

IMPROVING EFFICIENCY AND COORDINATION IN RICE PRODUCTION: EVIDENCE FROM MULUR VILLAGE

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ABSTRACT

This research explores the application of a Management Information System (MIS) aimed at improving coordination, efficiency, and transparency in the Mulur rice production network situated in Sukoharjo, Central Java. Utilizing a descriptive qualitative methodology paired with quantitative analysis, the study engaged 15 participants, comprising farmers, cooperatives, mill operators, and distributors. The MIS encompasses modules for land management, harvest forecasting, inventory management, and distribution to support data-driven decision-making and traceability within the supply chain. Quantitative findings reveal a high level of user satisfaction (mean = 4.23), with particular strengths in usability (4.35) and data precision (4.29). Qualitative insights indicate enhanced workflow alignment, quicker information sharing, and improved coordination among stakeholders. Nonetheless, challenges remain, including inconsistent connectivity, insufficient training, and partial system integration. Stakeholders pointed out the necessity for mobile accessibility, ongoing capacity development, and improved infrastructure.

INTRODUCTION

Management Information Systems (MIS) have become a fundamental foundation for improving organizational efficiency, coordination, and strategic decision-making (Hamdat et al., 2024; Massaty et al., 2025). MIS functions as an integrated framework that collects, processes, and disseminates critical data to support managerial control and adaptability to dynamic environments (Biswas et al., 2024; Kusumawardani & Massaty, 2025). Advanced MIS platforms such as Enterprise Resource Planning (ERP) and Decision Support Systems (DSS) enable seamless integration of business functions including logistics, finance, inventory, and human resources, thus enhancing

transparency, productivity, and competitiveness (Epin Andrian et al., 2024). This study examines the growing phenomenon of MIS adoption within the agricultural sector, where the digital transformation of management processes remains limited compared to industrial and commercial domains.

In agriculture, particularly in rice cultivation, the application of Management Information Systems (MIS) has demonstrated significant potential to transform traditional farming into data-driven management systems (Cai et al., 2024). Empirical studies have shown that integrated data coordination and real-time system usage accelerate decision-making and optimize resource allocation (Al-Atawi, 2024). Similarly, research in Indonesia revealed that web-based rice inventory systems employing the First-In-First-Out (FIFO) method reduce stock errors and enhance distribution efficiency (Aswari et al., 2024; Rahayu et al., 2025). However, most prior studies focus on industrial-scale or government-supported systems, leaving a research gap regarding the contextual implementation of MIS for smallholder and community-based agribusinesses. This gap represents not only a theoretical challenge in applying MIS models to localized agricultural ecosystems but also an empirical and methodological need for frameworks tailored to the operational realities of rural economies. The conceptual relationship among these components is illustrated in Figure 1, which outlines how the proposed Management Information System integrates key agricultural processes to improve coordination, efficiency, and decision-making across the Mulur rice production ecosystem.

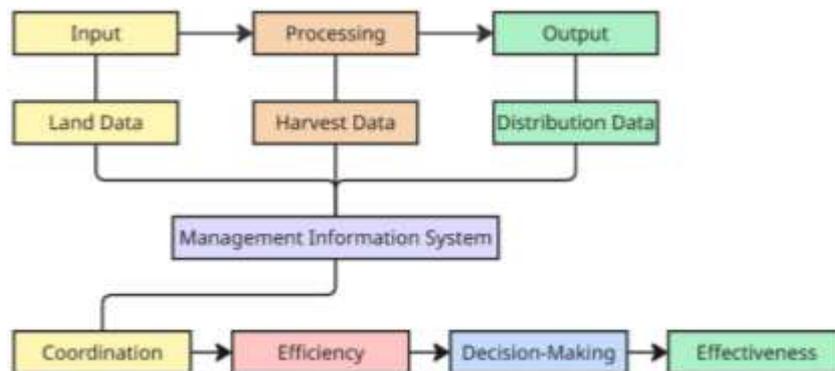


Figure 1. Conceptual Framework of MIS Role in Mulur Rice Production System

Sukoharjo Regency, particularly Desa Mulur, represents a significant agricultural area known for its high-quality Beras Mulur rice. Despite strong production capacity, coordination across farming, milling, and distribution processes remains fragmented, limiting transparency and operational optimization. Addressing this gap, the present study aims to develop a contextual MIS model integrating data on land usage, harvest prediction, inventory, quality monitoring, and real-time reporting. The model seeks to enhance coordination among farmers, cooperatives, and local distributors while improving efficiency and traceability (Anggraeni et al., 2022) across the Beras Mulur supply chain.

