 1 Blockchain transformation

the income, if it is favored. Blockchain combined with IoT transforms the food processing sector, including producers to manufacturers, and food product distributors. The blockchain was built to make agriculture competitive by leveraging farm services such as water, workers, and fertilizer with a better solution [3, 4] has shown in Fig. 1.

2.1.1 Blockchain Transformation Befalls Based on Four Steps

a) Generate Data Using IoT Device

By 2050, the global population is estimated to hit 9.6 billion. The agricultural industry implement IoT tools and sensors to support the rising population. A device is built-in IoT-compatible, smart farming to keep a close eye on farmer's field through sensors (Humidity, light, soil moisture, pH, and temperature). IoT sensors and devices produce data that might help the farmers be well-concerned about the crop's growth. The information obtained from IoT devices should first be processed before data is saved.

b) Cleaning and Enrich the Collected Data

Once the accumulated information is stored on the ledger, it must be organized and recognized. Data enhancement is performed to add additional value to boost the source of knowledge acquired. The next two steps to verify the data are filtered until it is stored on the distributed storage platform.

By Adding Meta-Information

Timestamp, demographic, and type details should be applied to the data to allow it more accessible.

Make Data Ready for Compliance

Saving data on the blockchain will not indicate compliance. Instead, it makes the regulation of enforcement quite transparent. Agreement helps to ensure that personal information connected with data gathered from the IoT device is secured and meets safety measures.

c) Produce Data More Insight with Machine Learning

Machine learning is used to obtain valuable information from the data produced by sensors. Predictive models can control several rare use cases like crop quality recommendation, identification, yield prediction, demand prediction, and automated crop growth factor. From the knowledge obtained from machine learning algorithms, both farmers and investors can produce growth in the irrigation system.

d) Data Saved on the Blockchain

The high-value data collected from machine learning is stored in IPFS (Interplanetary file system), a distributed storage platform that represented, hashed, and stored on the blockchain. In contrast to the previous method for storing crucial data on the centralized server that has the potential of a solitary point of failure, in blockchain the data is scattered through each node inside the network, prohibiting centralized authorities to monitor the system. The data seized in the blockchain drive to stimulate smart contracts to make guidelines that have been determined. Smart contracts allow data to be exchanged and stored in blockchain among the various stakeholders in the system. Although the information is available to any investor in the agricultural market, the efficiency of crop or food production is transparent.

2.2 Controlling Weather Crisis

Farmers typically experience uncertain weather conditions while planting different varieties of crops. However, weather predication and tracking are vital for the preservation of vegetables. For example, some of the plants cultivated in the US could not handle flooding due to heavy spring rains. The oxygen content exceeds zero, which makes it impossible for plants to carry out life-supporting activities like water intake, root development, and breathing. Furthermore, lack of transparency

will leads to uncertain and high price rise in the current food chain platforms. Consumers have no awareness, once the crops struggle from poor weather conditions, resulted in price increases. When blockchain can produce traceability, farmers and stakeholders can know knowledge about price variance in the food distribution sector. Since the licensed entities can monitor climatic conditions from the blockchain ledger, farmers can obtain crop insurance compensation through the smart contract. They are three essential step processes that proceed with weather control for the agricultural field based on blockchain.

2.2.1   Weather Station Sends Vital Data to the Blockchain

Smart agriculture allows farmers to recognize the conduct of the crop by applying sensors and mapping areas. Agricultural weather stations in farms may provide valuable information like soil temperature, air temperature, wetness in the leaves, rainfall, wind intensity, relative humidity temperature, atmospheric pressure, wind speed, and direction. All the above parameters are calculated, stored, and saved in the blockchain that helps the farmers and other authorized organizations to have transparent connections to it.

2.2.2   Preventive Measures Are Taken by Farmers

By collecting the data produced by weather stations, farmers can make accurate farming decisions. For instance, if you know that it will rain heavily in the coming 2 days, it will help you in getting what you want in progress.

