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BLOCKCHAIN TECHNOLOGY IN AGRICULTURE PRODUCT SUPPLY CHAIN

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ABSTRACT

Globalized delivery of manufacturing and agricultural production offer renewed attention to the health, efficiency, and validation of many vital criteria in the food and agricultural supply chain. That numbers of food safety and corruption hazards have generated an enormous need of an efficient traceability solutions which acts as an essential quality managements tools ensuring to enough product's safety within the agriculture supply chain. Block chain is the revolutionary technological method, which provides the ground breaking result for commodity traceableness in agriculture and in food supply chains. Today's agricultural supplying chains are complicated ecosystems mixing several stakeholders making it difficult to validate several significant requirements mainly towards nation of first origin, crop growth phases, quality standards compliance, and yield monitoring. This paper proposes a strategy that levitates the block chain and conducts business operations effectively across the agricultural supply chain for tracking crop prices and traceability. The proposed framework solution discards the need for trusted centralized authority, intermediaries and offers records of the transactions, improving efficient science and safety with high integrity and reliability. All transactions are registered and then stored in block chain's unchangeable ledger with linkages to a decentralized le network, thereby ensuring vary high degree of traceability and transparency in the supply chain ecosystem in a stable, reliable and in efficient manner.

Keywords: Blockchain Technology, Food Supply Chain, Benefits, Challenges, Digital Agriculture.

I. INTRODUCTION

To ensure product safety, handling the growth of farming products and effective management of logistics -chain in agricultural supply chain is censorious. That cover about food safety and the risk of contamination has renewed the prominence of tracing power across the supply chain Moreover, farming goods exchanged across multiple nations require accurate tracking and compliance with nation-specific regulations Tracing of goods in the agricultural field requires to gather, communicate and maintain critical data by specifically identifying the source, multiple data exchanges in the logistic network. High-spirited nature of data in the agricultural / food supply chain where products are manufactured, processed and sent through multiple intermediaries allows tracking and tracing difficult. Contamination of products and its public health consequences highlight traceability as the required policy instrument for tracking food quality and safety. The present traceability practice in the supply chain of agriculture is mainly affected by data fragmentation and centralized controls that are susceptible to both information modification and management. In case of contamination that identifies the source and isolates the product quickly from the supply chain. Today's supply chain is becoming really complex . At various stage multiple stakeholder are present. All these Stakeholder need to collaborate with each other in various direction for efficient and effective management. To deal with food scares and accidents, the food industry becoming more customer-oriented and need quicker response time. Good traceability mechanisms help reduce the manufacture and sale of dangerous or low quality goods, mitigating the risk for false ads, liability and recalls. Reducing the impacts of food safety . Improving food safety, and providing a means to verify food quality attribute are driving the development of traceability initiatives in agri-food system . The United Nation Food and Agriculture Organization (FAO) and the International Telecommunications Union (ITU) are continuing to work together to facilitate the use of innovation Information and communication technologies (ICTs) in agriculture . The importance of traceability has significantly increased with the globalization of the food industries. Therefore, the need for a reliable identification and tracking system is necessary to ensure the quality and safety of food which reaches the consumer . Block chain for Supply Chain is a natural fusion of two

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technologies, built for mutual or common ledge transactions. A supply chain often reflects a distribution of products through industries, and is also cross-border. Food provenance is one pf FSC's most difficult issue. This issue companies are facing today. A global supply chain network with asymmetric food regulation and multiple operating procedure between various countries makes end-to-end food tracking incidental to the food industry. Distributed ledger/Block chain is very important technology that can significantly impact the supply chain management. This paper shows the possibility of block chain technology using supply chain for both perishable product and manufacturing. In food supply chain firms are rapidly adopting block chain system. Example for retailers such as Carrefour indicates that block chain can be used to provide access to rich and details information about food product, which is used to reduce the uncertainty about quality and ingredient. Food safety has been an enormous concern in china over the last few years. As conventional agri-food logistic practices can no longer satisfy consumer demands, developing a traceability framework for agri-food supply is becoming increasingly urgent.

