

# A Smart Farming Approach using the Concepts of Blockchain

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**Abstract** - Most of the profit in agriculture is consumed by the middlemen, whereas the farmers face loss, due to which they commit suicides. The death of many farmers has become the major concern of developing nations. As a solution to this problem statement, this situation can be controlled to a greater extent through management of the supply chain of the crops through smart contract which helps the farmers to keep track of profit, loss and selling prices at each level. It helps the government to track the price variation in the market. The main objective of this is to solve one of the major concerns for the farmers in terms of revenue and transparency with the government bodies, by focusing on eliminating third-party vendors involved in the process. Common people can also get an overall and clear view of the supply chain by which they can also make profit by investing in the right manner.

**Key Words:** Blockchain, smart contract, farmers, supply chain management

## 1. INTRODUCTION

To improve profitability in farming which is essential to ensure the financial stability of farmers, they need a solution which can be trusted, and also at the same time a transparent and reliable source of information. The solution must also ensure the connectivity between farmers and supply chain, such as banks, market, and consumers so that the involvement of middlemen can be eliminated, who takes up majority of profit that a farmer makes as there is lack of transparency in the entire supply chain. Hence, the question is how best we can solve this problem with Blockchain Technology.

By using Blockchain it can be ensured that premium and organic brands stands out in the crowd and can also justify why their organic products or free range is worth spending the extra money on. The reason being, the source of their products or goods can be effortlessly traced, which provides the consumers with confidence that they are looking for, before buying any high-end and quality product. The agricultural sector might also find it useful because they can understand and validate how much their crops are worth, by comparing the money that they are being offered by a distributor to the amount paid to their competitor in their previous purchases. This will give all the farmers the opportunity to earn money that they truly deserve. One way of achieving this, is by eliminating the

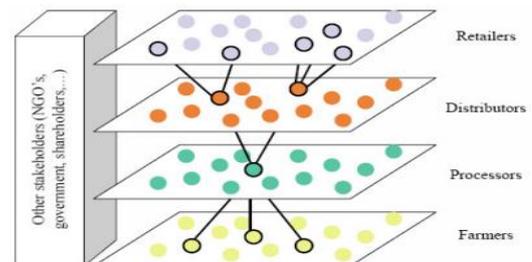
middlemen and directly linking farmers to consumers or retailers using Blockchain Technology.

## 2. EXISTING SYSTEM

### 2.1 Livestock Management

Wireless IoT apps can be used by large farm owners to collect data on their cattle's whereabouts, well-being, and health. This information assists them in identifying unwell animals so that they can be isolated from the herd, preventing disease spread. IoT-based sensors can be used to find their animals, which reduce labor costs. JMB North America is a company that provides cattle ranchers with cow monitoring solutions. One of the solution that aid cattle owners in observing pregnant cows which are on the verge of giving birth. When the heifer's water breaks, a battery-powered sensor is ejected. This sends a message to the rancher or herd manager. The sensor allows farmers to be more focused while working with heifers who are giving birth.

With the increase in the world's population, the demand for food also increases and its rate of development. Farmers must be smart regarding their crop or livestock management process if they are looking to reduce waste and down cut down total costs. With a decrease in the amount of land available for farm use and an ever-growing concern about water resources, farmers must be smart about crop and livestock management if they want to reduce waste and cut overall costs. Through remote monitoring and data-driven decision making, the [1] Internet of Things (IoT) allows farmers and growers to improve agricultural yield and boost livestock health.



**Fig -1:** Schematic representation of supply chain  
**2.2 Current agricultural technology landscape**

A massive chain of ecosystem has emerged in the sector of agricultural production to serve global customers and institutions. Global agribusiness, smallholder farmers,

crop insurers, and Agricultural Tech start-ups all play a role in the landscape. Farmers are empowered by modern precision technologies because they can detect and prevent disasters. Soil mapping, for example, gives geo-referenced information on growing conditions, whereas automated guidance systems use GPS to self-steer water, pesticides, and other crop treatments. The agricultural sector, on the other hand, is conservative and dominated by large-scale agriculture.

### 3. PROPOSED SYSTEM

In exploring the applications of blockchain solutions in the agricultural sector, we found that the potential of three specific use cases: supply chain tractability, smart contracts and crop insurance, and use of Hyperledger composer.

