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Leveraging the potential of agriculture sector and food supply with block chain technology - A review

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Abstract

Block chain technology, an eminent technology in recent era is known for its well distributed, safe, secured ledger transaction and forgery proof data creation and its maintenance among the users. A block chain facilitates a public platform by providing it secured ledger system. It is commonly accessible and secured database to store and distribute information without any central controller. This article emphasizes on Block chain technology as a reliable, promising, transparent, error prone and as a distributed ledger technology towards agriculture sector and food product supply chains. However, the hitches of the Block chain technology are also highlighted which may hinder the widespread and open practice of this technology among farmers and the consumers in future. These hindrances could be overcome by intended use of Block chain technology experimentally as well as by simultaneous working on its feedback.

Keywords: Block chain technology, Ledger, farmers and consumers

I. Introduction

Block chain technology is a renowned recently emerging, digital and ledger technology which provides not only distributed but forgery- proof record, to the users. Block chain ledger and transactions with its list are accessible to all of its users. The Block chains in Block chain technology (BCT) are secured by cryptography. The unalterable chain of blocks in block chain is linked by use of hash functions. The hash functions are based on “algorithms” from any input data and slightest alternation in input data may yield variables result than the original ones. The function of hash cannot be altered and this makes them unidirectional without returning to the original data making ledger “constant” and “unaltered”. Safer Block chain technology supports a shared and ledger for made transaction. This BCT ensures the removal of intermediaries central authorized with stabilized consensus mechanism. BCT is considered as “trust machines” as it shares information with “transparent” approach. The consensus mechanism supports legitimate network in decentralized system where third party required the trusted individual in a network of defined Block chain have characteristics of logging, inalterability of data, disinter mediate and decentralization, security and transparency contain extra leveraging. BCT comprises transparency where nodes designed and could access transaction by the parties. The chronological order of inter linked transaction with time-notice comes under logging with replicated multiple times stored data. Even a little shift effect Block chain and support unaltered data stability. The Peer to Peer nature of network inhibits the use of central server and involves the use of digital signatures that guarantees security.

II. Block Chain Technology as A Distributed Ledger Technology

Block chain connected to block chains is considered as DLT. Block chain is an honestly shared, secured database and record ledger whereas the exchange data such as payment in Block chain technology is known as Distributed Ledger Technology (DLT) as reported in previous studies (12). Three types of Block chains are reported as shown in Table 1.

Table 1: Types of Blockchain

Public Block chain	Consortium Block chain	Private Block chain
Decentralized Block chain	Partially Decentralized Block chain	Owned by the organization completely.
Cryptocurrency linked	Partially Cryptocurrency linked	No Partially Cryptocurrency linked

III. Block Chain Design and Its Network

Block chain consists of different layers and they are explained

in Figure 1 and their functions are explained in Table 2.

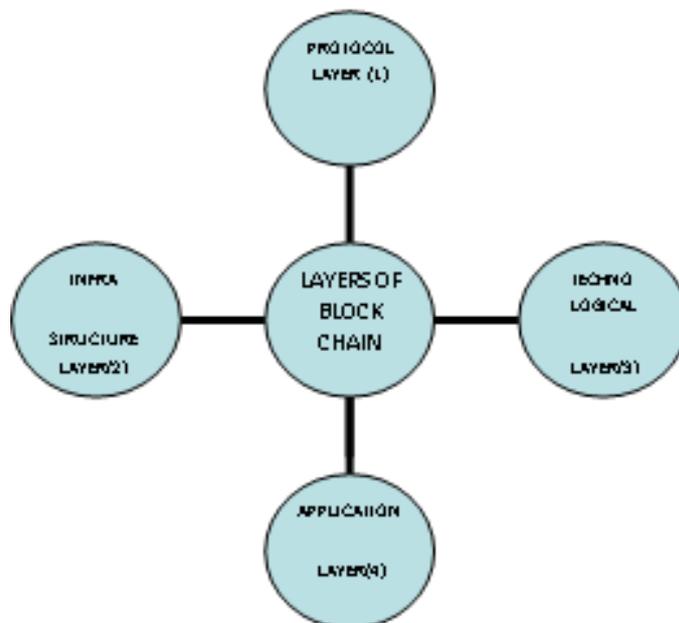


Fig 1: Types of Layers Comprising Blockchain Network

Table 2: Function of Layers

No. and Name of layer	Function
Layer 1, Protocol	Sets rules and verifies transactions
Layer 2, Infrastructure	Database with actual chains of blocks and replicates network
Layer 3, Techno logical	It offers service to block chain and make available for application
Layer 4, Application	Block chain as a service BaaS for user interaction

inalterability of recorded data, security, disinter mediated, decentralized databases and transparency that add value to block chain application secured system, maintains data reliability and promises transparency to its consumer. The decentralized system contributes in money in short time by automating and simplified structures. A block chain system aims to provide data reliability, security of system, transparency among transactions, proper equilibrium among money and time by decentralizing system through automated structures. On the bases of previous studies, the classification of block chain is explained in Figure 2 and previously reported. (1, 2)

IV. Blockchain Technology and Agriculture

Block chain technology has main characteristic of logging,

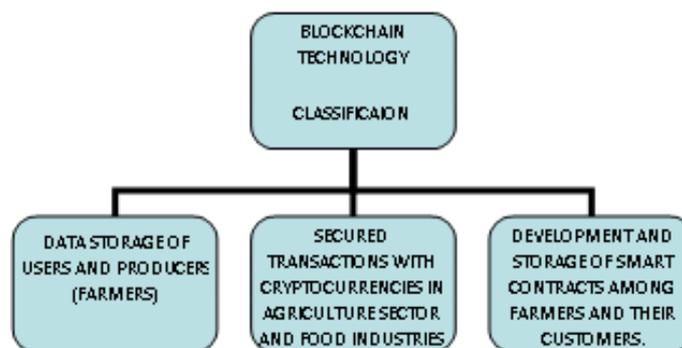


Fig 2: Classification of Block Chain Technology

In past BCT, have been used more than crypto currency and financial transaction concept and its applications in health. Currently, agriculture insurance needs to be explored. This system contributes by restoring IPR and patent issues transferring in charities and donations, financial transfer among supplier and buyer progression of smart contracts, uniform digitalized distribution of goods from farmers to consumers.

