THE INCEPTION OF BLOCKCHAIN TECHNOLOGY IN AGRICULTURE AND ITS CONTRIBUTION TO ECONOMIC REFORM OF THE AGRICULTURAL SECTOR

T. JEMIMA JEBASEELI, K. RAMALAKSHMI & R.VENKATESAN

Assistant Professor, Department of Computer Sciences Technology, Coimbatore, Tamil Nadu, India

ABSTRACT

The Blockchain technology gained immense popularity after the release of white paper under the pseudonym, Satoshi Nakamoto. The technology has brought revolutionary changes in the field of economics and finance but the appeal of Blockchain is far above the financial arena and finds itself relevant in many other fields as well. This paper explores the establishment of a network using the Blockchain technology to bring systematic and exhaustive growth in agricultural and subtler aspects of agriculture business making it to more economical for the small and mid-scale farmers and discuss the prospect of a peer to peer independent network among the farmers and agriculturally dependent counterparts.

KEYWORDS: Blockchain Technology, Security, Sustainable Environment, Agriculture, Peer To Peer Network.

Received: Mar 21, 2020; **Accepted:** Apr 11, 2020; **Published:** Jun 30, 2020; **Paper Id.:** IJMPERDJUN2020208

INTRODUCTION

Blockchain technology has not emerged out of anywhere rather it stood the test of time from the Renaissance era [1]. The earliest record of this technology usage can be traced back to the Medici family of Florence during the time period of Leonardo da Vinci where they have successfully implemented the double-entry ledger system [2]. This system made a breakthrough in the financial record keeping and dramatically reduces the clutter of the transaction process [3-5]. This system evolved through the years and now been implemented by Satoshi Nakamoto in bit-coin technology. To summarize this technology into a single sentence that blockchain is an online ledger system with cryptographic security. The blockchain works on the principle of no central intervention and relies on peer to peer connectivity for safety and maintenance. This biggest challenge is to ensure security and levy trust. This is achieved through a cryptographic technique called SHA-256. As shown in Figure 2, the blockchain commences from the inception block. This block is the starting point that is the parent of all the forthcoming additions.

In the technological terms, each of the non-verified action by any member that is still to be established and stamped in the block is termed as a “pending transaction”. Each transaction is verified by every member of the network. This ensures the legitimacy of the action. Also, the network is maintained by the peers in the users termed as “miners”. The job of these miners is to mine a new block where the pending transactions are to be stored.

Figure 1: (a) Central and (b) Distributed Systems.

Figure 2: Blockchain Properties and Reasons to Choose It.

Figure 3: Blockchain Comprising of 3 Blocks with Attributes as Previous Block Hash, Timestamp, Root, Nonce.

Blockchain removes the middle man from the process and data storage. In the present system, organizations ensure and guarantee through mediation. These mediators' people frequently rely on third-party human manual input that is inclined to extortion, making the procedure of opportune and costly. Also, the unified framework limits access to data and awards control. As shown in Figure 1, blockchain utilizes the distributed system where data is confirmed on the commonly shared register, it is immediately reported on entire participating peers on the network, which guarantees every customer has access to the latest facts. Blockchain utilizes a consensus mechanism to extent agreement among the

shareholders on the status of information in the network. The consensus mechanism utilizes financial incentives and consensus algorithms to authenticate communications in the distributed archive.

Blockchain uses cryptography to guarantee immutability and retreat the information. As shown in Figure 3, each entry is logged with a timestamp and a digital impression which is secured with cryptographic algorithms and is termed as “hash”, this hash links each personal best to each other and is then saved firmly over the distributed network. Hashes are the records in the ledger. This marks false events in the ledger perceptible to all of the others. The immutability of records, through a distributed ledger, makes each record in a distributed ledger verifiable and clear. In blockchain theory, all members of the distributed ledger have access to the full transaction history registered on the database. Contingent on the design and the laws of the chain, customers have the capability to control which categories of business aspects are shared, and with whom. The ledger itself is protected by cryptographic algorithms.

CURRENT STATISTICS OF AGRICULTURE INDUSTRY AND FOOD CHAIN SUPPLY

The normal revenue of an agriculturalist in India is 77,976 per year according to the economic survey 2018. Also, 52 percent of the area i.e. 73.2 million hectares of land is still irrigated [16]. Also, continuous climate change has caused inconsistent rain patterns. This has resulted in a very alarming situation of the farmers and they have emerged out to be the weakest section of the society [7]. To curb this government has brought many relief schemes for the farmers but due to irregular and asymmetric information base, the government reach has been limited. The fact is well known that it is not the sector that has incurred losses but the farmer community has seen all of the loss and one of the many reasons for this is the agricultural sector has seen the minimum digital transformations when compared to the other formal sectors in the economy.

CHALLENGES AND ISSUES

The current Agri-food industry is unable to encounter the food demand of the exploding population [5] [6]. The following are the issues exist in the recent market place.