#### 3.1 Supply chain tractability

Machine-intensive technologies were available during the start of the Industrial Revolution, allowing manufacturing processes to be scaled up to new levels. Food manufacturers have fine-tuned their supply chains into extremely complicated yet systematized networks that span borders and terrains in attempt to offer food faster and cheaper for customers. However, as supply chains have grown and complexity they have gotten is increasingly entangled. Local consumption is becoming more popular since people view it to be more transparent than standard agriculture consumption. Monsanto's proprietary seed characteristics are used to cultivate 80% of maize and 90% of soybeans in the United States. In addition, McKinsey and Company ranked the agriculture industry lowest in a research analyzing digital adoption and usage across 22 industries.

Local food consumption has exploded in the United States, with sales predicted to nearly double between 2014 and 2019. According to a research by Packaged Facts, half of Americans are willing to pay a 10% premium for locally grown and produced goods, while a third would be willing to pay a 25% premium. However, just like the "all natural" and "organic" labels, "local" is subject to deceptive activities by dishonest food value chain players. Ironically, as most other aspects of their life become more computerized, customers suffer a widening information gap. Meanwhile, consumers concerned about provenance can turn to digitization for help. Blockchain technology, as a type of digitalization, expands on the usability of other data capturing methods while also providing a secure and transparent approach for food traceability, with help of Trace Register. As a result, both suppliers and consumers can readily access a suite of proofs that validate a product's quality criteria. With more proven use cases emerging from initiatives built in developed economies, blockchain may gain even more traction in emerging markets.

#### 3.2 Smart Contracts and Crop Insurance

Farmers have encountered uncertain weather conditions in their job since the dawn of agriculture. Crop insurance is one approach for farmers to protect themselves from weather and economic risk. However, processing these claims is typically cumbersome, leaving farmers to be without coverage when they most need it. Also, it might take months, and even years, for these charges to be validated. Processing many claims for each weather disaster places a significant operational burden on an insurance provider's employees. Weather patterns are frequently erratic, making it difficult to scale the workforce efficiently to handle weather disasters.

Moreover, when an event occurs, claimants may commit fraud by reporting damages that are greater than the actual damage. Insurance companies are unable to adequately evaluate the legitimacy of such claims, ending in fraud losses. Farmers and insurance firms have been relying on inefficient claim processing methods based on outdated technology. The agriculture industry has a reputation of being difficult to take advantage of the latest and innovations. The crop insurance sector, however, is currently facing enormous disruption and offers tremendous scope for development, thanks to the introduction of Blockchain technologies and Smart Contracts.

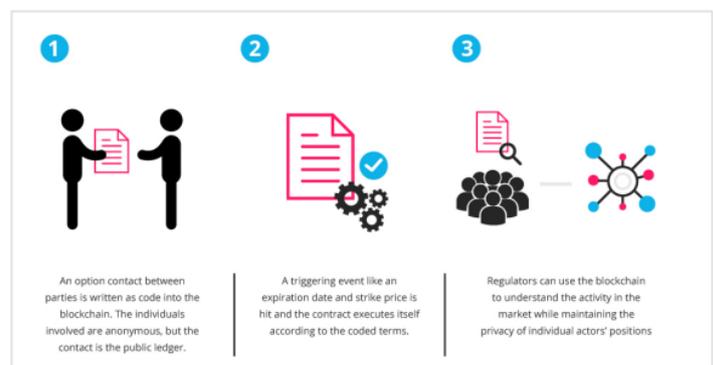


Fig -2: Smart Contracts technology overview

Smart Contracts will improve the claims processing system significantly. Weather data will be used proactively in the event of a natural catastrophe to trigger circumstances and procedures that will allow cash for claims to be issued. Farmers will be able to get the supplies they need to reduce the danger of a weather disaster in this situation. The operational volatility of running an agricultural business is considerably reduced because of unpredictably bad weather. Because of the automated processing provided by smart contracts, insurers can avoid the operational load of processing a huge volume of claims. In an event of a disaster, Internet of Things (IoT) devices can be employed on critical equipment assets to transmit data back to the smart contracts for verification purposes.

### 3.3 Use of Hyperledger Composer

Hyperledger Composer is a suite of collaborative tools for developing blockchain business networks that allow creating smart contracts and blockchain apps to solve business challenges simple and fast for business owners and developers. Composer offers business-centric abstractions as well as sample apps with easy-to-test devops processes to create robust blockchain solutions that drive alignment across business requirements and technical development. It is built with JavaScript and leverages modern tools such as node.js, NPM CLI, and popular editors.

