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Exploring Digital Traceability in Tanzania's Coffee sub-sector: Understanding Smallholder Farmers' Awareness, Readiness, and Enabling Factors

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Introduction

Traceability and transparency in agricultural value chains are becoming increasingly crucial to ensure food safety, consumer trust, fair trade, and sustainability [1]. In the specialty coffee market, consumers and buyers are demanding more information about the origin, quality, and ethical practices behind coffee production [2]. Blockchain technology presents a promising solution to establish transparent, tamper-proof systems for tracking every stage of coffee production. However, while the potential benefits are clear, awareness and readiness for blockchain-based traceability remain limited among smallholder farmers in Tanzania. This study explores the level of awareness, readiness, and key enabling factors that could support the integration of blockchain traceability in Tanzania's coffee value chain.

Materials/Methods

A mixed-methods approach was employed to collect data from 180 smallholder coffee farmers and cooperative leaders in two coffee-growing regions: Mbinga and Siha districts. Quantitative data were gathered using structured questionnaires, including Likert-scale items to assess the awareness and readiness of farmers towards blockchain technology. These data were analysed using SPSS, with logistic regression used to identify significant factors influencing readiness and potential barriers to adoption. Qualitative data were collected through key informant interviews and focus group discussions, which were analysed thematically to provide a deeper understanding of farmers' perspectives, challenges, and perceived opportunities related to digital traceability.

Results/Discussion

The study found that only 15.6% of smallholder farmers were aware of blockchain traceability technology. The primary barriers to awareness and readiness included low digital literacy (68%), limited internet access (59%), and insufficient technical support (52%) **(Table below)**. Logistic regression results indicated that cooperative membership ($p = 0.02$), higher education levels ($p = 0.01$), and access to financial services ($p = 0.03$) were significant factors influencing farmers' readiness to engage with blockchain-based traceability. Qualitative data revealed that farmers who were members of cooperatives expressed more positive attitudes toward technology integration, while those in remote areas highlighted infrastructure challenges as major obstacles.

Table: Obstacles to digital traceability in Tanzania's coffee sub-sector

Theme	%	Quote
Low digital skills	68	"We dont own smart phones."
Poor internet	59	"No signal in our area."
No tech support	52	"No one assists us."
Weak power/infrastructure	45	"Power is unstable."
Prefer manual records	43	"Books are easier."
Language barrier	37	"Apps use English."
High device cost	33	"Phones are expensive."
Low awareness	16	"Never heard of it."

Conclusion/Perspectives

The findings suggest that while there is limited awareness of blockchain technology among Tanzanian coffee farmers, there is considerable potential for the adoption of digital traceability systems. For effective integration of blockchain traceability in Tanzania's coffee sub-sector, there is a need to implement interventions related to, enhancing digital literacy, improving rural internet access, and strengthening the provision of technical support.

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