A Survey on Blockchain Technology In Agriculture

Dr.Sudha V [1], Anandhaoviya Ge[2], Kamali B[3], Sathya S[4]

[1]Professor, Dept of Computer Science And Engineering

[2, 3, 4]Dept of Computer Science And Engineering

[1, 2, 3, 4] Kumaraguru College Of Technology,Coimbatore-641049,Tamil Nadu,India.

Abstract- *Blockchain is a trending technology that is making a vast impact on today's modern world because of its transparency, decentralization and security features. Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a network. Blockchain is ideal for delivering that information because it provides immediate, shared and completely transparent information stored on an immutable ledger that can be accessed only by permissioned network members. Blockchain-based Smart Contracts technology will improve the transparent process of accessing the agricultural data(agricultural subsidies) and food chain management. Blockchain-based Smart Contracts technology will improve the disbursement of existing subsidy/welfare benefits to the farmers. Blockchain is a decentralized system that records debt history. It is transparent and a distributed ledger.*

Keywords- block chain, bit coin , smart contract, digital ledger, agriculture.

I. INTRODUCTION

David Chaum is the first person to propose a block chain-like protocol in 1982 dissertation "computer systems established, maintained and trusted by mutually suspicious groups". Next to that cryptographically secured chains of blocks was described bny Stuart Haber and WScott Stornetta in 1991.And the very first decentralized Blockchain concept was said by a person known as Satoshi Nakamoto in 2008. He introduced the Bitcoin digital currency to the world with the intent of enabling electronic cash payments directly between individuals without the need for third-party intermediaries. The first ever blockchain technology (Blockchain 1.0) is completely associated with Cryptocurrencies i.e Bitcoin. Since then, blockchain, the technology behind Bitcoin, has captured a substantial amount of interest from researchers and practitioners. Initially it was used only for the transactions of digital currencies, but later it is applied in other applications beyond currencies and payments. Next to that, the major innovation occurred was a "Smart contract technology", embodied in a second generation blockchain system called Ethereum. It will enable us the build or write a little computer programs directly into a blockchain. There are various types of blockchain are there and they are Public blockchain, Private blockchain and Consortium blockchain. There are various use cases of blockchain like agriculture are Crop and Food Production, Food Supply Chain, Controlling Weather Crisis, Managing Agricultural Finance. This survey paper deals with the study of various research papers related to blockchain technology in agriculture (applications, subsidy disbursement, finance model etc..) Todays world continues facing the huge challenges with providing enough food for its ever growing population, so that agriculture sector needs to adapt the innovative systems to overcome the vast challenges. Blockchain technology will able to reduce inefficiencies by saving time and energy in the agriculture sector and food value chain.

II. SURVEY USING BLOCKCHAIN IN AGRICULUTURE AND FOODCHAIN MANAGEMENT

This paper mainly contributes the use of Blockchain technology in agriculture loan disbursement method. Blockchain also ensures a feasible business model for peer-peer lending from a technical and business standpoint. Blockchain is a decentralized distributed ledger that is shared among all the participating users in the network. Previously various survey papers had reviewed the blockchain based on various aspects of scope. In this survey, first the underlying Blockchain architecture is reviewed and next to that smart contract technology is also reviewed. Second, we presented an existing blockchain framework used, algorithms used, security issues, future scope and application in agriculture sector is reviewed.

1.BLOCKCHAIN ARCHITECTURE

Blockchain technology is inseparable from its underlying properties- consensus and validation. Blockchain stores the transaction data as a block which are linked together to form a chain. It is optimized as a currency system and maintains the same structure on every node. Unlike traditional ledgers run by centralized institutions (e.g. banks), a public blockchain protocol is truly neutral in the sense that it does not rely on trust. A blockchain full node client is publicly available for anyone that wants to participate as a node.The important Blockchain architectural components are

- Transactions
- P2P Network
- Block
- Consensus Algorithm

Transactions: Transactions are building blocks of the blockchain system which have a recipient address, sender address and a value. The owner transfers the value by digitally signing the hash produced by adding previous transaction and a public key of the receiver. Each transactions is collected as bundle and delivered as a block to each node. Each transaction is time-stamped and collected in a block.

