Block Chain Technology and its implementation in Agriculture

[Article ID: SIMM0305]

Shruti Mohapatra[1], Rini Labanya[2]
Faculty of Agriculture, Sri Sri University, Cuttack, Odisha, 754006

Block chain technology is a distributed ledger system that records and verifies transactions across multiple computers in a way that ensures the security, transparency, and immutability of data. It was originally designed to support crypto currencies like Bit coin, but its applications extend far beyond digital currencies. Block chain technology offers several applications in agriculture, bringing transparency, efficiency, and trust to the industry. Here are various applications:

1. **Supply Chain Management**:
   - **Provenance Tracking**: Block chain can record every step in the supply chain, from seed to sale. This ensures transparency and traceability of agricultural products, allowing consumers to know where their food comes from.
   - **Reducing Fraud**: Supply chain fraud, such as counterfeit seeds or adulterated products, can be minimized as block chain records are tamper-proof. This is especially crucial in international trade.
   - **Efficiency**: Automating supply chain processes with block chain reduces paperwork, minimizes human errors, and streamlines the movement of goods.
2. **Traceability**:
   - **Food Safety**: In the event of a food borne illness outbreak or product recall, block chain allows for rapid tracing of contaminated products back to their source, minimizing the impact on consumers and reducing recall costs.
   - **Certifications**: Block chain can store data related to quality certifications, organic labeling, or sustainable farming practices, giving consumers confidence in the authenticity of product claims.
3. **Smart Contracts**:
   - **Automated Payments**: Smart contracts can be used to automatically execute and enforce agreements between various parties involved in agriculture, such as farmers, distributors, and retailers. For example, a smart contract can release payment to a farmer upon delivery of produce.
   - **Insurance Payouts**: In cases of crop loss due to adverse weather conditions or pests, smart contracts can trigger insurance payouts based on predefined conditions, reducing the time and administrative overhead.
4. **Crop and Inventory Management:**
   - **Data Recording:** Farmers can use block chain to record essential data about their crops, including planting dates, irrigation schedules, and fertilizer usage. This historical data can inform future planting decisions and improve crop management.
   - **Inventory Tracking:** Storage and inventory management can benefit from block chain by ensuring real-time visibility of stock levels and

reducing the risk of theft or spoilage.

5. **Quality Control and Assurance:**
   - **Quality Records:** Block chain can store records of quality control tests, including pesticide residue testing, inspections, and quality assessments. This data is accessible for auditing and compliance purposes.
   - **Counterfeit Prevention**: Ensuring that the products are genuine is a significant concern in agriculture. Block chain can help in verifying the authenticity of agricultural inputs like seeds, fertilizers, and equipment.
6. **Fair Trade and Payments:**
   - **Fair Pricing:** Block chain can facilitate fair and transparent payments to farmers, ensuring they receive a fair price for their products by reducing the influence of intermediaries.
   - **Enhanced Trust:** By making payment records immutable and transparent, block chain can enhance trust among all parties involved in agricultural transactions.
7. **Data Sharing and Collaboration:**
   - **Secure Data Sharing:** Block chain allows secure data sharing among different stakeholders, such as farmers, processors, distributors, and retailers. This improves collaboration and coordination in the agricultural ecosystem.
   - **Data Ownership:** Farmers can have more control over their data and choose to share it with trusted partners, potentially unlocking value from their data.

These applications demonstrate how block chain technology can positively impact the agricultural industry by improving transparency, efficiency, and trust in the supply chain, reducing fraud, and enhancing data management and decision-making processes. However, it's essential to address challenges such as scalability, interoperability, and regulatory considerations to realize the full potential of block chain in agriculture. There are some real-world implementations of block chain technology in agriculture becoming increasingly common. Here are a few examples and case studies showcasing how block chain is being utilized in the agricultural sector:

1. **Walmart's Food Traceability System**:
   - Walmart, one of the world's largest retailers, has implemented block chain technology to enhance the traceability of fresh produce. They partnered with IBM and several food companies to create a block chain-based system for tracking the source of leafy greens. This system allows Walmart to trace the origin of produce in seconds, a process that used to take days, improving food safety and reducing the impact of food borne illnesses.
2. **Te-Food and Pork Traceability**:
   - Te-Food, a block chain-based food traceability solution, has been used to trace pork products in various countries, including Vietnam. This platform enables consumers to scan QR codes on pork products to access information about the meat's origin, processing, and safety. It enhances consumer trust and ensures food quality.
3. **AgriDigital and Grain Trading**:
   - AgriDigital, an Australian agtech company, has introduced blockchain technology to streamline grain

trading. The platform enables farmers, traders, and buyers to conduct grain transactions with smart contracts. This innovation reduces the administrative burden, enhances trust, and accelerates the settlement process.

4. **BlockGrain and Grain Supply Chain**:
    - BlockGrain, another Australian company, uses blockchain to optimize grain supply chains. It offers a system that digitizes and records transactions, helping farmers and grain handlers track grain movements and manage their operations more efficiently.
5. **AgriChain and Coffee Supply Chain**:
    - AgriChain, an Australian blockchain-based agtech platform, has partnered with coffee farmers in developing countries like Papua New Guinea to improve the traceability and transparency of coffee production. This initiative aids in verifying fair trade practices and providing a premium for high-quality coffee.
6. **Ripe.io and Beef Supply Chain**:
    - Ripe.io has implemented blockchain technology in the beef industry, allowing consumers to trace the journey of their beef from the farm to the table. Their system records data related to the animal's health, feeding, and processing, providing transparency and ensuring food safety.
7. **World Wildlife Fund (WWF) and Tuna Fishing**:
    - WWF Australia has used blockchain to track sustainably caught tuna. They partnered with various stakeholders, including the fishing industry and governments, to implement blockchain technology, which helps ensure that tuna products are sourced from sustainable fisheries.
8. **OriginTrail and Organic Food**:
    - OriginTrail offers a blockchain-based solution for supply chain transparency, including organic and eco-friendly products. They've worked with various organic food producers to enable consumers to verify the authenticity of organic and environmentally friendly claims.

These case studies illustrate how blockchain technology is being applied to address various challenges in agriculture, from ensuring food safety and traceability to streamlining supply chain processes and supporting sustainable practices. These real-world examples also demonstrate the potential of block chain to create more transparent and trustworthy agricultural systems. They present several policy implications that governments and regulatory bodies need to consider as this technology becomes more prevalent in the industry. These policies should aim to foster innovation, ensure food safety, protect data privacy, and promote sustainable practices. Major policies have concentrated for privacy and ownership of data followed by their standardization, regulation, oversight, interoperability, antimonopoly measures, sustainable farming practices, consumer protection, international trade and traceability, cyber security and resilience and their environmental impact.

References:

Caro, M. P., Ali, M.S., Vecchio , Giaffreda, R. 2018. Blockchain-based traceability in Agri-Food supply chain management: A practical implementation. IoT Vertical and

Topical Summit on Agriculture-Tuscany (IOT Tuscany) , p. 1 - 4

Lan, G., Brewster, C., Spek, J., Smeenk, A. and Top, J. 2017. Blockchain for Agriculture and Food; Findings from the pilot study. Wageningen, Wageningen Economic Research, Report 2017-112. 34 pp.; 4 fig.; 2 tab.

Mohapatra, S., and Sainath, B. 2023. Application of blockchain technology in the agri-food system: a systematic bibliometric visualization analysis and policy imperatives. Journal of Agribusiness in Developing and Emerging Economies, https://doi.org/10.1108/JADEE-10-2022-0237