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BLOCKCHAIN: A BOON TO AGRI-FOOD PRODUCTS

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INTRODUCTION

Block chain technology may be a sort of virtual public bookkeeping protocol executed by a network of computer system, which permit digital information be recorded and distributed, but can't be edited. The recorded information are stored in "blocks". Each block of the blockchain has data (one or more records/transactions), a hash value of the immediate preceding block, a hash value of the contents of the present block. Blockchain is capable of providing immutable data records and traceable transaction history, which provides great potential to reinforce efficiency, transparency, and traceability. Blockchain may be a rapidly evolving technology with broad applicability. It appears set change to several areas of public and personal life. Within the food and agriculture industry, drastic efforts made to consolidate the info traceability of blockchain technology to enhance the safety/quality of the worldwide food supply chain and international distribution. The security and quality of agri-foods is of paramount importance for global food distribution. Generally, questions of safety arise for agri-foods during the pre/ post-harvest processing and production (excessive use of pesticides, fertilizers with additive chemicals, or heavy metal residues caused by irrigating with wastewater; during production, compromising with the adulteration of inferior products, intentionally mislabelling the origin of a foodstuff, mislabelling the assembly and/or expiration date).

Blockchain is different from a traditional database within the manner where there are specific rules about how data added to the blockchain.

1. The info added to the blockchain cannot conflict with other data that is already on the blockchain, thus data stored during a blockchain must be consistent.
2. Data may only be appended to a blockchain (e.g., new data cannot be inserted into a previously recorded block), and thus data stored during a blockchain is immutable.
3. Every computer system executing the blockchain protocol must agree on what the state of the info stored on the blockchain is (e.g., the blockchains stored in each computer system operating the blockchain protocol must be the same).

WORKING PRINCIPLE OF A BLOCKCHAIN

As, we do all know a block features a hash value, which is extremely very similar to a fingerprint and a hash algorithm is made in order that the littlest change within the source (e.g., the info contained during a block) produces a totally different and unpredictable hash value. Within the

blockchain system, whenever a transaction occurs, a singular hash value (consisting of a string of numbers and letters) is assigned to the transaction. Meanwhile the validity of every transaction must be approved or checked by other computing systems executing the blockchain protocol (also mentioned as nodes), and if a transaction is modified, the nodes are ready to detect the change by reading the hash value, and once approved, the transactions are often stored during a block of the blockchain. As each block includes both a hash value for its contents, also because the hash value of the immediately preceding block, a sequence of blocks are made, and any change within the contents of any previously recorded block would change the associated hash value for the block and thus break the chain. The contents of blocks are not any longer amendable once they're uploaded to the blockchain. However, new blocks be appended to the blockchain to include further transactions since blockchain can update itself periodically. Each participant often considered a node and every node has access to all or any the knowledge recorded within the blockchain.

The distributed and decentralized nature of the info maintained by a blockchain ensures a superior level of integrity and security, without counting on a trusted third party. Blockchains provide a high degree of transparency, since is predicated on a P2P communication protocol, and therefore the contents of the blockchain are often viewed by anyone.