- Regulate to changing/varying consumer preference.
- Promote more sustainable practice and decrease the environmental footprint.
- Reduce and optimize the cost incurred in the supply chain.
- Sustain profitable farming operations.
- Procure advanced farming equipment.
- Globally the agriculture sector is the biggest employer and at an estimate engages 30 percent of the workforce of the world this is a major concern.
- Food systems with supply chain everywhere in the globe are numerous and vary from fashionable, large-scale supply systems channels to outdated food chains.

Agriculture in low and lower-middle financial gain nations is defined by a foundation of the security of blockchain, which makes it impracticable to modify an entry without affecting majority of tiny farms [8-10], especially in India which makes it difficult for the overall turnover to cross the threshold. When it comes to small scale farmers and the

agricultural sector, the two biggest facts faced by the farmers are the irrigation of water and the cultivation equipment [11-13]. These issues can be readily solved by the blockchain technology by digitizing the supply chain and forming a network of independent farmers who can directly interact with each other through distributed ledgers and cut the middle man. Also, this will create a consistent virtual database that can be accessed by the government where it can tally the records of the farmer's economic setbacks and compensate to the right person as depicted in Figure 4.

THE ADOPTION OF CROP PRODUCTION AND EQUIPMENT SHARING

India has two crop seasons and divisions which are utilized when it comes to equipment sharing but first there is a need to look at the general crop pattern of India.

General Crop Pattern in India

The produced grains are classified into two major portions cereal and pulses; these occupy two-third of the total yield quantity-wise. Oilseeds occupy 14 percent of the cropped area and rest is occupied by the fiber crops like cotton jute etc. [14]. India's pattern of the agro-climate condition has several patterns within a state. This diversity can be understood by the fact that there are 30 rice-based cropping pattern, 12 types of maize cultivation technique and 17 cropping patterns [15].

Different Seasons of Crops

The seasons vary across states, in terms of crop seasons India can be subdivided into two zones: northern zone and southern zone. The northern zone has three different crop seasons Kharif, Rabi, and Zaid. Although such distinction is not available in southern India and the crop cultivation is done according to the moisture content of the soil.

Kharif, Rabi and Zaid Seasons

Kharif season is stretched between June and September; Rabi season is the low-temperature season where subtropical crops like wheat and grams are grown; Zaidi is between these two. This clearly demarcates the difference between the crop production throughout the year and one thing that is very clear from this is that farming equipment is not in use throughout the year as one farmer does the cultivate in all the seasons due to heavy weather diversity. This spares idle time for the equipment when they are not in use, during this period the farmer who is capable of cultivation can make a transaction from the nearest owner of the equipment on lease this way both of the farmers can benefit the same resource thus optimized.

Figure 4: Flowchart of the Proposed System.

Figure 5: Use Case Diagrams for the Application.

Table 1: Opportunities and Corresponding Challenges

Opportunities and Implementation	Difficulty and Challenges
Blockchain Application for Small Farmers	Lack of knowledge and expertise
Finance for Small Rural Farmers	Highly Uncertain and Lacktrust
Financial Transactions	Very Limited Field
Rules and Regulations	No Central Authority or Regulation
Scalability	Technical Scalability Issues
Reach to people	Digital Divide amongst Citizens

Due to the recent inception of this technology, there are wide and varied challenges that are being faced for the implementation of the blockchain. Recently, few implementations have indicated that developed applications lacked in size and scale. Furthermore, a very convincing financial model and business structure inexistent largely due to unawareness and lack of trust. Farmers around the globe have barely access to cutting edge technology adds to the problem also initial investment is difficult to be raised. Hence, it strictly needs government intervention to form strict regulations. From the policy prospect, several processes enhance the growth of blockchain minded ecosystems in agri-business. But the process to optimize the competitiveness and ensuring the sustainability of finance is the key aspect. As well as composing a clear administrative framework for blockchain implementations. As shown in Figure 5, it gives the solution back through the blockchain technology and creates the transaction system for materials and other equipment among the farmer's community to resolve the requirements. As shown in Table 1, to reduce the limitations of use, governments must invest more in experimentation and innovation, as well as in teaching and training, in order to produce and show proof for the possible benefits of this technology.

BENEFITS OF ADOPTING A BLOCKCHAIN SYSTEM IN THE AGRICULTURE SECTOR

- Application of the latest technology in this sector reduces manual work and subjected to automation.
- Quick and accurate transaction reduces time.
- Cost can be brought down considerably due to zero surcharges of the banks.
- Can be scaled for government help schemes.
- Induce globalization and enhance the market reach.
- Avoid fraudulent transactions in the agriculture sector to improve trustworthiness.

CONCLUSIONS

This paper demonstrated the application of blockchain technology suitable for the agriculture sector point towards to setup a recognized and reliable environment to construct a clear and more sustainable transaction and integrating key stakeholders into the business framework. Several startups are working in the development of software and make blockchain technology easier for farmers to manage, such as 1000 eco-farms, which have been implemented blockchain methods relevant to farming and agriculture, using food coin as the proposed ecosystem. To reduce limitations of use, governments must invest more in experimentation and innovation. Summing up, blockchain promises a huge opportunity for the agriculture business and economic reform of the country.

