

Blockchain for Beginners: How This Tech is Revolutionizing Farming

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Introduction

Blockchain is a distributed, decentralized, and frequently public digital ledger made up of records called blocks that are used to record transactions across numerous computers. This ensures that any block involved cannot be changed in the past without changing all the blocks that come after it. This enables the parties to independently and relatively cheaply audit and verify transactions. A distributed timestamping server and a peer-to-peer network operate a blockchain database independently.



Fig 1. Blockchain in Agriculture

Mass cooperation motivated by group self-interests validates them. Renowned for its decentralization, security, and openness, blockchain technology is increasingly making its way into a variety of sectors, including agriculture. The agricultural industry stands to gain much

from this cutting-edge technology, which has the potential to completely transform how we grow, distribute, and eat food. Key applications of blockchain in agriculture include supply chain transparency, smart contracts and automated payments, sustainable agriculture, financial inclusion, etc.

The Current State of Agriculture

Agriculture, the foundation of human civilization, is undergoing a major upheaval. Traditional farming practices remain important, but technological innovations are altering the industry. Some key trends shaping modern agriculture include precision agriculture, sustainable agriculture, technological innovations, global food security, etc. The future of agriculture depends on a balanced approach that combines traditional wisdom with cutting-edge technology. By solving issues and embracing innovation, the agricultural industry can secure food security, environmental sustainability, and economic prosperity for future generations. A few challenges the farming sector faces include Climate Change, Soil Degradation, Water Scarcity, Pests, Diseases, etc. Specifically, India's agriculture sector is a complex combination of ancient techniques and cutting-edge technologies. While it contributes significantly to the country's GDP and employment, it confronts various challenges.

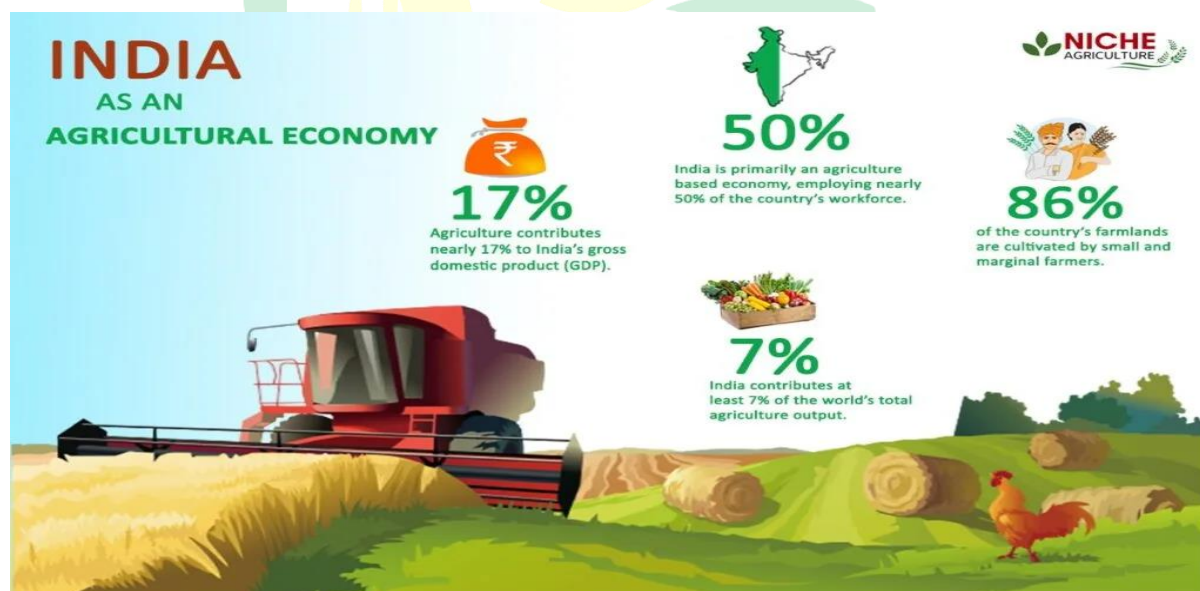


Fig 2. Current status of agriculture in India

How does Blockchain work?

A few notable challenges in the agricultural industry include food safety concerns, supply chain inefficiencies, lack of transparency, farmer exploitation, etc. With these

challenges, the traditional methods used in agriculture have their limitations. Paper-based record-keeping and manual data entry are Susceptible to fraud and corruption. Thus, blockchain makes every movement and transaction in the agricultural supply chain transparent and unchangeable. This implies that every stage is recorded and available from when a seed is sown until the finished product is delivered to the customer. However, in agriculture, blockchain can be used to collect soil moisture data, farmers' data, seed quality data, climate and environmental data, harvest and yield data, demand and sale price data, etc.

The way blockchain is used in agriculture is as follows

- 1. Data recording:** The blockchain keeps track of every stage of the supply chain, from planting to packaging. This contains details such as:
 - The farm's location
 - Planting and harvesting dates
 - Conditions of transportation and storage for the types of pesticides and fertilizers used
 - Details of processing and packing
- 2. Data Verification:** Every supply chain participant confirms the information that the preceding participant entered. This guards against manipulation and guarantees correctness.
- 3. Data Storage:** A block containing the validated data is uploaded to the blockchain. Because each block is connected to the one before it, the chain is safe and impenetrable.