2.2.3   Rapid Application for Agricultural Subsidies

In case of loss during a weather disaster, farmers can claim crop insurance immediately through blockchain. The transparent and immutable conduct of the blockchain allows insurance and other approved entities to securely access data captured by the smart weather stations. They may ask the blockchain directly to acquire the relevant data using smart contracts. After acknowledgment of an insurance claim, farmers receive the required amount in their appropriate wallets automatically. A blockchain-enabled solution can support farmers to get payment fast and seamlessly.

2.3   Managing Agricultural Finance

Some of the issues with formal sustainable development and smallholders are insufficient transparency, credit history, and complexities in contract compliance. The lack of affordable to the financial sector help can impact agricultural value chains;

as producers, we cannot optimize their supplies. Buyers are overwhelmed by difficulties to promise a sufficient quantity of goods. The financial firms allow small-scale farmers to spend on agriculture and help to alleviate funding limitations. Blockchain adds consistency to the agriculture finance cycle by transparency and accessibility of decentralized regulations.

2.3.1 Stakeholder Will Share each Process of Food Production

Whenever a contract happens, it is recorded in the blockchain, which allows all concerned parties to access through transaction transparency. The sharing of valuable information at each stage of food processing will make the whole process fair and equal.

2.3.2 Auditors Can Effectively Conduct Audits

Blockchain can operate as a form of authentication for recorded transactions, as it can store data safe and secure. Rather than asking farmers or retailers to apply audit financial reports, the auditors may personally verify the transactions through blockchain ledgers. Automatically generated auditing process provides cost-effective. Instead of performing evaluations at the end of the year, audit services will also be capable of carrying out audits during the year. Blockchain will enable the randomized analysis to replace by auditors, making it much easier to examine every single payment.

3 Technology of Blockchain in Agriculture

Based on the stages of economic growth, people worldwide are genuinely interested in the transfer of value. This transfer of value allows individuals to exchange products and services and to acquire productive assets and savings for their welfare. Distributed ledger technologies (DLTs) have been implemented to reduce the volatility during the value of the exchange. DLTs allow higher productivity, accountability, and quality control in the agriculture and food industry for the transfer of value and resources. A blockchain is an electronically developed real-time ledger for a particular data package available to all stakeholders and protected from any manipulation of data. The blockchain data is stored as blocks. Throughout the agriculture and food value chain, a blockchain controls the origin of a food commodity, monitors real-time product data, and executes agricultural and food transfer. Such advantages are easy and cheap food batch prompt for an emergency, reliability of the entire product condition record, enhanced customer interest, satisfaction, fairer prices, authorized sellers, and excellent management of compliance.

How to utilize Blockchain in Agriculture Domain?

Blockchain technology belongs to Industry 4.0, which applies to automation and data transfer in the development cycle. Industry 4.0 combines cyber-physical systems, cloud computing, IoT, and cognitive computing. The growth in cryptocurrencies like bitcoin is increasing prominence for blockchain technology. While the first use of blockchain is in cryptocurrency, it has enormous potential for other transactions. In one of the sectors, blockchain can be used in agriculture.

3.1 Significant Usage of Blockchain with Agriculture

3.1.1 Ensure Food Safety

To achieve food safety in the supply chain, blockchain technology can be utilized. Blockchain technologies strengthen traceability and accountability to identify weak and week processes in the agricultural supply chain [5, 6]. It assures that the optimal standards from farms to the store are maintained. The capability to trace food products source is vital in the context of a food safety epidemic. Industry regulators can quickly identify the contaminant source and meaning of affected goods [6]. Early recognition of the potentially contaminated source will allow food industries to pivot dramatically into action to prevent diseases and save lives. Such a prompt response will contribute to constraining food waste and saving money by cutting financial implications. Farmers, consumers, and businesses like IBM, Walmart have started working on food safety using blockchain technology.