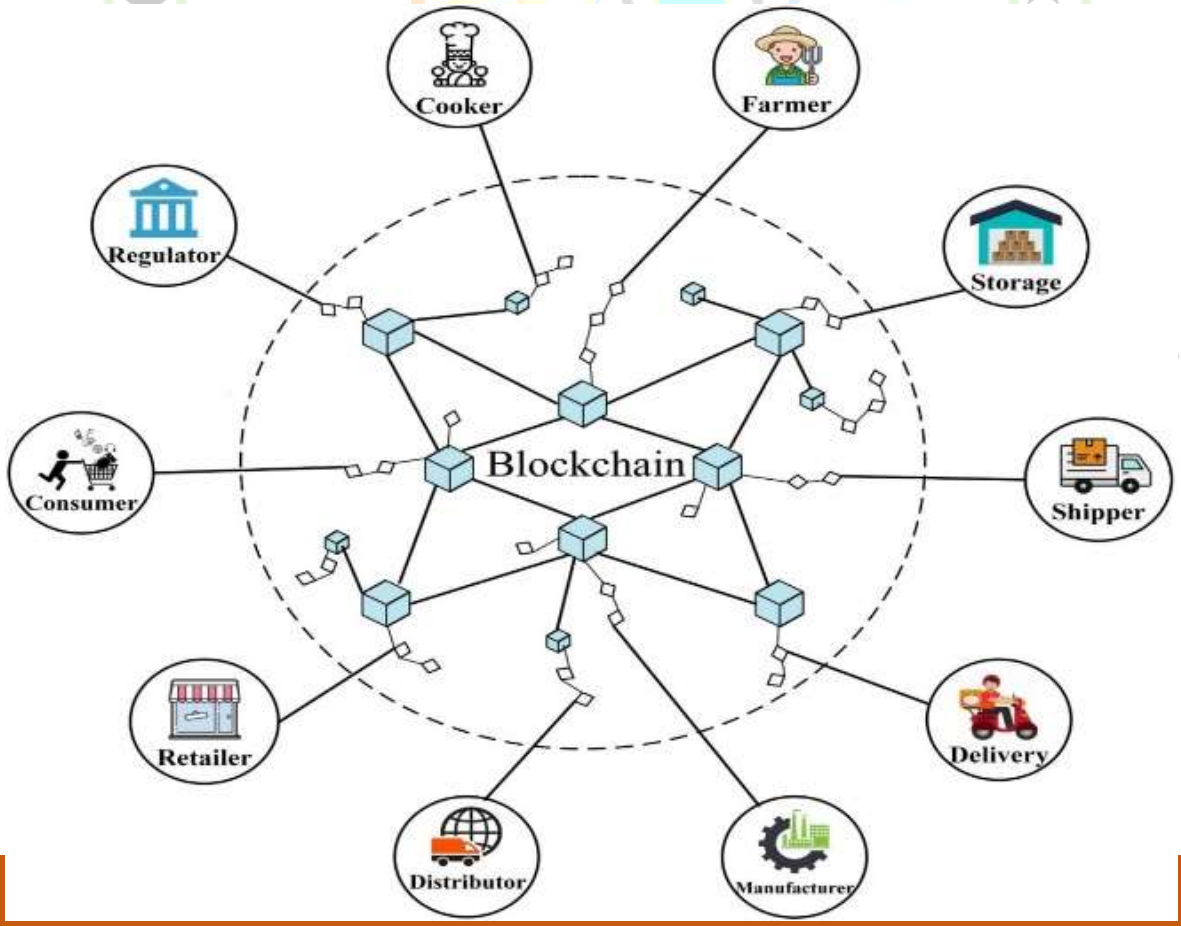

Fig. 1 Blockchain connect multiple participants in the food supply chain. (X. Jie *et al.*, 2020)

COLLABORATION MODEL OF BLOCKCHAIN TECHNOLOGY IN AGRI-FOOD

The current cooperation model made on the partnership of a blockchain company with a company. The company is liable for providing information associated with agri-foods, and therefore the blockchain company is liable for providing technical support, like platform build-up and database maintenance, etc. Several companies are developing blockchain technology globally, including Coinbase, Chronicled, Facebook, Circle, Binance, SALT Lending, Ripple, Steem, etc. Some companies working to include blockchain technology into the agricultural-food industry include IBM, Ripe.io, Transparent Path, Greenfence, OpenSC, Hungry Coin, FoodlogIQ, etc. Several food companies have collaborated with IBM to extend food safety by developing tracing systems. IBM Food Trust program has been exploring ways to utilize blockchain technology to make a secure, shared, and permissioned digital record of agri-food data, which enables participants on the network to access tools and data to enhance food safety and become a proactive contributors to bettering the food system as an entire (Trust).

BENEFITS OF BLOCKCHAIN TECHNOLOGY IN AGRI-FOOD

1. **Data transparency** - Traditionally, the food-supply chain management and interactions are generally unidirectional. Most of the participants within the supply chain can only connect with entities immediately downstream, which suggests upstream agents can communicate with downstream agents. Therefore, the usage of blockchain can make the agri-foods supply chain management more reliable and efficient. Blockchain can link all aspects of the food supply chain with a traceable and immutable information system. For agri-foods supply chain management, the important advantage is that the reliability of the info maintained on the blockchain combined with the very fact that it acts as a central location to store all aspects of knowledge associated with the life cycle of a food.

2. **Data traceability** - Blockchain are often used as a node database, which may track the digital data for every food item skilled different participants within the food supply chain, e.g. farmers, food processors, packers, distributors, and eventually store shelves. Currently, data traceability implemented by blockchain has been successfully implemented in many agri-foods, like wine, fertilizer, poultry, etc. With blockchain, supply chain managers can seamlessly track everything remotely during a distributed ledger, from expiration dates to warehouse temperatures (Kaye, 2016). In contrast with the normal methods which believe information supervision centers to transfer and share the knowledge, all the knowledge uploaded within the blockchain system is provided by first-hand sources. Tracking food products through each step of the availability chain was accomplished using smart-tagged bar codes. Bar codes are used for packaged products.

3. **Food safety and quality monitoring** - For global supply chains, food safety is important to stop cross-contamination and food pathogen outbreaks, which can be caused by worldwide shipment, and which can have a multi-national impact. Other questions of safety related to food production and processing include, improper sanitation procedures, failure of processing to eliminate

pathogens, improper storage conditions, cross-contamination of handlers, etc. It provides an information platform enabling all the availability chain members to access all information related to a specific food item, providing openness, transparency, neutrality, reliability, and security, to food supply chains (Tian, 2017).

4. Agriculture finance - Blockchain technology can realize rapid and real-time payments for agricultural financial services, and thus, reduce the transaction costs and risks while increasing income and dealing capital (Tripoli and Schmidhuber, 2018). Blockchain technology, like Ripple, are often wont to solve the matter of cross border payments as they use cryptocurrency.

CHALLENGES

1. The management of agriculture supply chain as whole – Building an appropriate connection between all the participants may be a major problem thanks to its vast nature.
2. Ensure data sets are open, safe and accurate – The data that are manually entered are often falsified and manipulated.
3. Managing extra costs – As for correct management, some barcodes/special ID codes assigned to the things. Thereby increasing the packaging costs.
4. Handling pre-existing data – Combining pre-existing data with blockchain may be a major havoc.

CONCLUSION

Recently, there are efforts to adopt blockchain technologies within the agri-foods area, yet there is still an excellent deal of under-realized potential. Decentralized, distributed blockchain technology enables better agri-foods management with better traceability and transparency, but it's not a panacea for all the setbacks faced by the agri-food supply chain. With better traceability and enhanced efficacy, this blockchain technology are often an excellent potential over the outdated and inefficient ways of the agri-food supply chain. However, many challenges need to be solved before the large-scale adoption of blockchain technology for a various range of agri-foods to foster a safer and unbiased future for the agri-food system.

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