

Blockchain in Agriculture

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In the agriculture domain, self-executing smart contracts together with automated payments would be the game-changer. The role of smart contracts especially in agricultural insurance, green bonds, and traceability could be very effective.

According to Report Linker, the blockchain in food supply chains and agriculture is estimated to be USD 60.8 million in 2018 and is projected to reach USD 429.7 million by 2023. The Dutch Ministry of Agriculture, Nature and Food Quality financed the first research project, “Blockchain for Agrifood” that has been proposed to explore blockchain implications for Agrifood. Pilot studies indicate that blockchain technology-enabled food to be traced from farm to grocery store in just a few seconds.

Blockchain also helps to keep tabs on abundant commodities and reduce cases of illegal harvesting and shipping frauds. The United Nation reveals that food frauds cost the global economy around \$40 billion per year because of illicit trades.

Opportunities for blockchain technology in Agriculture

1. **Procurement Tracking** — The challenge for the agriculture sector is to track and pay for the delivery of foods. Nowadays, the process depends on a third-party for coordinating the goods delivery. The sellers usually have an agent who ensures that the goods are delivered safely and buyers have an agent to recommend payment and audit the delivery.

The involvement of multiple agents add high costs to the system and makes the entire process time-consuming. With the blockchain, the whole process can be simplified to a single distributed ledger.

2. Crop and Food Production — With the help of smart farming, IoT sensors could fetch important information like the temperature of the soil, water level, fertilizer details and more and send it to the blockchain. Based on the data saved in blockchain, smart contracts could trigger and execute the specific actions. It will help in enhancing the quality of the farming process as well as produced crops.

3. Weather crisis control — Farmers have to face the issues of unpredictable weather conditions throughout the year. Monitoring and predicting such factors can be crucial for better crop survival.

Due to excessive rains, it becomes difficult for grown crops to tolerate flooding. Consumers are never aware of when did the crops suffer bad weather conditions and why did market face high surge pricing.

4. Managing Agricultural Finance — Lack of transparency in credit history and agreements are some of the significant problems confronting between smallholders and financial inclusion. Today, financial services do not only allow smallholders to invest in farming but also help them in resolving liquidity constraints.

As a result, it becomes challenging for buyers to pay farmers, restricting smallholders to sell crops at comparatively lower rates. With blockchain, the agricultural finance process becomes more transparent and fair, yet enables shared control accessibility.

The agriculture industry needs to do a lot of work to maintain and build consumer trust when it comes to the food quality check. A blockchain-based agriculture solution holds a lot of promise for the agribusiness industry with its ability to bring transparency in the system.

5. Agricultural insurance — systems in the Asia-Pacific region range from major public sector programmes of India and the Philippines through to public-private partnerships in China and the Republic of Korea and finally to purely private markets encountered in Australia and New Zealand and non-formal private mutual and community-based crop and livestock initiatives in Bangladesh, India and Nepal.

6. Land registrations — blockchain-based implementations could provide an incorruptible ledger of land records. Especially in the case of the rural poor, if this is linked effectively to sovereign ID/digital ID then the safekeeping of land records even in times of natural disasters or wars would not be an issue.

The United Nations Development Programme (UNDP) in India is working with partners to make land registry more reliable there. At a high level, this project will capture and permanently record each transaction throughout the sale of a property.

This means you achieve near real-time traceability and transparency with respect to the state of the property. The Swedish government's land-ownership authority, has piloted land registry and property transaction on the blockchain. They believe that this provides a safe and secure way to have digital originals and that it could reduce hundreds of millions of dollars of expenses for the government. The Republic of Georgia is experimenting on the use of the bitcoin network to validate property-related government transactions.

7. Bringing increased transparency in agricultural supply chains — a blockchain can assist in providing an immutable record from the provenance to the retail store of a product. This can give consumers increased trust in the products that they buy and it is also an opportunity to reward the producers who employ good agricultural practices to cultivate their produce. This would eventually lead to sustainable farming practices and responsible consumption.


8. Fishing Industry — The blockchain can be used to track and deter illegal, unreported and unregulated fishing which poses the greatest threat to marine ecosystems. World Wildlife Fund (WWF) in New Zealand is working on a pilot project to stamp out illegal fishing and human rights abuse in the Pacific Islands' tuna industry. They have collaborated with various other organizations to track fish from vessel to the supermarket, this Blockchain Supply Chain Traceability Project uses digital technology in the fresh and frozen tuna sectors of the Western and Central Pacific region to strengthen supply chain management.

9. Forestry —The Spanish Ministry of Agriculture, Fisheries and Food also plans to apply blockchain technology to develop the forestry industry. The operating group, ChainWood, aims to improve the traceability and efficiency of the wood supply in Spain by implementing blockchain technology in the industry's logistics.

10. Sustainable monitoring, verifying and reporting on green or climate bonds. — Green bonds were created to fund projects that have positive environmental and/or climate benefits. With the increase in bond value, it is necessary to have effective tracking, traceability and verification mechanisms to help increase investors trust in climate-smart-initiatives.

Understanding the risks with implementing blockchain to Agriculture

Being a technology that hasn't yet reached maturity, the blockchain brings in certain implementation risks that are important to comprehend and wherever possible to mitigate before deployment. A good understanding of the risks would assist in deciding whether Decentralised Ledger Technology or a centralized database would be more appropriate, and further choosing the appropriate DLT for a given scenario as the risks vary with the type of deployment, i.e. permissioned (private) or permissionless (public).

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1. **Energy requirement can be high** — A methodology to build consensus for entering a new data block amongst participating nodes is a core feature of blockchain. There exist several possible ways of reaching consensus, each with its own advantages and disadvantages. The one that is employed by Bitcoin and Ethereum, the most famous of blockchain implementations, is proof-of-work (PoW). It works on the principle of “hard to create, easy to verify”, which means a lot of energy needs to be spent by the node to earn incentive tokens. For a large chain like Bitcoin, estimates suggest data size exceeding 100 gigabytes and electricity requirements more than the entire country of Ireland. Although this is true for the PoW methodology, other alternatives such as proof-of-stake (PoS), Byzantine fault tolerance algorithm, and delegated proof-of-stake model to require less energy.
 2. **Policy and regulatory risks** — The policy and regulatory framework around blockchain is in its infancy and therefore entails high risks. The fluctuations in the price of Bitcoin and the reports of hacking of cryptocurrency have resulted in increased regulation by a number of countries and has attracted regulatory interest. These regulations vary from a complete ban on holding cryptocurrency (e.g. Bangladesh), a ban or regulation on cryptocurrency trading (China, Saudi Arabia) to a ban on holding initial coin offerings (ICOs). A number of blockchain projects, especially those dealing with currency or cross-

border transactions, requires KYC/AML compliance and it is important to understand the national framework before delving into these projects.

3. **Speed of transaction** — The speed of transaction is an important element as some of the public blockchains do not have high transaction speeds. On Bitcoin blockchain, a new block emerges on average every ten minutes but is not guaranteed; and this block time is different for every blockchain. For scalability, it is important to understand the requirement of applications in terms of speed (*transactions per second (tps)*) before choosing a solution. Theoretically, the Visa network can handle about 50 000 tps, which is a lot more than is offered by most mature blockchains today.