3.1.2 Traceability in Agricultural Products

Traceability promotes trust and confidence for retailers and customers about the product. When the complete agricultural supply chain is integrated into the environment driven by blockchain from product registration, transaction, and transport, then consumers will check that the item they obtain is precise, what they paid for. Each phase of the transaction is registered in the blockchain. Each statement by a supplier about the source of its items could be verified by observing an item's progress from the farmer to a level in which the stock has arrived, thereby eliminating concerns of mischaracterization. From a consumer's perspective, a transparently distributed ledger would consider them optimistic in the food production source and quality [7]. By observing the food supply chain, consumers would be more informed about the origin of their products and production dates. The quality of the product development, start-ups like provenance leverage blockchain to demonstrate in specific terms to sources of their food supplies. Provenance uses blockchain to protect and monitor its food supply chains and to make it public so that all stakeholders in the supply chain are involved in the process. Provenance employs the ledger to generate detailed reports of materials, supply chains, and goods, thereby providing the consumers additional clarity about the quality and source. The start-up offers the

customer a completely transparent record in the form of a real-time data repository. It makes customers every step in the process of the product. For instance, we can see the current product location, owner, and the product's duration for the specific group of people.

3.1.3   Mitigation of Food Fraud

The traceability and subsequent accountability of blockchain models play a significant role in preventing food fraud arising predominantly on inaccurate labeling. When the demand for antibiotics, herbal and GMO food develops, misleading advertising is ubiquitous. However, blockchain technology and IoT allow the entire supply chain to be controlled effectively. Even the small payment in farms, factories, or warehouses could be tracked, and information is shared across the supply chain using IoT devices like sensors and RFID tags [8, 9]. Blockchain will protect millions of dollars from large distribution companies by ensuring that productivity decreases fraud cases in hundreds of interactions among the supply chain.

3.1.4   Manage Transaction Cost and Competitive Marketing

Blockchain technology decreases trading costs and helps at reasonable prices. It facilitates product buyers to negotiate with their suppliers directly and transactions through mobile transfer. Therefore, it is easier for buyers and suppliers to obtain equal prices for their agricultural goods. The farmer receives a reasonable return of farming products, and the seller pays a reasonable price for the agricultural products delivered. The retailer saves much money since the technology removes agents and intermediaries. Eventually, blockchain technologies help farmers and suppliers to validate their incentives on other agricultural commodities [10]. Blockchain technology contributes to decreasing transaction costs for agrarian products resulting from the extensively fragmented market. The farm product industry depends heavily on the direct personal experience of a party in the supply chain until you can trust them to do business. The assurance and transparency have generated by the ledger, accessible to all parties to removed or decreased each party's need to access seperately its worthiness and its ability to implement contract. Those trading in the agricultural product will do business without having a broker trust.

3.1.5   Best Price and Payment Options

The application of blockchain technology would allow agri-participants to deliver fast payment options at a lower cost. Globally, farmers face significant delays in releasing payments from various national agriculture boards for their products: additional farmer's frustration due to the expensive nature payment method like wire transfers. Blockchain can tackle some of these redundancies. Some developers

have already programmed the blockchain-based application to peer-to-peer transfers that secure, cheap, and virtually instant. By using smart contracts, payments are automatically activated once the buyer determines that specific requirements have been satisfied [11].

3.2 Blockchain in the Food Industry

In reality, information and communication technology (ICT) play a substantial part in improving the applications of the agriculture and food industries. ICT facilitates e-farming, which encourages market productivity, food security, health and reduces volatility and uncertainties. E-agriculture depends on empowering agriculture to exchange knowledge to make farms better, competitive, safe, and prevent potential consequences. Blockchain can be a better option in the sharing of knowledge. Attempting to apply Blockchain to e-agriculture frameworks supports to build trust between stakeholders who contribute their experience and the use of e-agriculture servers offers to boost their farming [12]. These services can maximize cost efficiency; strengthen food safety, and decrease ambiguity and risks.

In contrast to primary agricultural activities, cryptographic protocols can be used in farming-related fields like the bee sector to track bee adulteration practices, endorse smart pollination contracts, and strengthen the beehive insurance industry [13]. Blockchain can be used with ICT in the food industry to promise food safety. For instance, RFID is used to develop a quality control system for the agrifood supply chain [11].

The system can afford reliable information over sensitive data collection and interaction procedures in the agricultural supply chain to maintain food security in all stages of distribution, manufacturing, storage, supply, and marketing. Besides RFID, blockchain can be incorporated into certain IoT technologies and advanced ideas for food protection like hazard analysis and critical control points to manage and promise food safety and quality in the supply chain [14].

