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Digitizing the Liberica Coffee Supply Chain Through the Liberchain Platform: Applying Science and Technology to Farmer Groups in Sambas Regency

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Abstract: *The Liberica coffee farmer group in Sambas Regency faces challenges in maintaining systematic production and financial records, as well as limited marketing networks. This community service program aimed to implement the Liberchain digital platform at the Batu Layar Sejahtera Farmer Group in Sendoyan Village and evaluate its acceptance among farmers. A participatory and problem-based approach was applied through needs analysis, system design and development, socialization, training, field assistance, and evaluation. The platform was developed to support digital production records, product information, and coffee supply chain management. Evaluation was conducted using a 23-item questionnaire with a five-point Likert scale. Twelve farmers completed the questionnaire; however, one respondent who had never used the application was excluded, resulting in 11 respondents in the final analysis. The overall acceptance score was 3.37 out of 5.00, indicating a neutral level of acceptance. Trust received the highest score (3.63), while ease of use received the lowest score (3.22). These findings indicate moderate initial acceptance and highlight the need to simplify the interface and provide continued assistance. The implementation of Liberchain provides a practical foundation for digitizing farmer group records and managing coffee supply chain information. Ongoing mentoring is essential to strengthen farmers' ability to use the platform and support its sustainable adoption.*

Introduction

Coffee is a vital commodity for smallholder farmers in Indonesia as a source of income. Issues arise not only in cultivation but also in record-keeping, quality, and information transparency throughout the supply chain. At a coffee cooperative in Wonosalam, simple traceability reports are handwritten directly on the packaging, leading to the development of a mobile phone-based traceability system with QR codes to facilitate management and reporting to customers (Karningsih et al., 2025). In the Gayo Highlands, the implementation of blockchain-based traceability among Arabica coffee farmers has reportedly yielded measurable economic benefits, but requires capacity building, investment in supporting infrastructure, and equitable governance (Sari, 2025).

Agricultural digitalization is also transforming how farmers acquire and manage knowledge (Ingram & Maye, 2020) and their involvement in e-commerce (Su et al., 2021).

Community service efforts within coffee farmer groups in Tawangmangu demonstrate that the adoption of post-harvest technology and digital marketing through websites, with a community-based empowerment approach, expands market access and suggests sustainable capacity building (Dewi et al., 2026). The digital literacy skills of local business actors are a particular concern in such efforts (Ollerenshaw et al., 2021).

Liberica coffee has long been cultivated by the people of Sambas Regency and grows in coastal peatlands. The Batu Layar Sejahtera Farmers Group in Sendoyan Village, Sejangkung District, manages approximately 30 hectares of Liberica plantations with approximately 32 members. They produce LIBERIKAQU brand coffee and sell it as fruit, green beans, and ground coffee. Interviews revealed that inventory records are still manual using books or basic spreadsheets, information on coffee origin is easily lost in the distribution chain, and marketing relies on social media, consignment sales at stalls, and a single primary buyer (Alfari et al., 2026). As a result, harvest yields, costs, and production costs are not monitored, resulting in unknown profit margins.

The success of such technologies depends on user acceptance. The technology acceptance model places perceived ease of use and usefulness as determinants of attitudes and intentions to use a system (Davis, 1989), which is then expanded to include social influences and cognitive processes (Venkatesh & Davis, 2000) and facilitating conditions (Venkatesh et al., 2003). In electronic transactions, trust has been shown to be as important as technological factors (Gefen et al., 2003; Pavlou, 2003). Trust is understood as the willingness to assume risk with another party based on an assessment of their ability, benevolence, and integrity (Mayer et al., 1995). This is relevant for platforms that manage farmer data and transactions.

Based on these issues, the Community Science and Technology Implementation scheme implemented the Liberika Smart-Hub platform, implemented as the Liberchain web application, in collaboration with the Batu Layar Sejahtera Farmers Group. Its objectives are threefold: to provide a production recording platform, a digital showcase, and product origin tracking; to introduce and assist farmers in using the application; and to measure farmer acceptance and trust in the application as a basis for improvement and sustainability.

