Blockchain in Agriculture: An Application Perspective
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Abstract
The objective of this research paper is to introduce the concept of Blockchain technique application in the agriculture sector, how the blockchain technology is different from existing technologies. The benefits of agricultural sector and the takeaways producers, distributors and end users need to be addressed. The scope of the paper includes transparent events, informed contracting, data monitoring, reducing human error etc. The structure of the paper can be seen as Introduction of Blockchain technology (BCT); Unique features of BCT; Issues in agricultural sector; How blockchain can solve the issues in Agriculture industry; Swot analysis of BCT in the agriculture sector; Current use of BCT by Corporates/Companies; Perspective feasibility—Community farming, Scandal proof supply chain, Credit supply to farmers, Remittance from Diaspora etc.

Keywords
Blockchain, Rural Management, Technological Innovation, Agriculture Sector, Farmer Financing

Introduction
The food production should be more in next few decades showing a sign of urgent environmental requirement, a fundamental transformation of the Food and Agricultural industry will be absolutely essential. Blockchain is one of the existing technologies playing a key role in this transformation (“The Blockchain”, 2015). Block-chain being a new domain is rapidly growing in adoption across the world in the form of crowd sourcing, funding and launching of crypt currencies, aided by the increasing trend towards decentralization, open-source technologies and pay as you use approach sweeping the world. It is important to learn about the block-chain paradigm in the context of the various technologies that are operating in tandem and also to understand the impact of Block-chain beyond the use of Crypt currencies, currently dominated by Bit coin.

Blockchain is a distributed database that is updated in real time, easy to monitor and stored in decentralized location. The security level ensures that nobody could cover up an error by simply changing the database entry as everyone might be watching. Block chains are open for anyone in a transaction. What makes the blockchain remarkable is that it performs the functions like check-pointed transactions, distributed communication or auditable log of updates. It is not possible to run blockchain by any company, decision making is not required and data removal is also not possible. Hence, it is an uncertain tool that has been made possible by advances in cryptography, internet performance and computing power.

Transparency and efficiency of customers turn a global agribusiness to emerging digital technologies. Blockchain and artificial intelligence are the options to reduce resource and time-intensive processes those are associated with global agricultural supply-chain (Friedma and McMichael, 1989).

The research article is organized as follows. It starts with literature review in section 2. Section 3 defines the research methodology. Section 4 reveals the applications followed by conclusion in section 5. The structure of the paper can be seen as Introduction of Blockchain technology (BCT); Unique features of BCT; Issues in agricultural sector; How blockchain can solve the issues in Indian agriculture sector, Perspective feasibility—Community farming, Scandal proof supply chain, Credit supply to farmers, Remittance from Diaspora etc.

Literature Review
The literature review is double fold: one is unique features of BCT and another one is involved with issues in the agricultural sector.

Unique Features of BCT
The simplest way to explain a blockchain is that it is “one big ledger in the cloud”. Ledgers are important. All money and assets around the world are mere entries in a ledger. When you send money from London to someone in India, the physical money does not somehow fly there, but the entries in your and her ledgers change. Unfortunately, the way the system is structured now, there are a bunch of intermediaries between you and her, who also have ledgers, and these ledgers should also be reconciled. This causes friction and friction causes time delays and costs.

The farmers, who were once regarded as the very heart and soul of the economy are now struggling all over the world to sell their produce at a decent price. They work day and night to cultivate good crops. They sleep with empty stomach. They have handful of income and bagful of debts. In India where the situations are so severe that some of them end up committing suicide, the middlemen take away all their produce and they are left
with nothing to feed themselves. They have to protest by eating raw rats to draw attention of the government. As per UN reports, up to 50% of crop value vanishes between harvest and the Point of Sale (“Starving Indian Farmers”, 2017). The farmer needs a transparent, trusted and reliable source of information which can connect them directly to the market, banks & consumers and eliminates middlemen who do profiteering at the cost of farmers due to lack of transparency in the process.

Methodology
Agriculture is facing a lot of challenges now a day which includes low production, surplus production, storage issues, and quality issues, etc. And this is precisely the solutions which block chain offers. Some commonly visualized applications of Blockchain in agriculture are as below:

How safe is my source of food?
With the rise in the life style diseases, the customers have become conscious to know the sourcing of food which might have bearing on their well-being. The appetite of consumers to pay higher prices to verifiable source has made many companies to make this aspect of their USP. The blockchain technology provides the competitive edge here.