3.3 Challenges in Food Industry by Using Blockchain

1. The problem is that the data is as accurate as given by the data provider. In a specific supply chain, there will be one or more "untrustworthy" data providers. It suggests that blockchain is possibly ineffective to prevent food fraud unless all data are examined appropriately. Blockchain is still far from essential, but incomplete or uncontrolled data limits its feasibility. To mitigate such limitations, we should not build an IoT, blockchain, and smart contract in solitary confinement, but should also build a social–technical background. For instance, when procedural food inspection is influenced by persistent, local corruption.

2. Industrial sectors like supermarkets and hotels are chronically marginalized and food traceability schemes seems to be expensive without enhancing profits. As an outcome, the strong motive is often not essential for investing in this kind of advancement. Big supermarkets like Walmart have the assets and capacity to interact with regulars and inspectors. Still, beyond that, individual market players often build processes designed to address the demands of minimal adherence and no longer.

4   Application of Blockchain in Agriculture

4.1   Smart Farming

Several smart farming models focused on combining the application of IoT and blockchain technologies are introduced and deployed. Lin et al. (2018) developed a blockchain and IoT-based smart agriculture system. The crucial part of the system is a platform to create trust between players through blockchain. Agents are associated with the product from its farm to sales that process the storage of data in blockchain by smartphones. Blockchain-based ICT e-agriculture model is used at local and regional scale, in which each individual is having real-time aquatic quality data stored in the blockchain [11]. Most of the enterprises have started giving dedicated attention to blockchain applications to smart agriculture. For instance, Fliament offers strategies to interact with physical objects and nodes over smart agriculture technology. It is designed based on penny-size hardware used with previous machines or equipment linked with a USB port for efficiently interacting with the blockchain. Blockchain is used by farmlands to produce smarter and effective farming practices. For instance, In Taiwan, the farmland irrigation organization utilizes blockchain to collect data and provide public relationships [15]. Each organization acts as a "public legal person" and exposes its data and information regarding irrigation management to the blockchain, and the public uses those data. Transparency conveys the people's contribution to irrigation management and improves its determination to strengthen water supplies. The statistical database generated by blockchain is used to direct decision-making in the building and maintenance of irrigation canals [11]. Smart farming with blockchain will not reduce, if not improve, the technological limit toward involvement of the farmers [16]. It is primarily driven to accumulate accurate data from massive farmers rather than small farmers for uploading to the blockchain.

4.2   Food Supply Chain

Through rising globalization and increased market competition, food supply chains are becoming more diverse and broader than before. There are still prevalent issues with food supply chains such as food traceability, quality, food assurance, food

safety, and inefficiency in the supply chain, which creates significant risks to society the economy, and food security. From the producer's point of view, the practice of blockchain technology supports to create a trust association with customers and strengthen product legitimacy by transparently delivering specific product details in the blockchain. Enterprises are enriched capable of gaining the quality of their commodities, and therefore, grow their profitability. This will make it impossible for low-quality and fraud suppliers to remain on the market and push all suppliers to boost the standard of commodities in the agronomic and food industries.

From the viewpoint of customers, blockchain provides accurate and authentic knowledge about how food is generated and taken out of circulation. It will address the apprehensions of customers about food safety, quality, and environmental friendliness of food [17]. The use of blockchain allows customers to associate with producers as consumers can comprehend the process of food production more comfortably with detailed information. It facilitates consumers by minimizing limitations to the trade of goods to improve the relationship, thus boost consumer faith and trust in food safety.

From the viewpoint of regulatory agencies, blockchain delivers transparent and consistent information for them to execute competent and active regulations [18]. Blockchain can control product details from the origin to the trade store. It offers a convenient, irreversible way of loading data obtained from the beginning of the supply chain. For example, DNA of livestock animals, pesticide residues of grain or vegetables. Such data can be validated and verified by any individual involved in the supply chain of the product [10]. It can be quite costly to acquire these data on all products but can be performed on samples.