Block: Blocks has the information or data as a block header and transactions. Blocks are the data structure whose major work is to bundle up a set of transactions and are replicated to all nodes in a network. There are various blocks are there, main branch blocks/Side branch blocks/Orphan blocks.

P2P Network: The blockchain is the peer-to-peer network working based on IP protocol. It follows a flat topology with no centralized node. Every node equally consume and provide services while collaborating using a consensus algorithm.P2P network are more secured because they do not have a single point of attack or any failure as in case of centralized network. The blockchain can be both permission-based network as well as permission-less network. A permission-based network is a consortium blockchian whereas a permission less network is a public blockchian because any individual can join the network. A permission-based blockchain or private blockchain needs authentication or verification of the participants within the network.

Consensus Algorithm: There is no central authority to verify the transactions in blockchain yet it is completely safe and secure only because of the consensus algorithm. It a core part of blockchain network. In this algorithm there is a procedure through which all the peers of the network reach out to a common agreement about the present state of a ledger. Through this way, consensus algorithm reach the reliability in the blockchain network.

2.SMART CONTRACT

Smart contract was proposed by a computer scientist named Nick Szabo in 1990's.Smart Contract can be created and deployed by anyone to a blockchain. Smart contract is a contract that establishes the terms of an agreement. It is a small piece of code which is executed on a blockchain like Ethereum. To speed transactions, a set of rules called smart contract-is stored on blockchain and executed automatically. Smart contracts are written in various programming languages like Solidity, Web Assembly and Michelson. In an Ethereumnet work, each contract code is stored on a blockchain which allows any interested party to inspect the contractor's code and the current state to verify its functionality. It allows developers to build various decentralized applications. Once smart-contract app has been added to the blockchain, then it can't be changed or reversed. Smart contract related applications are referred as "dapps", which include decentralized finance that aims to transform the banking industry. DeFi apps allow to make complex financial transactions(savings, loans, insurance) without a bank or other financial institution taking a cut and from anywhere in the world.

COMPARITIVE ANALYSIS OF BLOCKCHAIN IN AGRICULTURE:

A) Blockchain technology is used in food supply chains ,agricultural insurances, smart farming ,transactions of agricultural products. Information and Communication Technology (ICT) substantially increases the effectiveness and efficiency of collecting, storing, analyzing and using data in agriculture. It allows agricultural practitioners and farming communities to easily obtain update-to-date information and thus make better decisions in farming.

Disadvantage: It does not avoid bias in collection and use of data, individuals are motivated to use data in a way that favors their own interest, an effective way of avoiding such bias is to make data manipulation difficult or even impossible.

Conclusion made: Blockchain is a transformative ICT that have the potential to revolutionized how data is used for agriculture. The blockchain technology offers a reliable approach of tracing transactions between anonymous participants.

Refrence:A Survey of Blockchain Technology for Agriculture: Applications and Rationale - Xiong et al 2020

B) Whrll offers small and marginal farmers a way to avail credit at cheaper rates from formal financial institutions. It provides farmers with a receipt once they deposit the produce. Traditional warehouse receipt relies on centralized nodes for information. It needs for traditional legal contracts and maximum manual intervention. Whrll helps the farmers, traders and farmer producer companies to raise capital to tide over lengthy crop cycles that range from 6-12 months. It follows Distributive model. It collects data from warehouses and feeds it to its blockchain system which creates an immutable record of the collateral.

Conclusion made: It helps mitigate fraud due to the inherent features of blockchain—immutability, transparency, and real-time availability of the latest relevant data values on the network. These features enable financial institutions to estimate the value of the collateral (agriculture produce) accurately.