This is the node or ledger that holds all the data for each transaction, and it is shared by all of the parties involved. As a result, if any of the nodes are changed, all the blocks must be mined, and all parties must be aware of the changes. The transaction becomes transparent because of this.

## 4. SYSTEM DESIGN

The project is a block chain implementation which uses Hyperledger composer. Hyperledger projects are blockchain related tools built by the open-source community and the Hyperledger organization. It is an open-source project by IBM which lets us build, deploy, and test our blockchain projects easily.

### 4.1 Composer Terminology and Concepts

1. **Participant** - A participant is someone who can own anything or conduct an action on the ledger. This may be a farmer or a government official in our case.
2. **Asset** - An asset is a monetary item in the ledger. This may be crops or even money in our case.
3. **Transaction** - A transaction occurs when a group of people creates or trades assets. A government agency accounts money to farmers in our case.
4. **Event** - When the value of an asset changes. We can emit events in our example every time a new transaction is made.
5. **CTO File** - The extension (filename.cto) with which we declare our model, which describes the application's participants, assets, transactions, and events.
6. **Transaction Functions** - This is the JavaScript code that really performs the transaction logic. It is passed a transaction object as a parameter (which has fields for whatever is declared in the CTO file's transaction model variable). Making a new owner for a farmer's commodity.
7. **Asset Registry** - The location where the data is stored. Transaction functions make advantage of this.

8. **getFactory()** - Any time you wish to generate a new asset, participant, or transaction, you call this function in your code.
9. **Namespace** - This is the method by which you divide items into groups. For example, our ledger has two types of participants: farmers and government agents. When a new participant is recruited, he or she will be assigned to one of the two groups: farmers or government agents.
10. **Business Network** - A Business Network Archive (.bna) file, which represents your blockchain, contains all your files (models, scripts, permissions, and queries). This can then be deployed across a fabric network.

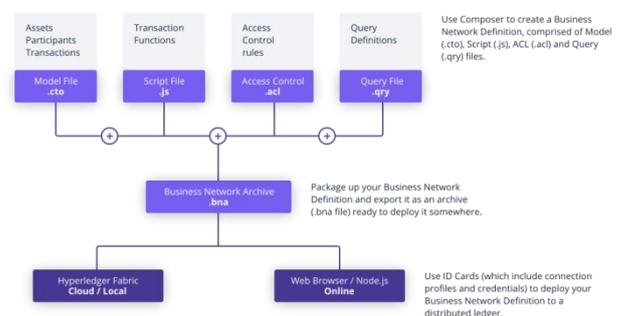


Fig -3: Implementation Process

### 4.1 Back-end process

We start by creating a Docker image, which will be used to build and define our network. Multiple peers are formed and certified on the docker container. We use IBM's default API request for certification. Making rest calls creates the Peer admin card, which is then used to make an API request to activate the playground on the local browser.

### 4.2 Front-end process

We build a new business network from the ground up on the composer playground. A business network contains a few distinguishing characteristics, including a name and an optional description. You can also choose to build a new business network from scratch or import an existing template. We see a new business network card called admin for our business network smart-farming in our wallet now that we've developed and implemented the business network.

We define two things after connecting to the deployed business: the model file and the JavaScript function for transaction logic.

## 5. CONCLUSIONS

[2] Blockchain will benefit developing countries by eliminating fraud and corruption while also strengthening

legal property rights and allowing the poorest to establish businesses. It can also expedite monetary operations and ensure that relief is delivered with less possibility of theft and fraud.

Smart Contracts, which are built on the same Blockchain technology that drives Bitcoin, can help farmers resolve their issue. Smart contracts are used to manage the crop supply chain, farmers around the world to track profit, loss, and selling prices at every level. It makes it possible for the government to keep track of market price changes. The public also gains an overall and comprehensive perspective of the supply chain, allowing them to profit by investing wisely.

## REFERENCES

- [1] "Blockchain and the Internet of Things (IoT) in the industrial sectors", Dennis Miller, IEEE Xplore Digital Library, DOI:10.1109/MDM.2017.12
- [2] "Blockchain in developing countries", Nir Kshetri, Jeffrey Voas, IEEE Xplore Digital Library, DOI:10.1109/ICUAS.2017.7991472M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.