Several approaches driven by blockchain technology to boost the traceability of agricultural products were developed. Tian (2016) proposed a traceability system for the agricultural food supply chain by Radio frequency Identification (RFID), a non-contact automatic identification system [10]. It can monitor products through the supply chain using accurate details. Using blockchain ensures that the system's output, procedure, store, and supply records are accurate and truthful. Blockchain-based traceability system which directly connected to IoT devices by providing virtual production and consumption data. The traceability is accomplished by ethereum, and the hyper ledger saw the tooth blockchain platform [19]. The current blockchain technology is still in the early stages of development within the food supply chain. At the same time, it has several unstable and incomplete points in the practice of deploying blockchain technology. Besides, the application of blockchain technology involves significant participation and involvement of stakeholders in the food supply chain that is notable for performing its functional role. Due to its functionality, accessibility transparency, and decentralization, blockchain technology allows controlling of food quality information across the supply chain. It supports to prevent fraud in food procurement and decrease the cost of maintaining the food supply chain. It helps entire stakeholders like manufacturers, customers, and government regulatory authorities.

4.3   Limitations

Blockchain technology allows knowledge of traceability in the food supply chain and strengthens food safety. It maintains safe data storage and management, facilitating the production and application of data-driven technologies for smart agriculture and smart index-based agricultural policies. It can also reduce the cost of transactions that will boost farmer access to the market and produce new streams of revenue. Despite significant potential benefits, key constraints arise for the deployment of blockchain technology in agriculture enterprises. Furthermore, more analysis is required on the participant's incentive to provide a blockchain leader with legitimate and accurate information. It may be vital for smallholder agriculture. The knowledge produced in the agricultural process is distributed and controlled by individual farmers. The implications of blockchain technologies for farmers may rely on the size of the farm. On one side, smaller farms might quickly become involved in the blockchain-based insurance industry. Another side, it could be more efficient to capture and incorporate on-farm data for larger farms.

4.4   Challenges of Deploying Innovation in Agriculture and Specific Steps Required Follow to Overcome them

The agriculture supply chain seems to be more complicated and volatile than most other supply chains. In contrast, agricultural production relies on weather, diseases, and pesticides, which are hard to track and control. The scarcity of traceability in the agriculture supply chain contributes to slow economic and often complicate process of transactions. Furthermore, counterfeits can occur at any point in the supply chain and can lead to harmful consequences to all business participants, government, and customers; has shown in Fig. 2.

Blockchain projects will minimize the risk of counterfeit products and improve the agriculture efficiency based on blockchain by ensuring transparency and removing intermediary connections through the agricultural value chain. Moreover, by mitigating uncertainly and allowing retail investors to trust decentralized ledger and smart contract to offer a massive opportunity for competitive business involvement between smallholders and micro, small and medium enterprises (MSMEs). The fundamental challenge for agriculture supply chains occurs in the transportation of goods. While transaction information can be identified from the fingerprints associated with each payment, the transfer of the physical product from farm to consumer through a supply chain takes an even unchangeable commodity cycle. Technologies to locate physical goods across the supply chain for agriculture based on QR codes to the packing products, advanced radio frequency identification (RFID) chips, RFID application, and RFID supply chain in agriculture, Crypto-anchor technology for agriculture, and Near field communication technology (NFC) [20].
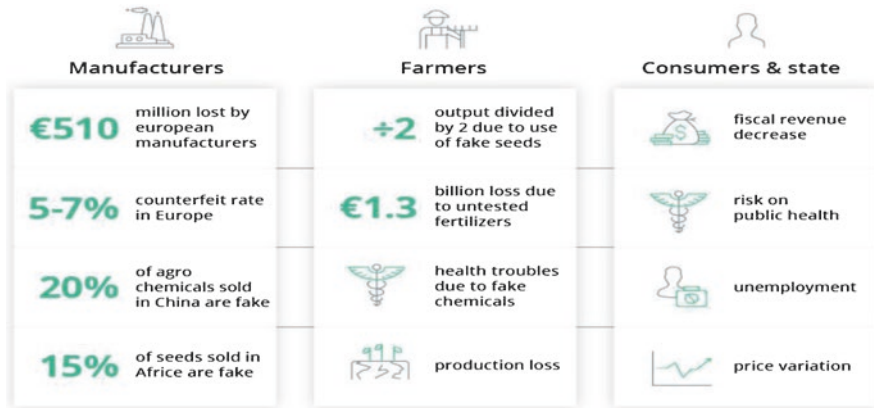
Manufacturers		Farmers		Consumers & state	
€510	million lost by european manufacturers	÷2	output divided by 2 due to use of fake seeds		fiscal revenue decrease
5–7%	counterfeit rate in Europe	€1.3	billion loss due to untested fertilizers		risk on public health
20%	of agro chemicals sold in China are fake		health troubles due to fake chemicals		unemployment
15%	of seeds sold in Africe are fake		production loss		price variation

