Integrating Blockchain technology for Nutritional Safety- A New Way Forward

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Abstract:

The food industry is diversifying and adapting to shifting consumer tastes and environmental issues. Consumers value the quality and uniformity of the fundamental ingredients used to make packaged goods, as well as the longevity, originality, logistics, lifespan, and recyclability of packaging. For the global distribution of food, the safety of agricultural products is critical. In order to enhance efficiency and maximize product manufacturing and distribution, data and information technologies are becoming increasingly vital in the global food and agriculture industry.

In the "food and agriculture" (FAI) industry, blockchain is a well-known technical innovation. It facilitates the timely sharing of information such as origin, batch number, and production date, as well as the openness and transparency of the manufacturing environment, food safety certification, and organic products, all of which contribute to food safety and customer trust.

Keywords: Blockchain, Food and agriculture industry, Internet of Things

Dear Editor,

With the emergence of the COVID pandemic, consumers are paying more attention to pure and indigenous components with little or no chemical additives and unprocessed or inadequately processed items to promote robust immunity.[1] The food chain must become more viable to improve customer confidence and willingness to buy. Identifying and managing the sources of contamination in agri-food chains require tracking and verifying information throughout the food supply chain, which adds to sustainability management.[2]

The safety of agricultural products is critical for the global distribution of food.[3]Imprudent usage of germicides, fertilizers with additional compounds, or metal ions deposits produced from irrigation with wastewater may damage the standard and safeness of agro-foods before and after harvesting.[4] These safety problems are caused by inadequate monitoring or surveillance systems and pose serious hazards to human health.[5] The global food and agriculture sector is relying more and more on data and Information Technologies (IT) to increase productivity and optimise product manufacturing and distribution.[6]Recent advancements in blockchain technology are being tested in several food and agricultural industries.[7]

"A blockchain is a distributed database, which is shared among and agreed upon a peer-to-peer network. It consists of a linked sequence of blocks (a

storage unit of the transaction), holding timestamped transactions that are secured by public-key cryptography (i.e., hash) and verified by the network community. (Figure 1) Once an element is appended to the blockchain, it cannot be altered, turning a blockchain into an immutable record of past activity". [8-9]

Public blockchains are blockchains with no permissions, allowing all participants to see all records, whereas private blockchains maintain privacy by allowing only a limited number of people to examine specific information. They can also be anonymized and presented.[10]

Blockchain is efficient in preventing database tampering, and replication.[10]It enables the prompt exchange of information about origin, batch number, etc., as well as the openness and transparency of the manufacturing environment and food safety certification, all of which support food safety and customer trust.[11]

The consortium blockchain satisfies consumer expectations for food safety and complies with government agencies' standards for food safety and quality assurance.Producer nodes join the private blockchain, whereas consumers and regulators join the public blockchain, ensuring the security of

business transactions and meeting public demand for essential data. To establish their identity, all eligible users must use a unique identification, such as government-issued documents, to enroll in a consortium chain system. This chain can be maintained and utilized as a shared ledger by nodes belonging to different consortium agencies. The consortium blockchain can be used to verify food quality and safety based on the listed attributes.[12]

In 2017, the American retailer Walmart and the IT company International Business Machines(IBM) launched the first initiatives in food traceability, demonstrating the effectiveness of blockchain systems using mangoes and pork as examples.[13]

In the agri-food sector, a blockchain collaboration model was created where the food firm delivers agricultural data while the blockchain company is in charge of technical support, including platform setup and database maintenance. "IBM, Ripe.io, Transparent Path, Foodlog IQ", etc are among the companies attempting to integrate blockchain into the food system.[5]

The IBM Food Trust program has looked into using blockchain technology to establish a safe, shareable, and permissioned digital copy of agro-based data, allowing involved parties to get access to

Figure 1: Working of "blockchain technology"
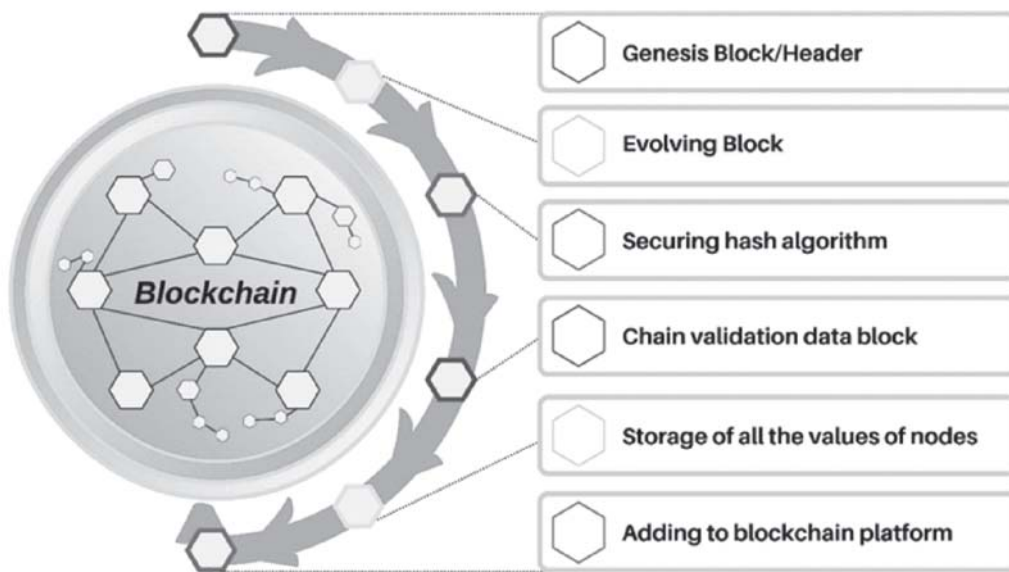
technology and information that can assist enhance food security and the food chain in general (Trust). Large-scale firms and key component distribution organizations such as "Walmart, Carrefour, Nestle", etc are now creating such systems.[5]