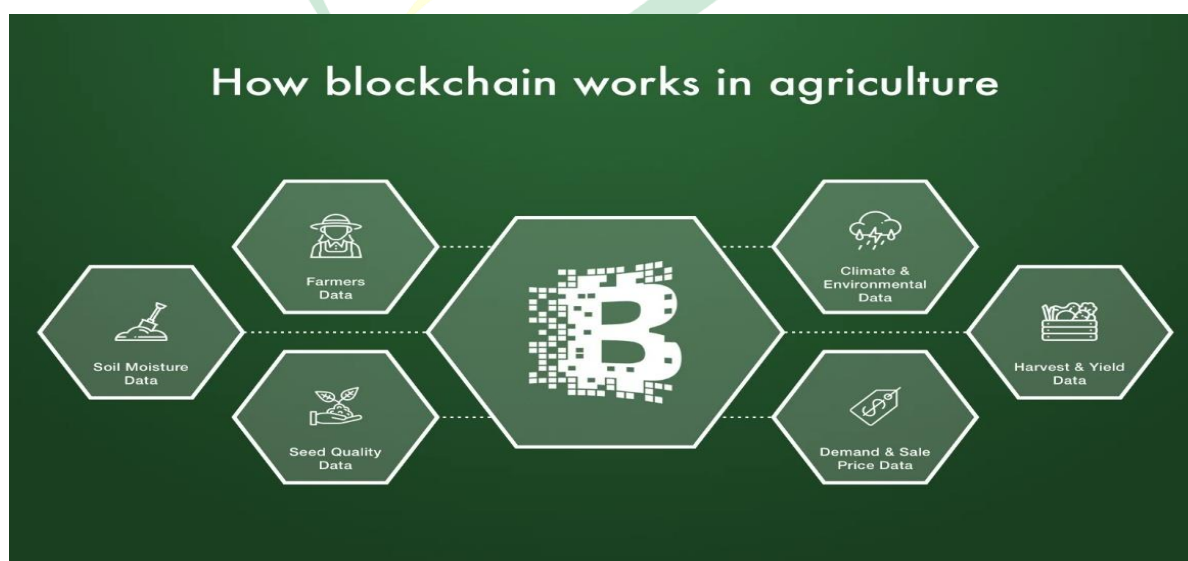


Fig 3. How blockchain works in agriculture



How Blockchain Can Revolutionize Farming

- **Traceability and Transparency:** Tracking the journey of food from farm to fork enhances consumer trust and confidence. Blockchain can also improve transparency in the food supply chain.
- **Food Safety and Quality Assurance:** Identifying and addressing food safety issues promptly ensures product quality and authenticity
- **Efficient Supply Chain Management:** Streamlining supply chain operations reduces waste and spoilage which in turn optimizes logistics and distribution.
- **Empowering Farmers:** Fair compensation and direct-to-consumer sales give farmers access to finance and insurance easily. This can also protect the intellectual property rights of the farmers.

Real-World Applications of Blockchain in Agriculture

One recent stride in India is the Digital Agriculture Mission, which was authorized by the Union Cabinet in September 2024. This mission encompasses several digital agriculture efforts, including AgriStack and the Krishi Decision Support System (DSS). AgriStack is a farmer-centric Digital Public Infrastructure (DPI) that intends to improve service and program delivery for farmers. It contains a Farmer ID system, similar to Aadhaar, that would be linked to other farmer-related data such as land records, animal ownership, crops sown, and subsidies received. Pilot projects have been carried out in six states: Uttar Pradesh, Gujarat, Maharashtra, Haryana, Punjab, and Tamil Nadu. The Krishi Decision Support System (DSS) combines remote sensing data on crops, soil, weather, and water resources to create a comprehensive geospatial system. This system intends to give the agricultural sector fast and trustworthy information. KRanTi is a blockchain-based farmers' credit system developed in India to help small and marginal farmers receive financing faster. This system aims to provide farmers with access to credit without the pressure of instant payment, enabling them to purchase high-quality agricultural inputs and sustain their operations. These initiatives are part of a larger attempt to use blockchain technology to improve the transparency, traceability, and sustainability of Indian agriculture.

Conclusion

Blockchain technology has the potential to improve agriculture by increasing openness, efficiency, and trust. It improves traceability and transparency throughout the supply chain,



ensures food safety and quality, streamlines operations, and empowers farmers through increased direct access to finance and sales to consumers. In India, recent efforts such as the Digital Agriculture Mission and the KRanTi system demonstrate blockchain's potential to address conventional agricultural concerns while improving sustainability and economic prosperity. By adopting such advances, the agricultural industry may transcend its constraints, assuring food security and environmental sustainability for future generations. Blockchain technology in agriculture is a positive step toward a more transparent, efficient, and egalitarian food system.

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