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## Blockchain-enabled sustainability certification in coffee: Assessing opportunities and risks via expert consensus

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### Abstract

Small coffee producer organisations, cooperatives, and traders in the Global South face compounding pressures: volatile prices, persistent power asymmetries, and tightening regulatory demands such as the EU Deforestation Regulation (EUDR). Sustainability certification has long been promoted as a pathway to more equitable market participation, yet existing certification systems are frequently criticised for high costs, limited transparency, and inadequate benefit distribution to producers.

Blockchain-enabled sustainability certification (BESC) is increasingly being discussed as a means to address these structural deficiencies by enhancing traceability, reducing fraud risks, and strengthening accountability across agri-food value chains. However, empirical evidence on its practical value and, critically, on its implications for equity and smallholder inclusion, remains limited.

This Delphi study investigates the feasibility, stakeholder acceptance, economic, and social implications of blockchain for sustainability certification in the coffee value chain. A two-round qualitative Delphi study was conducted in 2025 with 12 experts representing exporters, roasters, certification bodies, technology providers, and sustainability researchers. Data were analysed by qualitative content analysis and quantitative measures.

Results indicate strong expert consensus that blockchain can enhance traceability, data integrity, and regulatory compliance, including under frameworks such as the EUDR. However, experts expressed limited confidence that blockchain will substantially reduce certification costs or replace third-party certification systems, viewing it instead as complementary within hybrid models.

Over the past decade, there have been several BC projects and Pilots in the coffee sector, but still, the empirical evidence is minimal. Insights from this study provide a deeper understanding of how blockchain can be successfully implemented in coffee sustainability certification. It further addresses challenges related to the proliferation of existing power imbalances and governance requirements.

The findings have direct implications for policymakers, development practitioners, and technology designers working on digital innovation in tropical agricultural value chains, and contribute to ongoing debates on how governance and institutional conditions shape whether digital tools serve as tools of empowerment or exclusion.

**Keywords:** Blockchain adoption, coffee value chain, sustainability certification, technology for sustainability

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