Fig. 2 Negative effect on counterfeit products in Agriculture

5   Future of Blockchain in Agriculture

Using blockchain, we can solve problems for helpless farmers. According to the World Bank report says that "Agriculture help to alleviate hunger, boost profits and enhance food health for 80% of the impoverished world population living in rural, functioning predominantly in agriculture". Blockchain technology can be exploited by organizations, governments, non-profit organizations to tackle global challenges for helpless farming. Ultimately, blockchain is a digital ledger for keeping decentralized information that provides access for numerous entities throughout who interact in the platform. The data contained in this ledger is timestamped and will not be in any scenario, been changed. Information is static. The most unexpected distinction of blockchain is its capability to prevent the participation of agents into the system by developing a direct communication network among farmers and consumers.

The lack of agents within the network has several benefits like better farm income, less travel expenditure, greater flexibility, and cost-effectiveness in the agricultural logistics chain. The deployment of a blockchain-enabled platform for farmers to export agricultural products will optimize the entire agriculture supply chain and incorporate producers into the global economy. The platform will empower farmers and allow them to become a community and enter the market without any intermediary involvement. It spreads the influence of MNCs who are usually the primary buyers, fixes prices, and recommends farmers to grow in a given season. Through blockchain, community-driven producers and small companies can benefit by putting their mark on the world agriculture sector. Smart contract –distribution and tokenized shareholding will enhance community agriculture's efficiency by creating direct communication among farmers and consumers. The additional benefit of the cryptocurrency trading would also make the helpless farmers relatively stable. Blockchain is driven by the ability to enhance fundamental rights and

innovation. We have already explored solutions to the lack of monitoring in fertilizers and pesticides in the farms and fraud on farmers or agent's price of goods.

Blockchain combined with IoT development can be a one-stop solution to the problems of product control from seed to food supply. It can be used to track everything's including individual livestock on dairy farms, to specific farms to all areas at a low cost. The farmers could follow their farm with environmental factors like humidity and temperature at any time on a blockchain platform. Besides, blockchain can be used for the complicated land registry procedure in the agriculture supply chain for poor farmers. Often small farmers are incompetent and subjected to fraud while processing the property. Blockchain can be revolutionary in the cost-intensive data collection process. The poor helpless farmers depend heavily on subsidies; however, the amount of cash that reaches individual helpless farmers is a real mystery. Blockchain guarantees reliable data management to secure that the assigned quantity arrives at the hands of farmers who are urgently need it.

6   Conclusion

Blockchain technology initially developed to generate internet-native money, the technology behind cryptocurrency, and have many comprehensive applications to deliver digital infrastructure to next generation for agricultural trade and global supply chain. Blockchain technology influences any enterprise that comprises digital data, and agriculture is no exception. The agricultural sector would benefit by incorporating blockchain technology to the point that operational and trading aspects can be digitized and then transmitted as digital infrastructure to blockchain technology. Furthermore, such benefit is achieved across the value chain, and for individual farms to be financially profitable, will rely on organizing the adoption of new technology within the sector. At Early-stage development technology, the relative unfamiliarity in technology among parties, and required to coordinate adoptions are some vital challenges faced certain aspects. The new technology may be challenging, complicated, and disruptive. The possible complications that it solves are massive, and if it is explained, it could contribute toward significant benefits to agricultural producers by increasing the margin of prices. It could be a strong reason to suggest the agricultural sector to invest in blockchain technology.

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