Implementation Method

The community service was implemented using a participatory and problem-based approach that involved partners as subjects at every stage, from determining the recorded data to testing the application. This approach is in line with community-based empowerment that emphasizes partner involvement from planning to evaluation, such as in the coffee farmer group program in Tawangmangu (Dewi et al., 2026). The subject of the community service was the Batu Layar Sejahtera Farmer Group in Sendoyan Village, Sejangkung District, Sambas Regency (1°25′19″ N, 109°20′32″ E), with approximately 32 members.

The implementation consisted of five stages (Figure 1). First, needs analysis through structured interviews with group administrators, field observations, and system analysis using the PIECES framework (Performance, Information, Economics, Control, Efficiency, Service) (Alfari et al., 2026). Second, technology implementation in the form of system design using data flow diagrams (DFDs) and entity relationship diagrams (ERDs) and platform development. Third, socialization and training on application usage for group members. Fourth, field mentoring. Fifth, monitoring and evaluation using questionnaires. The team conducted five field visits on March 30, April 16, May 25, July 4, and August 6, 2026, and evaluations were conducted from October 27 to November 9, 2026.



Figure 1.The flow of community service implementation

Application acceptance was measured with a 23-item questionnaire across five dimensions: ease of use (5 items), usefulness (5), attitude and convenience (4), continued use intention (4), and trust (5), plus two open-ended questions about experiences and constraints. These dimensions followed the pattern of the technology acceptance and trust model outlined in the introduction. Responses were on a five-level Likert scale ranging from strongly disagree (1) to strongly agree (5) (Likert, 1932). The form was completed by farmers between October 27 and November 9, 2026. Results are reported with anonymous respondent codes.

Data were analyzed descriptively using the mean, standard deviation, and percentage of agree or strongly agree responses (scores 4 and 5). The mean was categorized into five equal intervals: 1.00–1.80 strongly disagree, 1.81–2.60 disagree, 2.61–3.40 neutral, 3.41–4.20 agree, and 4.21–5.00 strongly agree. Internal consistency was calculated using Cronbach's alpha (Tavakol & Dennick, 2011). Since there was no pre-test, no pre-test was performed. Data quality issues were explicitly addressed, and the stability of the results was tested using four scenarios.

Results and Discussion

A needs analysis revealed that the coffee supply recapitulation from dozens of members was done manually, making it prone to misrecording, easily losing information on coffee origin, and lacking restrictions on data modification authority (Alfari et al., 2026). These findings translated into a system with three external entities: admin, farmer, and buyer (Figure 2), as well as a database with 13 entities covering farmers, land, harvest, stock, fertilizer, fertilization schedule, base price, transactions, quality, and reports. Access rights are differentiated according to user role.

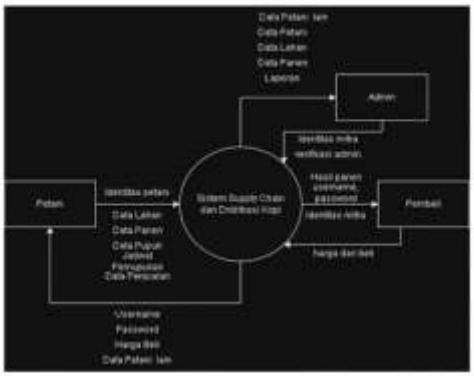


Figure 2. DFD context of coffee supply chain and distribution system

The design is implemented on the Liberchain platform, which is publicly accessible through https://liberchain.sbs. An inspection of the public page on October 3, 2026, revealed a homepage, a catalog of three products with prices and stock, a shopping cart, a network of five partners, and user registration and login. Land, harvest, and fertilizer recording features are behind a login and cannot yet be verified from the public page. A usage module was developed as support material, and documentation of the activity was uploaded to YouTube (https://youtu.be/L0OHL6R_XBM).

The socialization and demonstration of the application was conducted in the group meeting room. Members sat in a circle, the material was projected using a projector, and students assisted members in trying out the application using a laptop (Figure 3). Documentation shows that there were approximately 13 members, eight men and five women, or approximately 41% of the 32 registered members.