Reference: Whrrl: A blockchain based disruptive financing model for agricultural practices - Mitali, Pritam Patro, Ami Joshi and Himmat Patel, Aug 9,2021

C)In January 2013 the Government of India has launched the Direct Cash Transfer scheme under DBT for fund distribution and delivery system. In this scheme, the subsidies (cash/payments) are directly credited to the farmer's account and validated by the Unique Identification Authority of India (UIDAI) to bring transparency, reduce fraud and delays happening by the hierarchy of government administrative offices. The DBT has various drawbacks such as Government subsides do not reach all eligible farmers ,Lack of proper auditing ,Inability to track subsidy, inadequate digital bank infrastructure in rural areas.

Conclusion made: The combination of DBT based direct cash transfer scheme by adopting Blockchain-based Smart Contracts technology will improve the disbursement of existing subsidy/welfare benefits to the farmers. Blockchain smart contract ensures transparency , de-duplication, reduced delays and reduces instances of fraud, systematic-immutable backtracked database, auditable, transparent and automated.
Reference: A Blockchain-based framework for Agriculture subsidy disbursement - Savita Bakare et al 2021 IOP conf.

D)The consumer is the end user of the food supply chain, he/she buys the product and demands traceable information on quality standards, country origin, production methods, etc. The current system is till date inefficient and unreliable. Exchange of good are based on complex and paper-heavy settlement processes. The transactions are vulnerable to fraud, intermediaries get involved. People are not aware of the origins of the good.

Conclusion made: Blockchain has the potential to monitor social and environmental responsibility: To make agricultural robotic swarm operations more secure, Distributed way to perform transactions among different untrusted parties. Blockchain in finance: The blockchain introduces a new method of accounting for value transfers, Blockchain could help in affairer pricing through the whole value chain. Increases consumer awareness and empowerment.

Reference: The Rise of Blockchain Technology in Agriculture and Food Supply Chains - Andreas Kamilaris1,2, Agusti Fonts1 and Francesc X. Prenafeta-Boldú1

E) One of the most logical applications of blockchain is in agriculture which is plagued with several challenges. With rising consumer consciousness towards food safety, blockchain application can play a vital role in solving many agri-related problems like food safety, food supply chain etc.
Conclusion made: Using blockchain the food supply chain gets simplified as the data management across a complex network. It also Increase the traceability of each product sold-from manufacturer to end buyer. Distribution and delivery of subsidies can become more transparent resulting in targeted disbursement of subsidies plugging leakages in the existing system.

Reference: Block Chain in Agriculture – Alekh Sanghera, Co-Founder, far Mart Services, March 2018

BASIC CONCEPTS AND CHARATERISTICS OF BLOCKCHAIN IN AGRICULTURE

- Decentralized consensus
- Mining
- Smart contracts
- Encryption/Decryption
- Networking concepts
- Programming language
- Hash
- Hash chain
- Cryptography
- Merkle Tree
- Traceability

III. FUTURE PROSPECTS

This survey paper covered various aspects of Blockchain in Agricultural sector and food supply chain sector. Blockchain has a great potential to grow and revolutionize the way of business, agriculture and payments all over the world. There are various projects has been going on and various research has been undertaken in adopting blockchain technology. Blockchain technology has a phenomenal range in establishing transparent and secure environment. With so many experiments have been taking place via legacy as well as new businesses, stakeholders, researchers in major industries are looking forwards to integrating blockchain technology into their processes.

IV. CONCLUSION

This study contributes to the currently existing literature on the topic of peer to peer lending using Blockchain. This paper combines researches from multiple reports and analyses of how the industry is shaped currently. Furthermore, this paper also analyses how the model of peer to peer lending could be potentially scaled soon by adding newer technologies and by expanding into newer domains. Additionally, this paper stresses on how decentralization of data using blockchain technologies would help create a robust system and would also help extract data and process the same at a much faster rate – thereby reducing the turnaround time significantly.