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How Block chain Technology Can Revolutionize Agriculture In India?

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Abstract

Block chain technology is gaining popularity across various industries including agriculture related businesses owing to its efficient system of keeping track of all the activities in a particular commodity's supply chain. India has greater advantages compared to other economies as being one of the major producers of fruits and vegetables in the world, the Information Technology hub, where it would be easy to develop a customized software for block chain. Increasing the per capita consumption could be made possible by improving the efficiency of supply chain using block chain technology. As an agrarian economy, the policy makers always focus on increasing farm production and income sustainably. The improved efficiency in supply chain for agricultural commodities using block chain also helps in realizing greater share in consumers' rupee and ensures safe and healthy food for the consumers.

***Keywords*:** food processing, marketing, supply chain, sustainable, Traceability,

Introduction

A block chain can be technically defined as a book of accounts containing transactions of all the participants in the chain of activities or events. It assures a dependable source of actuality about the status of the farm lands, inputs, inventories and contracts/agreements in agriculture, where the collection of such data is often considered expensive.

In simple words, a block chain helps to track the sources of food right from the farm where cultivation has been taking place, crop production practices followed, value addition and processing of the produce, storage and transportation up to market distribution channels through which produce is made available to the consumer. This helps in creating trustworthy

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food supply chains and build trust among the producers, consumers and other actors of the chain. Such a technology provides advantage to all the stakeholders in the chain.

A producer can track the movement of the produce and gets to know where and when the consumer purchases the produce, value addition happening to the farm produce and price realized from the consumer for the same produce. It also helps the producer to know about the demand as well as preference for the produce from the consumers.

The technology of block chain is being used in various fields such as finance, engineering etc. It is being recently employed in the area of agriculture in India. Some of the agribusiness organizations in India has already started reaping the advantages of block chain technology in agriculture, for instance Sahyadri Farms., an FPO based at Nasik, Maharashtra. They have successfully employed the Block chain technology in various fruits and vegetable crops, who has global market presence including Europe, Middle East and North American countries.

As the second largest producer of fruits and vegetables, India has ample opportunities to make use of the block chain technology to solve the existing problems in food traceability and food safety. It ensures a two-way transparency by creating a bridge between the farmer and consumer. Further, we can ensure sustainable farm income for the farmers and safe and healthy food for the consumers.

The concept

Basically, block chain consists of a series of data which are irreversible and marked with a time stamp. The data will be controlled and coordinated among the cluster of computers which are not owned by any single entity (*Fig. 1*). Individual component of the chain is often referred as a block. Through cryptographic principles, these data blocks are secured and bound to each other. Individual block contains the data (anything of value), its own hash value (cryptographic and generated through computational algorithm) and a pointer to the hash of the previous block.

In a broader sense, information on agri-supply chain consists of data at farm level, processor level and distribution level. At farm level, the data points can be geographical location of farm land, soil and weather parameters, inputs used for the cultivation which includes seeds, fertilizers, chemicals etc. harvesting stage and methods etc. At processor level, data related to

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grading standards followed by the processor, ingredients used to prepare value added products, various value added products prepared, food safety levels followed, packaging material used for primary packing and labelling etc. will be collected. At distribution level, data on secondary packaging, storage, transportation, vehicle routes and safety measures followed etc. will also be collected.

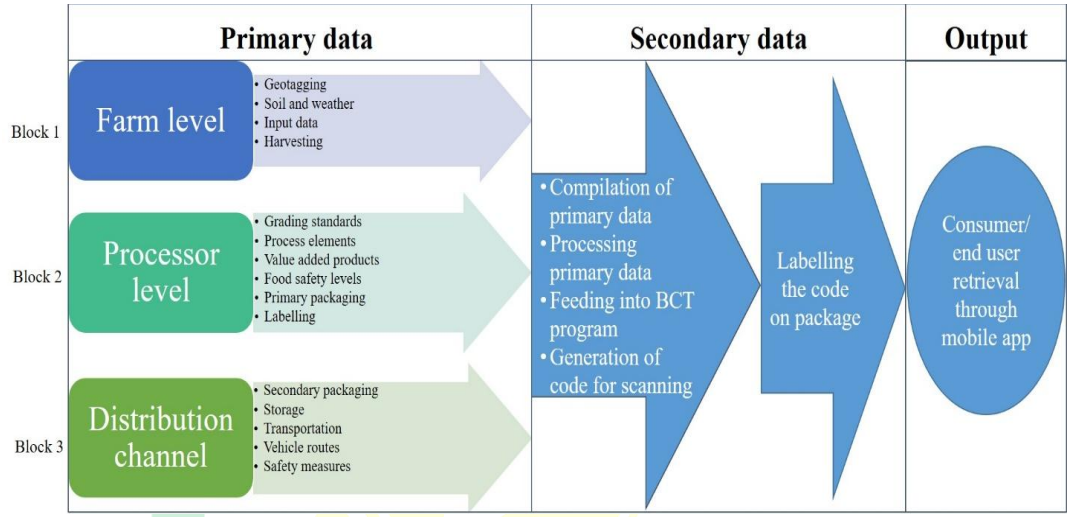

Fig. 1 - Flow of information in blockchain technology

The data from all the blocks will be compiled and processed to generate secondary information. This information will be converted in to scanable codes which can be retrieved by the consumers using smart phones/ apps at retail points. The secondary information generated can be considered by the various authorities for the certification to facilitate the marketing of agricultural produce both in domestic and international markets without any time-lapse in the process of certification.

Why in Agriculture?