Figure 3.Delivery of material (left) and assistance in using the application (right)

The questionnaire was completed by 12 farmers, or 37.5% of registered members. Eleven respondents were aged 20–29, and one respondent was aged 40–49. Nine respondents had used the app for 1–3 months, and seven respondents used it several times per week. This age profile needs to be confirmed, as documentation of the socialization program shows participants with a wider age range.

The data could not be analyzed as is. One respondent stated they had never used the app and was therefore excluded from the analysis. There were 15 duplicate answers to one item (five respondents) and two blank items that were not counted. Four respondents gave consistent answers to all valid items, and they were still analyzed but tested in a sensitivity scenario. Therefore, the main analysis used 11 respondents and 236 valid answers.

The overall average acceptance score was 3.37 out of 5.00 (neutral), with 51.7% agreeing or strongly agreeing (Table 1). Trust scored the highest (3.63; agree), followed by usefulness (3.41), attitude and convenience (3.36), continued use intention (3.26), and ease of use (3.22). Only trust crossed the agree category line, and usefulness fell just below it.

Table 1.Application acceptance scores per dimension (n = 11)

Dimensions	Item	Valid answer	Average (1–5)	% S + SS	Category
Ease of use	5	54	3.22	44.4%	Neutral
Usefulness	5	49	3.41	57.1%	Neutral
Attitude and comfort	4	42	3.36	50.0%	Neutral
Intention of further use	4	43	3.26	39.5%	Neutral
Trust	5	48	3.63	66.7%	Agree
Overall	23	236	**3.37**	51.7%	**Neutral**

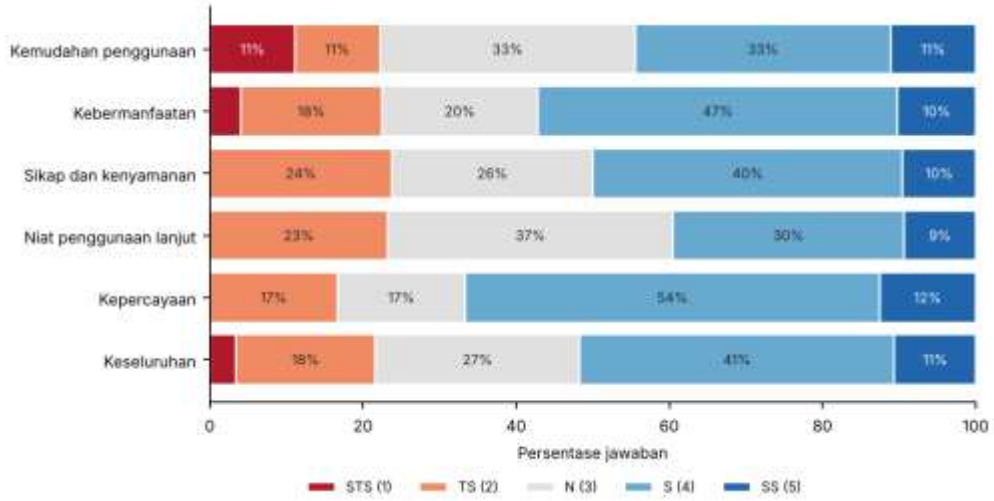


Figure 4.Distribution of answers per dimension (n = 11)

The highest-scoring statements were trust in the app as a fair transaction intermediary (3.80) and honest transaction manager (3.67). The lowest scores were easy-to-understand interface (3.00) and willingness to use the app for all transactions (3.18). Scores per item can be requested from the author.

Table 2 shows the overall score ranges from 3.29–3.39 in the four data handling scenarios so that the neutral category does not change. When respondents with uniform answers were excluded, trust remained highest (3.71) while ease of use dropped to 3.06. Cronbach's alpha per dimension ranged from 0.92–0.99 in the main analysis and 0.72–0.98 after respondents with uniform answers were excluded (5–6 respondents). Very high values may suggest repeated items and, with a number of respondents this small, are only indicative (Tavakol & Dennick, 2011).