What is the share of my profit in the food supply chain?
Every day we are getting news reports about distress in farm sector forcing many farmers to suicide. On the other hand, intermediaries in trade of farm produces are making big money. The current food supply chain suffering from information asymmetry making it difficult to know which stage of this chain is distorting prices to the disadvantage of the others. The welfare government wishes to do away with this information asymmetry which is precisely possible with the adoption of block chain technology.

Are farmers getting authentic inputs?
With the growing imitation & duplicity of brands it is difficult to ascertain the quality of the products bought. For a poor farmer on pesticide of one particular brand may be available at different rates over the counter. The source of these different rate pesticides may not be known to retailers, what to talk of farmers. A poor farmer buys a cheaper pesticide thinking it to be more suitable but end up in losing the crop. Thereby further increasing his financial distress. Here the blockchain technology with its temper-proof time stamped capabilities can be put to use to authenticate various products and their sources.

How far is the land free from litigation?
Land recording will be efficient and easy through blockchain technology. It will result in huge cost savings and bring complete transparency in the government system. A pilot study is being conducted in Andhra Pradesh, a state of country India where a start-up company

Can the farmers avail the subsidies given by the government?
Does the subsidies reach the farmer-has always been the question across the globe. The process of disbursement of subsidies is very complex as it requires multiple stakeholders. With the use of blockchain technology all the pilferages in the existing system can be reduced and all the distribution and delivery of subsidies can become more transparent.

Block-chain Applications

**IBM Food Trust, blockchain technology:** The spread of E. coli has forced major retailers to reconsider the way they track their produce. There is no question that there is a strong public-health and business case for enhanced food traceability. By quickly tracing leafy greens back to source during an outbreak using recent advances in new and emerging technologies, impacts to human health can be minimized, health officials can conduct rapid and more thorough root cause analysis to inform future prevention efforts, and the implication and associated losses of unaffected products that are inaccurately linked to an outbreak can be avoided. The state then reports it to the Centers for Disease Control and Prevention. Once Walmart is alerted, it will immediately be able to trace the head of lettuce back to its origin within seconds (Galvez et al., 2018).

**FoodCoin:** Tian (2016) explained about a company established in Lucerne, Switzerland. Their main objective is to create a blockchain ecosystem to help natural food sellers to reach their audience. It will make closer the relation between companies and their customers, as well as with other companies that might help them.

**Archer Daniels Midland Company**/ Bunge Limited, Cargill Incorporated and Louis Dreyfus Company are investigating ways to standardize and digitize global agricultural shipping transactions for the benefit of the entire industry. The companies also seek broad-based industry participation to promote global access and adoption.

**Pundi X, a global developer** of blockchain-based technology solutions, and HARA, the Indonesian company dedicated to revolutionizing global agriculture with data, will jointly deploy thousands of blockchain-based point of sales (“POS”) devices to farmers to facilitate data collection and financial inclusion across developing economies (Tripoli and Schmidhuber, 2018)

**Ripe.io (a startup):** It uses blockchain in agriculture. Blockchain can be used to track crops, yielding higher-quality produce and putting better information in the hands of farmers, food distributors and restaurants. Along
with costs, blockchain may help how to keep a track of other data related to food as well, like: origin, temperature at which it is stored, how is it being transported etc.

De Filippi (2018) in Argentina leveraged the disruptive power of blockchain and created a website which has a catalog of everything the farmers produced and the payment is done in Bitcoin when the customer checks out. It is very easy to incorporate crypocurrency as a payment gateway in any website. CoinPay enables you to have payment made via Bitcoin and Litecoin.

**FarmShare:** Farmshare works to alleviate hunger and malnutrition by recovering and distributing fresh and nutritious food to those who need it most. It uses blockchain currency to buy, sell and trade cryptographic tokens that can be exchanged for weekly deliveries of locally-produced organic food.

**Conclusion**
The agricultural industry could see increased global exchange of produce through the exchange of digital products and currency. This could affect everyone from rural farmers selling to consumers across the globe, to large nations accurately tracking their aid relief. This could lead to fairer distribution of goods and currency amongst some of the poorest regions of the world, as well as increase community-based agricultural models on a global scale (Swan, 2015).

Collective farming though a very useful way of increasing farm produce, not gaining pace due to uncertainties and non-transparencies in the distribution of Farmshare to different stakeholders. The transparent and time stamped data keeping of blockchain technology can ensure fair distribution of farmshare and thus promote collective farming.

**References**