II. RELATED WORK

The research and development activity mainly focuses on tamper-proof and immutable records in turn enables trust and reliability among untrusted peers within the financial technology. This concept made many sectors to identify Blockchain Technology as a platform for model shift. To achieve data reliability, Prov-Chain [14] travel around the use of Blockchain

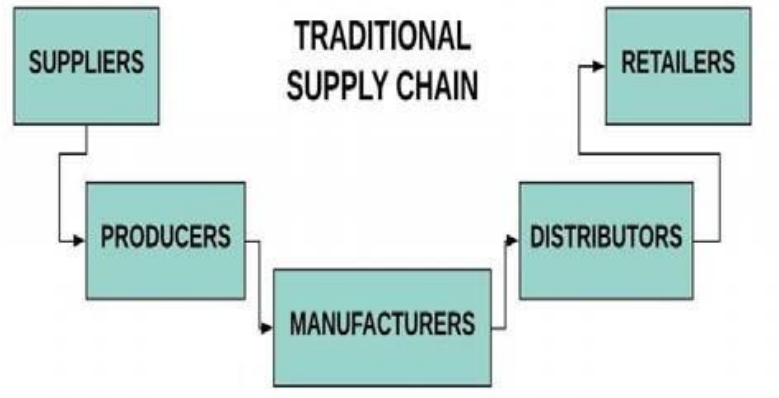

Fig. 1. Traditional Supply Chain

These can be overcome by using Blockchain technology which serves as a public ledger over a distributed network or all information maintenance including verification, validation etc.,[4] using which we can maintain tamper proof records, provide security and avoid third party intermediaries in transactions. It mainly reduces transaction cost and also improves quality of the product. The cryptographic method used here brings out trust among users which helps in demand for the product. The encryption techniques which are used in crypto currencies helps in verification of users and blocks. So here in a blockchain, each block contains information about transaction, and other details. Fig 2. The chain holds ledger from the beginning, when the genesis block was created. Here each block has a reference to previous block through a hash value. The peer-to-peer network [5] helps in validating new transactions and users. The Proof Of Stake (POS) algorithm produces challenges to be solved by users which is then validated and then added to the block if it is valid

III. BLOCK CHAIN IN AGRICULTURE AND FOOD SUPPLY CHAIN

While the blockchain technology gains success and proves its functionality in many cryptocurrencies, various organizations and other entities aim at harnessing its transparency and fault tolerance in order to solve problems in scenarios where numerous untrusted actors get involved in the distribution of some resource (Manski 2017), (Sharma 2017). Two important, highly relevant areas are agriculture and food supply chain (Dujak and Sajter 2019), (Tripoli and Schmidhuber 2018). Agriculture and food supply chains are well interlinked, since the products of agriculture almost always are used as inputs in some multi-actor distributed supply chain, where the consumer is usually the final client (Maslova 2017).

There is evidence that blockchain applications started to become used in the supply chain management soon after the technology appeared (Tribis, El Bouchti and Bouayad 2018). Blockchain in supply chain

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management is expected to grow at an annual growth rate of 87% and increase from $45 million in 2018 to $3,314.6 million by 2023 (Chang, Iakovou and Shi 2019).

The main drawbacks of traditional Supply Chain are:

1. Food safety cannot be assured at any stages
2. The detailed information about the origin ofthe product will not be available
3. Failed to provide transparency andtraceability
4. Controllability – The life span of Control used of anyone to facilitate transactions and also no chance of user errors or frauds