Customers are willing to pay more for locally produced goods when they receive product information via "smart labels," including farms that produce the primary substance (milk), the potential contribution of thermo chromic labeling to promote local food security, and the nutritional advantages of dairy. For producers, technology ensures operational transparency and control of the manufacturing process from start to finish andpersonalizes digital advertisements.[1]

The combination of blockchain technology and the Internet of Things has the potential to revolutionize the food business. Consequently, some merchants have already put pressure on their providers to utilizethe blockchain to create a more open distribution network and improve food security. It is necessary to make sure that the food and blockchain data are integrated and that no exchange occurs. Explicit branding of foods containing artificial but innocuous ingredients is viewed as a source of concern by many consumers. Therefore, additional methodologies and analytical technologies are required to meet the expectations of the food industry. When maintaining the confidential information and the digital information capacity required by modern technology, several challenges must be overcome. All this necessitates a tough change in the corporate world and current work process, primarily for micro and mid-size enterprises, as well as the creation of appropriate data transmission criteria and protocols.Therefore, it is time-consuming to develop blockchain technology.[13]

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References:

1. Neculai-Valeanu A-S, Ariton A-M, Rimbu C-M, Vrinceanu N. Farm-to-Fork SMART LABEL for Increasing Consumer Trust and Ensuring Support for Local Milk and Dairy Producers. 2021;8.

2. Feng H, Wang X, Duan Y, Zhang J, Zhang X. Applying blockchain technology to improve agri-food traceability: A review of development methods, benefits and challenges. J Clean Prod. 2020 Jul 1;260:121031.

3. Lin J, Shen Z, Zhang A, Chai Y. Blockchain and IoT based Food Traceability for Smart Agriculture. In: Proceedings of the 3rd International Conference on Crowd Science and Engineering [Internet]. New York, NY, USA: Association for Computing Machinery; 2018 [cited 2022 Mar 16]. p. 1–6. (ICCSE'18). Available from: https://doi.org/10.1145/3265689.3265692

4. Tse D, Zhang B, Yang Y, Cheng C, Mu H. Blockchain application in food supply information security. In: 2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM). 2017. p. 1357–61.

5. Xu J, Guo S, Xie D, Yan Y. Blockchain: A new safeguard for agri-foods. Artif Intell Agric. 2020 Jan 1;4:153–61.

6. Sengupta U, Kim HM. Meeting Changing Customer Requirements in Food and Agriculture Through the Application of Blockchain Technology. Front Blockchain [Internet]. 2021 [cited 2022 Mar 16];4. Available from: https://www.frontiersin.org/article/10.3389/fbloc.2021.613346

7. Kim HM, Laskowski M. Toward an ontology-driven blockchain design for supply-chain provenance. Intell Syst Account Finance Manag. 2018;25(1):18–27.

8. Niknejad N, Ismail W, Bahari M, Hendradi R, Salleh AZ. Mapping the research trends on blockchain technology in food and agriculture industry: A bibliometric analysis. Environ Technol Innov. 2021 Feb 1;21:101272.

9. George RV, Harsh HO, Ray P, Babu AK. Food quality traceability prototype for restaurants using blockchain and food quality data index. J Clean Prod. 2019 Dec 10;240:118021.

10. Chattu VK, Nanda A, Chattu SK, Kadri SM, Knight AW. The Emerging Role of Blockchain Technology Applications in Routine Disease Surveillance Systems to Strengthen Global Health Security. Big Data Cogn Comput. 2019 Jun;3(2):25.

11. Galvez JF, Mejuto JC, Simal-Gandara J. Future challenges on the use of blockchain for food traceability analysis. TrAC Trends Anal Chem. 2018 Oct 1;107:222–32.

12. Application of blockchain technology in food safety control current trends and future prospects: Critical Reviews in Food Science and Nutrition: Vol 0, No 0 [Internet]. [cited 2022 Mar 10]. Available from: https://www.tandfonline.com/doi/abs/10.1080/10408398.2020.1858752

13. Creydt M, Fischer M. Blockchain and more - Algorithm driven food traceability. Food Control. 2019 Nov 1;105:45–51.