A. Restoration of Transparency in Agriculture Supply Chain

The consumer trust issues and complains against agriculture business sector to Agri-Food production, their composition and processing conditions are the major issues that requires revelation. Therefore, BCT is the best solution to sort out such trust issues (7).

B. Block Chain Technology Ensures Traceability in Agriculture Supply Chain

The complex process of maintenance of similarity among paper work and real data requires special attention assumes the standard by stakeholders for the Agri-Food products. Block chain can support by providing the required information as proof to the consumer, guarantee and manufacturing conditions and by following standard specifications from producer side. BCT's distributed and decentralised major attributions are important in restoring traceable Agri-Food sector. The farmers will tag in their product and its background would trace and thus fraud theft will be reduced vice-versa. The similar approach of fish tagging was implemented in project by Indonesia. (10)

C. Block Chain Technology as an Identifier of Source Problem and Reporter of System in Malfunction

The error in malfunction in the production of Agro-based items can be easily and immediately identified and further produced data is tamper proof which insures that data record are clear and clean. The real times problems that occur during the production and processing time could be evaluated no blocks in block chains system. Therefore, BCT ensures security of reliability of data and transparency.

D. Block Chain Technology Guarantees the Validity and Authenticity of Certification

The ledger system used for agriculture sector will not only verify the standard criteria but also reduces audit and inspection time and also cost. This could be applied to wide range of agro-food products and justifying its certification. The clients of the farmers will be allowed to monitor the Agri-Food products on the basis of real time in production unit and intermediate products will be discarded. Previously, French start company named connecting food used certification and used SaaS with IBM and CEA. (6)

E. Food Wastage Regulation by Block Chain Technology

The blocks could store the information of the processing of different agro-food and identify the malfunction in production unit which in turn inhibits spoilage and safe time and money.

F. Poultry and Dairy Farm Products and Block Chain Technology

Carrefour "implements Block chain technology for traceability of their animal products first time. (5) In developing countries like India dairy and poultry farms could be monitor using similar approach where certified chickens and cattle fed upon standardised disease free and healthy diet without antibiotic treatment which could be tracked. Their lifecycle and life events from birth to Selling point to the customer must be tracked and recorded. The approach of Block chain technology acts as an added value service to the current system and will leverage maintenance of quality standards without forgery and unethical practices.

G. Agriculture Farmers Insurance and Block Chain Technology

In developing country like India, small scale industry with the less land area produces food which gets completely consumed and yet poor farmers are not insured. The risk factors in production created by objective indicators such as weather condition, soil profile, water content and temperature might be recorded by satellite. The received date by satellite if crosses the threshold values of these objective indicators than

insurance service will automatically pay to these insured farmers. This will be regulated by blocks under Block chain technology. In previous studies, Kenya farmers were supported under Swiss Re Hackathan project (11). Therefore Block chain technology eventually will help in saving time and problems of onsite inspection as well.

H. Block Chain Technology Supports Agrofood Sales and Payment to Farmers

In developing country like India, a time lag among sale of food commodity and payment to the farmers leads to lack of trust and discrepancy among farmers and their consumers or clients. The cooperatives works on verbal commitments and paper based documentation which eventually give rise to corruption and cheating (4). Similarly, the perishable agro based commodities quality might also get deteriorated and farmers get enforced to sell out such products early, which causes economic loss (9). Therefore, Block chain technology could support farmers by providing them access to correct and accurate information about the national and international customers, who are in need of such agro-based products. Furthermore, automatic payments can be aided by use of smart contracts. The problem of useless intervention could also be regulated by Peer to Peer network between the farmers and their product purchasing customers. In conclusion, Block chain technology has important role in developing trust among farmers and their buyers through authentic data recording in form of open registers which are easily accessible to both parties about the costing and time of purchase.

I. Block Chain Technology Agriledger aids Farmers and Their Cooperatives

Block chain technology based ledger system promotes and creates framework of trust among the farmers and cooperatives where farmers get access to loans, payment and bank services with enhanced vision to study market condition and simultaneously helps them to improve their product distribution.

J. Drawbacks of Block Chain Technology in Agrobased Food Development

Block chain technology is not a zero risk system. The case of mistakenly loss or stolen keys for the transaction data by private block chain may result in permanent loss of their data and transaction details. The anonymity of block chain could be lost and security of block chain is carried out by algorithm and in case the process gets blocked, the whole block chain may get collapsed. The consistent maintenance of nodes is required by participants to avoid phenomenon of Block chain neglect. The Previous studies reported by Igor Kabashkin states these reasons and similar reason may contribute in imposing threat to idea of running block chain technology on Agri-Food supply chain. (8).

Conclusion

Block chain [provides more number of opportunities to Agro sector by supporting farmer's development as smart farm concept. The benefit of accessibility, transparency and assurance of handling and regulating their own data by themselves is another contribution of Block chain technology to farmers. Still, block chain as distributed ledger technology requires more working upon security factor in Agriculture sector. At the same time, with Agriculture sector legal and technical tissue also needs to focused. The issues could be sorted by intended use of Block chain technology

experimentally and working upon experimental result's feedback is necessary.

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