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India as an Emerging Hub of Global Manufacturing and Reliable Supply Chain- A Blockchain Perspective in Exports

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Abstract

The implementation of blockchain in agriculture could revolutionize the sector by creating an immutable record of transactions, from farm to fork. This would not only ensure food safety and quality but also enable fair pricing and reduce intermediaries, directly benefiting farmers. Moreover, smart contracts on the blockchain could automate payments and enforce agreements, streamlining processes and reducing disputes in the agricultural supply chain. These advancements align with the "Make in India" initiative by fostering innovation, attracting investments, and positioning India as a leader in agri-tech solutions.

Technology-driven, integrated supply chains enable entities to reduce inventory and costs, add product value, extend resources, accelerate time to market, expand market, increase pricing for sellers and variety for buyers as well as retain customers. In order to have a successful supply chain, the Indian Government has sought to involve multiple stakeholders to improve interactions between farmers, processors, distributors and retailers. The Indian government's focus is on supply chain-related infrastructures like cold storage, abattoirs and food parks.

Keywords: Blockchain, Agriculture, Farmers, Supply Chain, Agri-Tech Solution

I. INTRODUCTION

The "Make in India" campaign, initiated in 2014, aims to elevate India to a global manufacturing hub by attracting foreign investments and enhancing domestic production capabilities.(Choudhury, 2020) This manufacturing focus is deemed essential for job creation, reducing import dependence, and increasing exports(Liu et al., 2019) . However, India faces significant challenges in achieving this objective, including infrastructural limitations, complex regulatory frameworks, and the necessity for workforce skill enhancement(Kimta& Dogra, 2024).

The conventional agricultural industry encounters numerous challenges:

1. Supply Chain Inefficiencies:

Supply chain inefficiencies in the agricultural sector include fragmented distribution systems, a dearth of adequate storage facilities leading to significant post-harvest losses, limited access to controlled frozen transport for perishable goods, and the involvement of numerous intermediaries, which reduces farmers' incomes. Furthermore, unreliable transportation infrastructure contributes to delays and product deterioration.

- Fragmented distribution systems
- Lacking of memory storage facilities directs to substantial post-harvest leftover(Tang, 2023)
- Controlledfrozen transport availability for agriculture products(Hasan & Habib, 2022)
- Severalthird party involvement causes to reducing the income of the farmers(Quintana et al., 2022)
- Unreliable transport infrastructure causes delays and product worn out(Park & Choi, 2014)

2. Traceability Concerns:

Traceability concerns within the agricultural sector include a lack of robust record-keeping practices and limited adoption of tracking technologies. This hinders the ability to trace the origin and quality of agricultural products, posing challenges in meeting global food safety and quality standards. Moreover, the lack of traceability increases the risk of food fraud and adulteration.

- Lack of record keeping practice or methods (Patel et al., 2023)
- Nil or minimal practice adopted in tracking technology (Ryan, 2017)
- Difficulties in tracing the agricultural product's quality and its origin(Aung & Chang, 2022)
- Challenges in attaining worldclass food safety and assuring the quality standards
- Escalated risk of food scam and adulteration(Oriekhoe, Ihemereze, et al., 2024)

3. Market Instability:

- Irregularproductcosts due to supply-demand differences(Schewe et al., 2017)
- Seasonal variations in production and usepatterns(Lagi et al., 2015)
- Change of global market movements on regionalcharges(Schewe et al., 2017)
- Limitedopen to marketplaceinfo for agronomists(Schewe et al., 2017)

- Unavailability of peripheral factors such as climate conditions and policy variations(Lagi et al., 2011)

These concernsinfluence the productivity, value, and sustainability of the conventional farming sector. Referring these challenges demands a versatile approach, in corporating scientific revolution, policy amendments, and advanced infrastructure.

Blockchain technology offers potential solutions to these challenges in the agri-based products sector(- et al., 2024) :

1. Supply Chain Efficiency(Pakseresht et al., 2022) :

The blockchain facilitates real-time product tracking from farm to customer, reducing delays and ineffectiveness (Adewusi et al., 2023). Smart-contracts can rationalize transactions, reducingmediators and escalates farmer revenues(Jaiswal et al., 2019) (Kumarathunga et al., 2022). Decentralized ledgers give transparency in recordadministration, improving storage and reduction in post-croplosses(- et al., 2024) .

2. Enhanced Traceability:

An immutable blockchain data ensuresgenuineness and source of agricultural goods(Margarida Cachada et al., 2022). Every supply chain stage can be recorded, generating a evident and provable product history(Jabade et al., 2023). This increasesfulfillment with food safety guidelines and decreases the risk of food scam(Panwar et al., 2023).

3. Market Stability:

The blockchain-based platforms can give real-time market information, enabling farmers with evidence for expanded decision-making(Kumarathunga et al., 2020). Smart contracts can enable direct farmer-consumer networks, lowering price instability caused by mediators(Kumarathunga et al., 2022). Tokenization of agronomicresources can enable new economic instruments, possiblybecome stable prices and easing market risks(Yang, 2024).

4. Quality Assurance:

An IoT devices combined with blockchain can supervise and recording environmental situations during transport and storage(Menon et al., 2021). This data, accumulated immutably on blockchain, can validatefaithfulness to quality standards and improve conditions for perishable things(Dange&Nitnaware, 2023).

5. Financial Inclusion:

The blockchain-based financial services can give farmers with enhancedapproach to credit and protection(Mhlanga, 2023). Cryptocurrency commerce can decrease costs associated with global payments and settlements(Chung et al., 2023).

6. Improved Logistics:(Duan et al., 2024)

The blockchain can optimize route arrangement and resource distribution in transportation(Oriekhoe et al., 2024). Smart contracts can automate payments and document processing, streamlining customs clearance for international shipments(P S & K V, 2021).

Blockchain technology has the promise to substantially transform agri-based production, enhancing efficiency, transparency, and profitability throughout the supply chain.

II. CONCLUSION

In conclusion, blockchain technology presents a transformative opportunity for India's agricultural sector, aligning with the "Make in India" initiative. By enhancing traceability, improving supply chain efficiency, and stabilizing markets, blockchain can increase farmer incomes, improve food safety, and boost agricultural exports. Leveraging blockchain technology can position India as a global leader in agri-tech solutions, driving economic growth and ensuring a sustainable and prosperous future for its farmers.

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