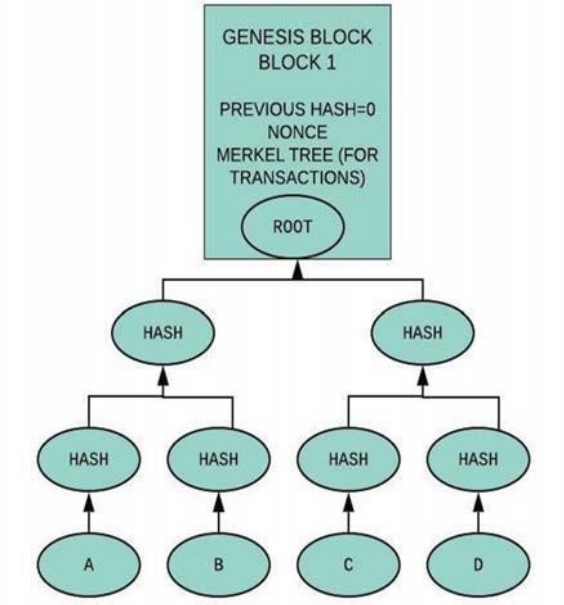

Fig. 2. First Block – Genesis Block

The smart contract is a promise among parties involved in a transaction that holds each party in authority for their role in the transaction to a traditional contract and also ensure that the contract is enforced. Smart contract improve the transparency, traceability and effectiveness of a supply chain allowing it to be more agile in strengthening the relationships among the parties. Each and every smart contract is assigned with a unique address of 20 bytes. The contract code can never be changed once the contract is deployed into the blockchain, user can only send a transaction to the contract's address. This transaction will then be executed by every consensus node in the network to reach a consensus on its output. There are two types of smart contract, deterministic and non-deterministic. A deterministic smart contract is when executing it doesn't require any information from an external party. A non –deterministic smart contract is a contract that depends on information (database) from an external party.

IV. AGRICULTURE BLOCKCHAIN OVERALL PROCESS

The Provider-Consumer Solution provides blockchain a most efficient structure of a database having a public ledger that includes digital information on the products, people, or events that can be accessed or inspected by many users. With the help of blockchain, there is a chance to

- Increase Transparency
- Reduce Error
- Prevents product delays
- Eliminate unethical and illegal activities
- Better management
- Increase the trust between consumer and supplier

Customer demands are increasing every day and to meet that we need an improved supply chain. Also for a better marketing environment, we can make use of Blockchain technology in supply chains. The supplier

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uploads the data about the food product like its harvested date, price. The Food product is then tagged with RFID chip [8]. The tags are placed on any items, ranging from individual parts to delivery labels. Inside the RFID tag, it consists of a microchip and antennae. Identifying information from the Special printers are used to print the tags which wirelessly load the identifying information to the tags. The information on the tags can be used for a various tasks

When RFID scanners scan the item, information is read from the tag which could include some necessary information that could be very effective in maintaining Supply chain such as:

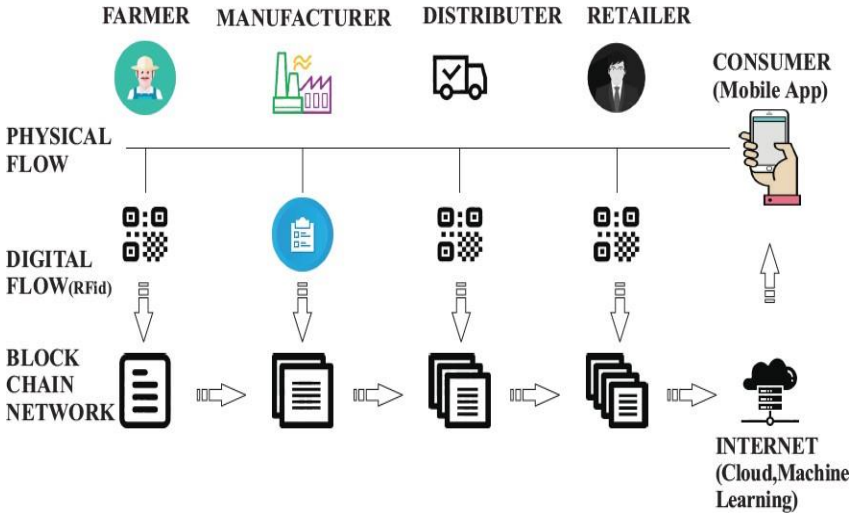

Fig. 3. Streamlined Form of Agriculture Food Supply chain in Blockchain

V. CHALLENGES AND OPEN ISSUES

There are various challenges for the wider adoption of blockchain technology, which are mentioned in related work under study and also in relevant survey and position papers (Chang, Iakovou and Shi 2019), (Galvez, Mejuto and Simal-Gandara 2018), (Hald and Kinra 2019), (Tribis, El Bouchti and Bouayad 2018), (Zhao, et al. 2019), (Pearson, et al. 2019). Table 2 lists potential benefits and existing barriers for the use of blockchain in agriculture and the food supply chain, as identified in Section 5 and Sections 6.1-6.5 respectively, as well as in (Chang, Iakovou and Shi 2019), (Pearson, et al. 2019). A case study in the Netherlands revealed that SME lack the required size, scale or know-how needed, in order to invest in blockchain by themselves (Ge, et al. 2017).

Table 1: Potential benefits and existing barriers for the use of blockchain in agriculture.

Opportunities and potential benefits	Challenges and barriers
Traceability in value chains	SME have difficulties in adopting thetechnology
Support for small farmers	Information infrastructure might preventaccess to markets for new users
Finance and insurance of rural farmers	Lack of expertise by small SME
Facilitation of financial transactions indeveloping countries	High uncertainties and market volatility
Fairer pricing through the whole value chain	Limited education and training platforms
A useful platform in emission reductionefforts	No regulations in place
Consumer awareness and empowerment	Lack of understanding among policy makersand technical experts
More informed consumer purchasingdecisions	Open technical questions and scalability issues(e.g. latency of transactions)
Increased sustainability and reduction ofwaste	Digital divide among developed anddeveloping world

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Reduced transaction fees and less dependence on intermediaries	Decline of cryptocurrencies in market share and high volatility (reputation issues)
More transparent transactions and lessfrauds	Cost of computing/IoT equipment required
Better quality of products, lower probability for foodborne diseases	Design decisions might reduce overallflexibility
	Privacy issues
	Some quality parameters of food products cannot be monitored by objective analytical methods, especially environmental indicators

VI. FUTURE SCOPE

There will be more of niche marketers in operations, area, and crop-specific small equipment which will make operations even at small farms easier and more efficient. Future and Scope in Agriculture It is sure, and undoubtedly the GDP of all the developing and developed countries is influenced by the agricultural sectors. And, it is an integral component of the annual plan of any state or central government. Agriculture is the backbone of many Asian and African countries.

VII. CONCLUSION

This article demonstrates that blockchain technology is already being used by many projects and initiatives, aiming to establish a proven and trusted environment to build a transparent and more sustainable food production and distribution, integrating key stakeholders into the supply chain. Yet, there are still many issues and challenges that need to be solved, beyond those at technical level.

To reduce barriers of use, governments must lead by example and foster the digitalization of the public administration. They should also invest more in research and innovation, as well as in education and training, in order to produce and demonstrate evidence for the potential benefits of this technology. Gupta (Gupta 2017) discusses the possible transition of governments towards the use of the blockchain, noting the fact that governments and their relevant departments should observe and understand the particular “pain points”, addressing them accordingly.

From a policy perspective, various actions can be taken, such as encouraging the growth of blockchain-minded ecosystems in agri-food chains, supporting the technology as part of the general goals of optimizing the competitiveness and ensuring the sustainability of the agri-food supply chain, as well as designing a clear regulatory framework for blockchain implementations.

The economic sustainability of the existing initiatives, as they have been presented in this paper, still needs to be assessed and the outcomes of these economic studies are expected to influence the popularity of the blockchain technology in the near future, applied in the food supply chain domain.

Blockchain technology is still at the development stage but it has been emerging as one of the better technologies in recent times. As agriculture is the most important field of the state, BCT can make a revolution in this field by improving the supply chains and also most importantly by providing traceability and security. It can dramatically increases the economic status of the country, reducing the corruption rate and increasing the satisfaction of producers and consumers. The Provider-Consumer Network is a blueprint for creating such a prototype to assemble the components. We described the usage of token, smart contracts in Ethereum Platform to integrate between nodes in the supply chain Management.

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