REFERENCES

1. Constantin Ciutacu, Luminita Chivu, Jean Vasile Andrei. (2015), *Similarities and dissimilarities between the EU agricultural and rural development model and Romanian agriculture. Challenges and perspectives*, *Land Use Policy*, 44, 169-176.
2. Jean-Marc Touzard, Ludovic Temple, Guy Faure et Bernard Triomphe Dans. (2015), *Innovation systems and knowledge communities in the agriculture and agri-food sector: a literature review*, *Journal of Innovation Economics & Management*, 117-142.
3. Kojo S. Amanor, Sergio Chichava. (2016), *South-South Cooperation, Agribusiness, and African Agricultural Development: Brazil and China in Ghana and Mozambique*, *World Development*, 81, 13-23.
4. Chrispin R. Matenga. (2017), *Outgrowers and Livelihoods: The Case of Magobbo Smallholder Block Farming in Mazabuka District in Zambia*, *Journal of Southern African Studies*, 43(3), 551-566.
5. Mikael Bergius, Tor A. Benjaminsen, Mats Widgren. (2017), *Green economy, Scandinavian investments and agricultural modernization in Tanzania*, 825-852.
6. Adolphus Angol Naswem. (2017), *Reviving agricultural extension for effective transition from subsistence to commercial agriculture in Nigeria*, *Journal of Rural Social Sciences*, 32(1), 3–20.
7. Saturnino M. Borrás Jr., Jennifer C. Franco, S. Ryan Isakson, Les Levidow, Pietje Vervest. (2015), *Flex Crops and Commodities Special Forum, The rise of flex crops and commodities: implications for research*, 93-115.
8. Angelina Sanderson Bellamy, Antonio A. R. Ioris. (2017), *Addressing the Knowledge Gaps in Agroecology and Identifying Guiding Principles for Transforming Conventional Agri-Food Systems*, *Sustainability*, 9(3), 330.
9. Dawit Tsegaye Sisay, Frans J. H. M. Verhees, Hans C. M. van Trijp. (2017), *Seed producer cooperatives in the Ethiopian seed sector and their role in seed supply improvement: A review*, *Journal of Crop Improvement*, 31(3).
10. Adetumbi, J. A., O. J. Saka, and B. F. Fato. (2010), *Seed handling system and its implications on seed quality in south western Nigeria*, *Journal of Agricultural Extension and Rural Development*, 2 (6), 133–40.
11. Alemu, D, Z. Bishaw. (2015), *Commercial behaviours of smallholder farmers in wheat seed use and its implication for demand assessment in Ethiopia*, *Development in Practice*, 25 (6), 798–814.
12. Almekinders, C. J. M., N. P. Louwaars. (2002), *The importance of the farmers' seed systems in a functional national seed sector*. *Journal of New Seeds*, 4, 15–33.
13. Altaye, S., H. Mohammed. (2013), *Linking seed producer cooperatives with seed value chain actors: Implications for enhancing the autonomy and entrepreneurship of seed produce cooperatives in southern region of Ethiopia*, *International Journal of Cooperative Studies*, 2(2), 61–65.
14. Gashu T. (2011), *Why do farmers join in contractual wheat seed production: A case study from Woken, Amhara*, *Local Seed Business Newsletter*, 7, 10–12.
15. Louwaars, N. P, W. S. De Boef. (2012), *Integrated seed sector development in Africa: A conceptual framework for creating coherence between practices, programs, and policies*, *Journal of Crop Improvement*, 26, 39–59.
16. <https://www.financialexpress.com/budget/economic-survey-2017-18-agriculture-climate-change-likely-to-lower-farmers-income-by-25/1035560/>

17. Chavan, Amrita B., and K. Rajeswari. "The design and development of decentralized digilocker using blockchain." *International Journal of Computer Science Engineering and Information Technology Research (IJCSEITR)* 9.2 (2019): 29-36.
18. Manju, V. C. "Sybil Attack Prevention in Wireless Sensor Network." *International Journal of Computer Networking, Wireless and Mobile Communications (IJCNWMC)* 4.2 (2014): 125-132.
19. Kasireddy, Shirisha, and M. Balraju. "Cloud Security with Gateway Model to Meet Elastic Nature." *International Journal of Computer Science and Engineering (IJCSE)* 5.6 (2016):1-6
20. Qamar, Khizar Hayat, et al. "A Sociological Study of the Factors Responsible For Low Production per Acre in Agriculture Sector In District Gujrat." *IASET: International Journal of Agricultural & Bio-Chemical Science (IASET: IJABS)* 2.1 (2017):33 – 38
21. Salunkhe, Harshal Anil, and B. B. Deshmush. "Impact of Subsidy on Agriculture Sector in India-An Analytical Study." *International Journal of Agricultural Science and Research (IJASR)*, 4.2 (2014): 9-16.