Theoretically, this study contributes to the development of MIS models adapted to

agrarian contexts by bridging the conceptual framework of organizational information systems with the practical realities of small-scale agricultural management. Empirically, it provides evidence of MIS potential in improving operational performance and data governance in local food production systems. Methodologically, it offers a framework for integrating participatory approaches into system design to ensure contextual relevance. Overall, this research contributes to advancing knowledge on MIS implementation in agriculture and supports sustainable digital transformation that empowers rural economies through data-driven management and technological inclusivity.

LITERATURE REVIEW

Management Information System (MIS) and Organizational Effectiveness

Management Information System (MIS) is a coordinated structure that collects, processes, stores, and disseminates information to support decision-making and managerial functions within an organization (Olorunlana, 2024). MIS enhances organizational effectiveness by enabling better planning, monitoring, and control of operations (Tarannum & Hossain, 2024). Through integrated modules such as accounting, human resources, and logistics, MIS reduces redundancy, improves information flow, and facilitates real-time decision-making (Hassan et al., 2024). In industrial and service sectors, the implementation of MIS has been associated with increased operational efficiency, transparency, and responsiveness to market dynamics.

MIS in the Agricultural Sector

The adoption of MIS in agriculture has grown alongside the digital transformation of farming practices (Khanna, 2021). Studies in Japan indicate that data-driven management systems can optimize irrigation, fertilizer use, and harvest scheduling, leading to higher yields and cost efficiency (Ogawa et al., 2021). In developing countries, however, the adoption rate remains low due to infrastructural limitations and digital literacy challenges (James, 2021). Research in Indonesia by Aswari et al. demonstrated that web-based rice inventory systems using the First-In-First-Out (FIFO) method significantly reduced stock discrepancies and improved distribution accuracy (Aswari et al., 2024). Similarly, integrating MIS with cooperative management systems enhanced coordination between farmers and local distributors (Rustam et al., 2025). Despite these advances, MIS implementation in small-scale agribusinesses still lacks contextual adaptation and community participation in design and operation.

Critical synthesis and limitations of previous studies. Despite reported benefits, prior MIS studies in agriculture show several limitations. First, many systems are designed to optimize single functions (e.g., irrigation scheduling or inventory control) and therefore provide limited evidence on end-to-end coordination across land management, harvest forecasting, inventory, and distribution. Second, much of the literature emphasizes adoption or technical performance while giving less attention to multi-actor coordination mechanisms (how farmers, cooperatives, mills, and distributors share data, validate records, and resolve inconsistencies). Third, evidence from rural and smallholder settings often highlights barriers (infrastructure, connectivity, and digital literacy), but these factors are not consistently integrated into system design and

evaluation, resulting in solutions that are difficult to sustain and scale. These gaps indicate the need for MIS research that evaluates coordination and transparency outcomes in community-based agricultural ecosystems.

Research Gap and Conceptual Framework

Previous research has predominantly focused on large-scale agricultural systems with strong technological infrastructure, while community-level applications remain underexplored (Chanda et al., 2025; Olarewaju et al., 2025).. Moreover, existing studies frequently examine isolated MIS functions or adoption factors, with limited analysis of how integrated modules support coordination and transparency among multiple actors in rural supply chains. The present study addresses these limitations by examining an MIS implementation in Mulur Village that integrates land management, harvest prediction, inventory tracking, quality monitoring, and reporting within a single platform. The framework (Table 1) therefore positions information integration as a mechanism to improve coordination, efficiency, and decision-making across farmers, cooperatives, mills, and distributors.

Table 1. Conceptual Framework of MIS Implementation in Mulur Rice Production Ecosystem

System Component	Information Processed	Purpose / Function	Expected Outcome
Land Management	Land area, soil type, crop rotation schedule	Support planting decisions and optimize land use	Efficient resource allocation and planning
Harvest Prediction	Weather data, growth stage monitoring, yield estimation	Forecast production volume and harvest timing	Improved accuracy in planning and logistics
Inventory Management	Stock levels, storage capacity, product quality	Track rice flow from milling to distribution	Reduced stock errors and optimized storage
Quality Monitoring	Moisture level, grain size, contamination reports	Maintain product consistency and food safety	Enhanced quality control and consumer trust
Real-Time Reporting	Integrated data from all components	Enable data-driven coordination and quick response	Transparency, traceability, and operational efficiency

Comparative Analysis of MIS Implementation Across Sectors

While MIS has been widely implemented in industrial and governmental sectors, its adoption in community-based agriculture remains limited (Hassoun et al., 2023). Industrial sectors often utilize comprehensive Enterprise Resource Planning (ERP) and Decision Support Systems (DSS) that integrate all business functions, enabling effective resource management and data-driven strategies. (Giua et al., 2021) Government sectors have also adopted MIS for monitoring agricultural production, subsidies, and food distribution, though implementation often faces bureaucratic constraints (Ye & Deng, 2021).

