

TRANSPARENCY AND AUTHENTICITY OF MANGO SUPPLY CHAIN

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ABSTRACT – The mango industry faces challenges due to the perishability of fruits, seasonality, and high demand in processing and fresh fruit markets. To ensure product authenticity, tracing methods are crucial. This study examines the existing traceability system and authenticity while identifying logistics gaps in the mango supply chain. Research focused to develop a block chain-based method to enhance quality, safety authenticity and returns of mango value chain. Primary data collection comprised of environmental scanning, institutional analysis, and participatory approaches. 74 respondents mango value chain included into the sample. Qualitative tools and descriptive statistics were utilized to assess traceability. Results showed that export-oriented mango value chains, especially TJC mangoes, maintained safety, quality standards, and traceability. However, fresh mangoes for local markets and processing lacked similar measures. Poor postharvest management and contamination issues, notably with ripening agents, significantly impacted the safety and quality of the fruits. Exporters demonstrated tracing capabilities up to the collection agency level using stickers with quality information. Common logistics issues included limited awareness among value chain actors, poor communication between nodes, and information asymmetry were key barriers. This study underscores the need to improve traceability, safety, and quality standards in the mango supply chain. Implementing block chain technology could address these challenges and enhance efficiency, transparency, and trust throughout the industry, benefiting all stakeholders.

Keywords: Mango supply chain; Block chain; Logistics issues; Traceability

1. INTRODUCTION

Mango is grown in 29,229 ha of area with production of 529.5 million fruits in Sri Lanka [1]. Food traceability is a critical tool for ensuring food safety and quality. It allows for the tracking of food products through the supply chain, which can help to identify the source of food safety issues and reduce postharvest losses. [2]. Traceability using block chain technology ensures fruit quality and authenticity, protecting buyers. QR codes link e-certificates to packaging, enabling remote tracing of farm origin, batch numbers, processing data, soil quality, fertilizers, storage temperatures, and transportation details, enhancing transparency and trust in the food supply chain [3]. Mango producers in marginalized areas have limited access to high-quality fertilizer and pesticides, no control over quality, and less bargaining power with traders [4]. They also have a poor understanding of market prices and production inputs. Logistics management is involved with the receiving, handling, movement, storage, and delivery of commodities, services, and completed items in a supply chain management system. Logistics are required both at the start and at the end. The logistics of the food chain are critical components of the entire logistics system [5]. Traceability is essential for reducing postharvest losses and improving food safety in Sri Lanka. However, the feasibility of implementing traceability in the country's fruit supply chain is still being debated. Hence, there is a need to analyse or examine more closely the existing transparency system and authenticity and implementing a blockchain-based supply chain management system in Sri Lanka's mango industry is to address these significant challenges.

2. MATERIALS AND METHODS

The study was conducted in Jaffna, Anuradhapura, Dambulla, and Ratnapura, areas that are recognized as main mango production regions in Sri Lanka. Research approach was deductive, and the study was based on

primary data and data collection tools were interviewer administrated questionnaire, in-depth interviews with key informants and on-site observations to examine the existing logistics system and practices, as well as the issues within those systems. The sample size consisted of 75 mango supply chain actors, and the snowball sampling technique was instrumental in gathering the respondents.

3. RESULTS AND DISCUSSION

3.1. Present Status of the Mango Supply Chain with Reference to Authenticity and Transparency

Mango supply chain ended up in local market is weak in product authenticity and traceability system, making it impossible to trace the product back to producers point. However, exporters are able to trace their product up to the collection agent level since buyers who specialize in export business place a sticker with information such as quality details. Some collection agents classify mangos into A, B and C grades, bundling them in plastic boxes with tags. Some collectors also issue bills to farmers and maintain records in books. As a result, export-oriented mangoes were able to trace back to the collecting center level. Moreover, no established authenticity exists as the exporter dominates the channel and is solely responsible for updating all data in the system, leading to unavoidable fraud. The current degree of transparency and authenticity prevents Sri Lankan mango harvest from entering high-end markets. Consumers are unable to track the goods back to its origin. As a result, the ability to access high-end markets is limited.

3.2. Logistics Issues of Mango Supply Chain

The mango growers concur that they are uninformed ($\mu=3.473$) of the market pricing in other parts of the island, the prices of different collecting agents, and the export market prices. They also agree that there is no two-way information flow from one supply chain node to the next. The majority of actors ($\mu=3.676$) felt that there is no transparency in the mango supply chain. Farmers now have limited knowledge on market prices and production inputs, low quality control, fluctuating access to quality fertilizer and insecticide, and minimal negotiating power with traders due to a lack of transparency. The supply chain actors unanimously agreed ($\mu=4.730$) that there is a lack of information and understanding regarding mango supply and logistics, which has an impact on mango quality and market pricing. Mango harvest damage is widespread throughout the harvesting stage, storage, and transportation due to a lack of awareness development and information dissemination services.

Table 1. Mango growers logistics issues

	N	Minimum	Maximum	Mean	Std. Deviation
Awareness about market price	74	1.0	5.0	3.473	1.1846
power to bargain on the prices	74	2.0	4.0	2.892	.5120
Transparency on transport	74	2.0	5.0	3.676	1.0993
Consumer awareness on safety & quality	74	2.0	4.0	3.514	.8639
Gaps in Knowledge and information on safety & quality standards	74	4.0	5.0	4.730	.4471
Valid N (listwise)	74				

Note :5 strongly agree, 4 agree, 3 neutral, 2 disagree, 1 strongly disagree

3.3. Smart Supply Chain Model

The researchers suggest the possibility of developing a traceable, smart value chain model for the studied mango supply chain. This model would enable the tracking of the product up until the exporter by scanning the QR code. A decentralized system would distribute data management among supply chain participants, with producers, processors, and distributors updating information about mangoes, ensuring accuracy and accountability.



Figure 1. Fresh mango supply chain

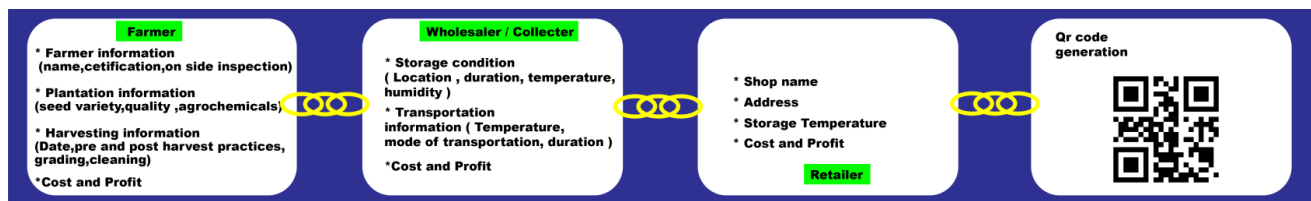


Figure 2. Basic concept of Mango block chain

4. CONCLUSION

Implementing blockchain technology in Sri Lanka’s mango supply chain addresses challenges like postharvest losses, poor market linkages, and limited access to quality inputs. The system enables real-time tracking, reducing losses and improving visibility. Accurate data sharing strengthens market linkages, while verifying input origin ensures access to high-quality inputs. The transparent blockchain enhances consumer trust by providing detailed product information. However, challenges like internet connectivity and stakeholder training need consideration. Embracing blockchain can revolutionize the mango industry, boosting efficiency, trust, and competitiveness, benefiting consumers and the economy.

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