India leads in the production of many food crops including fruits and vegetables, but lacks scientific storage and timely distribution across the nation. This results in wastage up to 20 to 25 per cent of the total production of fruits and vegetables. There are large number of intermediaries in the existing food supply chain, which results in swallow up of major chunk of the price paid by the consumers among the market intermediaries. An organized and technology driven agri-supply chain network can improve the entire system by increasing the efficiency of food distribution. In India, many agritech-startups have come up with exemplary

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models in agri-supply chain network such as Ninjacart, Crofarm, Waycool, Farmlink etc. Employing block-chain technology in the agricultural supply chain assures increased efficiencies through lower transaction costs, optimized logistics, enhanced data management, enhanced food safety protocols and more robust traceability.In India, technology firms are building partnerships with firms involved in logistics across the globe to develop customized block-chain applications considering the geographical features of India, which might help in efficient tracking and delivery of agricultural produce and value added products. Block-chain is likely to accelerate the movement of agriculture industry towards a greater traceability and transparency from farm to fork. It benefits all the actors in the supply chain. The information provided through block-chain forms a base for purchase decisions of the consumers.

Block chain has the ability to improve digitization, automation and food tracking, thus paves way for transforming Indian agriculture to agribusiness. Block chain technology being used in other fields such as engineering, finance etc. can be re-engineered considering the requirements of the agri- supply chain network and system for tracing out the origin of food, settling transactions and track the demand from customers to create new and exciting marketplaces for the produce. If an option is added to feed consumer feedback in the system, it tremendously reduces the cost of the company in generating data on consumer feedback and quick actions can be made to bring changes in the products to meet the expectations without delay.

Employment of Block chain Technology in Agriculture in India-Benefits

- **Traceability and Auditability**

  In Indian agricultural marketing the major challenge is how to track the produce? The reason being involvement of large number of intermediaries in the distribution channel. This adds to higher costs and the whole process becomes time consuming. By using blockchain technology, the complete process can be streamlined into a single distributed ledger. As the number of intermediaries decreases, the retail price of the produce to be paid by the consumer may also decline. Thus, consumers can also get benefitted out of the system. Similarly, the farmers will be able to sell their produce directly to the market with the shorter supply chain network or sometimes without the need for intermediaries.

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- **Logistics and Payments**

  Logistics remains as the biggest challenge in the agri-supply chain right from the need for the inputs in the food production till the final produce reaches in the hands of the consumer. Furthermore, considering the peculiar feature of horticultural crops especially fruits and vegetables etc. which are highly perishable, hence demand timely and appropriate method of storage and transportation. The application of blockchain technology simplifies all the aspects of logistic requirements for effective utilization of farm produce. The major challenge being faced by Indian farmers are poor distribution network for marketing, untimely payments and poor price realization for their produce. Blockchain technology helps effectively and efficiently address all these challenges. Block chain enabled smart contracts work automatically once a specified condition is satisfied by triggering payments without additional transaction charges. Ultimately, farmers end up in high price realization for their produce.

- **Actuality of Food Safety and Quality Control**

  The quality of the farm produce depends basically on the inputs used and cultivation practices followed by the farmers, postharvest handling of the produce processing, storage etc. The food safety concerns mainly owe to use of fertilizers and plant protection chemicals, which many times in Indian produce are found to be high in the form of residues compared to global food safety standards. The market research shows that Indian consumers are becoming health conscious and choose their produce considering the food safety levels. This calls for judicious/ minimal use of the chemicals leading to least/ no residue content on the final produce. The information on the food safety levels provided to the consumers using the block chain technology, thus serves as the base for decision making. From the consumer preference and feedback, and market standards, the farmers and processors can be educated to modify their existing practices to have minimum/ zero chemical residues and thereby achieve higher acceptance and preference in the market.

- **Data Security**

  Block chain software platform ensures that the data is encrypted, meaning that modification in data is extremely difficult task. It is also possible to save a cryptographic signature of a document or file in a developed block chain and this

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ensures that the files are un-tampered. Because of decentralized nature of block chain, one can always verify the file signatures across all the ledgers on all the nodes in the network. Block chain offers reliable, independent data verification which is undeniable. A lack of a single authority makes the system fairer and considerably more secure. Instead of depending on a central authority to securely transact with other users. Since the data is saved on multiple computers, it is extremely secured even if one or two computers malfunction.

- **Storage of precise data on crop production**

  The data generated at various levels of block chain such as weather and soil related information, irrigation, fertilizer and chemical application details etc. will be collected and sent to the block chain system. Based on the data fed in block chain software, smart contracts can automatically trigger and perform precise actions. These automatic triggering actions and feedback system help the farmers/producers in improving the quality of the agricultural and agribusiness processes as well as crop produce and value added products.

Challenges

1. Poor technological knowledge of many stakeholders in using the system
2. Transformation of farm produces into different value added products may involve inputs/ raw materials from different actors in the value chain, which may complicate the traceability.
3. Extremely heterogeneous nature of stakeholders with regard to their roles and business transactions
4. It poses significant interoperability and deployment obstacle if the food supply chain is largely distributed across the globe.
5. Lack of conviction among the stakeholders may negatively impact on the trustworthiness of the system
6. Intellectual property concerns related to the technology

Conclusion:

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Indian agriculture is characterized by fragmented landholdings and meagre usage of advanced technology in crop production and marketing. On the other hand, India is considered as the global hub for information technology. Though some of the technologies such as weather forecasting, automation in select operations in farm, dissemination of price and market related information through internet and mobile platforms have been in practice, but in discrete. Linking each of these components and further gap existing between agriculture and technology can be mitigated by molding technological aspects as per the customized requirements of Indian agriculture to harness the fullest potential of technology to generate higher farm income bring in high level of food safety and sustainable food production.