Table 2.Sensitivity test for data handling

Scenario	n	Total	Easy	Purpose	Attitude	Intention	Believe
A. All respondents; duplicate answers are not counted.	12	3.39	3.29	3.41	3.35	3.26	3.64
B. Main analysis (without R8)	11	3.37	3.22	3.41	3.36	3.26	3.63
C. Without R8 and respondents answered uniformly	7	3.29	3.06	3.33	3.26	3.11	3.71
D. Without R8; multiple answers are averaged	11	3.38	3.25	3.40	3.35	3.26	3.63

Description: Total = average of all items; Easy = ease of use; Usefulness = usefulness; Attitude = attitude and comfort; Intention = intention to continue use; Trust = trust.

Open-ended responses complement the picture. Five respondents considered information and transactions easier and clearer, for example, "It's easy to find prices and clear sales details." Eight of the twelve respondents reported no issues. One respondent noted the interface was less understandable and suggested a simpler interface, and one respondent described the application as "a bit choppy."

The results indicate moderate initial acceptance, not strong acceptance. Neutral scores and only about half agreeing suggest that farmers recognize the benefits of the application but are not yet fully comfortable using it. This pattern aligns with the technology acceptance model: the lowest ease of use (3.22) appears alongside neutral continued use intentions (3.26) (Davis, 1989; Venkatesh & Davis, 2000). Statistical relationships between the dimensions were not tested because there were too few respondents, so the relationships are conjectural.

The highest level of trust, particularly in the fairness of the intermediary and the honesty of the manager, is consistent with findings that trust is as important as technological factors in electronic transactions (Gefen et al., 2003; Pavlou, 2003) and with the view that trust rests on the integrity of the trusted party (Mayer et al., 1995). A plausible explanation is that the platform is managed directly by the group so that farmers know the manager, but this explanation has not been tested.

Low usability scores point to digital literacy barriers, which were also an early issue in the

program (Ollerenshaw et al., 2021), and to interface simplification. The development of a coffee traceability system at a cooperative in Wonosalam used a user-centered design approach and tested satisfaction with the System Usability Scale (Karningsih et al., 2025). A similar approach, testing interface prototypes with farmers before launch, could be applied to Liberchain's refinement phase.

The community service program in Tawangmangu reported expanding market access and increasing income through technology adoption and digital marketing (Dewi et al., 2026), while this community service program has only reported user acceptance. The impact on income, margins, and market access has not been measured. Research in Gayo also indicates that the economic benefits of traceability technology require ongoing capacity building, supporting infrastructure, and equitable governance (Sari, 2025). These findings support follow-up plans in the form of continued mentoring, data management by group administrators, and interface improvements.

The expected social changes, such as the emergence of data managers among farmers and the practice of record-keeping, are only early indications. During the documentation, group members tested the application directly and discussed it with student mentors. New institutions or local leaders have not been observed, and QR code-based traceability on packaging has not been confirmed.

The results should be read with caution. There were only 12 respondents, there was no pre-test or comparison group, there were multiple, blank, and uniform responses, and the age profile of respondents needs to be confirmed. Therefore, the results cannot be generalized to all group members, and increased farmer capacity cannot be statistically proven. Future evaluations should utilize pre- and post-tests, maintain a neat attendance list, and have a facilitator explain that each item must be answered with only one answer.

Conclusion and Suggestions

The Liberchain platform was successfully developed and implemented by the Batu Layar Sejahtera Farmers Group as part of an effort to digitize the Liberica coffee supply chain. Farmer acceptance was neutral (score 3.37 out of 5.00), with the highest trust (3.63) and the lowest ease of use (3.22), and these categories were stable across the four data handling methods. Theoretically, these results confirm that trust and ease of use need to be managed together in implementing technology for smallholder farmers.

Suggestions: Simplify the interface and test it with farmers; register all members and appoint a permanent data manager; continue mentoring with pre- and post-test evaluations; measure the impact on revenue, margins, and customer visits; and verify the QR code-based traceability feature on packaging.

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