In contrast, small-scale or community-based agricultural systems such as Beras

Mulur in Sukoharjo face different challenges, including limited funding, infrastructure, and technical expertise (Rakotomalala & Cao, 2019). These differences highlight the necessity of a contextualized MIS framework that is adaptable, affordable, and user-friendly for rural environments. Table 2 summarizes the comparison of MIS adoption across sectors, emphasizing the research gap that this study seeks to address.

Table 2. Comparison of MIS Implementation Across Sectors

Sector	Adoption Level	Main Functions	Challenges in Implementation
Industrial / Commercial	High	ERP, DSS, supply chain, finance, logistics, HR integration	High cost, complexity in integration, training needs
Government Agricultural Programs	Moderate	Monitoring production, distribution tracking, subsidy management	Bureaucratic processes, limited system flexibility
Community-Based Agriculture (e.g., Mulur Rice)	Low	Inventory control, land data recording, cooperative coordination	Limited infrastructure, digital literacy gaps, funding constraints

RESEARCH METHOD

Research Design

This study employs a descriptive qualitative design (Stanley, 2023) supported by limited quantitative data to analyze the role of the Management Information System (MIS) in improving operational effectiveness within the Mulur rice production ecosystem. The research focuses on exploring how MIS can enhance coordination, efficiency, and transparency in various production stages from farming and milling to distribution and reporting. The study aims to develop and validate a contextual MIS model that integrates key information components such as land management, harvest prediction, inventory, quality control, and real-time reporting. The qualitative approach was selected to capture authentic field conditions, user experiences, and contextual challenges of MIS adoption in a rural agricultural environment, ensuring that the proposed model aligns with local operational realities.

Research Location and Participants

The research was conducted in Desa Mulur, located in Sukoharjo Regency, Central Java, Indonesia. The area is recognized for its high-quality *Beras Mulur* rice, which represents an important agricultural commodity in the region. Despite its production potential, the management of farming, milling, and distribution activities remains fragmented. This condition makes Desa Mulur an ideal context for analyzing the implementation of a Management Information System (MIS) aimed at improving coordination, operational transparency, and data-driven decision-making.

The study involved multiple stakeholders directly engaged in the rice production and distribution processes. Participants were selected using purposive sampling to ensure the inclusion of individuals with relevant roles in the supply chain. The research involved 10 farmers responsible for land management and cultivation, 2 rice milling operators, 1 cooperative representative, and 2 local distributors overseeing product logistics and sales.

This diverse group of participants provided comprehensive insights into the existing challenges and opportunities for MIS adoption in community-based agricultural management.

Data Collection Techniques

Data collection employed both qualitative (Barker & Pistrang, 2021) and quantitative (Ghanad, 2023) instruments to obtain comprehensive insights into the functionality and user perception of the Management Information System (MIS) in Desa Mulur. The qualitative data were gathered through semi-structured interviews with key stakeholders including farmers, cooperative staff, and system administrators, while the quantitative data were collected via a structured questionnaire distributed to 15 respondents representing the main user groups.

The questionnaire consisted of five main dimensions related to MIS performance and impact, measured using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The dimensions, indicators, and objectives are presented in Table 3. The questionnaire instrument was developed based on the USE Questionnaire and other established usability instruments (Farah et al., 2022).

Table 3. Questionnaire Dimensions, Items and Number of Items

Dimension	Items
System Usability	<ol style="list-style-type: none"> 1. The menu structure of the MIS is easy to understand. 2. I can complete my tasks in the system without assistance. 3. The system responds quickly when I input data.
Data Accuracy	<ol style="list-style-type: none"> 1. The data provided by the system (land usage, harvest prediction, inventory) is reliable. 2. I rarely find errors in the system's reports. 3. The system updates in a timely manner.
Efficiency Improvement	<ol style="list-style-type: none"> 1. Since using the system, I spend less time coordinating between farmers, millers and distributors. 2. The system reduces redundant data entry. 3. Decision-making is faster with system support.
Information Integration	<ol style="list-style-type: none"> 1. Data from land use, harvest, inventory and quality modules are well-integrated. 2. I can trace a rice product from field to distributor via the system. 3. The system allows me to access relevant data from different modules in one interface.
User Engagement	<ol style="list-style-type: none"> 1. I frequently use the system in my daily work. 2. I am motivated to learn new features of the system. 3. I actively provide feedback to improve the system.

Validity and reliability of the questionnaire. To strengthen measurement rigor, the questionnaire was developed through an adaptation process based on the USE Questionnaire and related usability scales, ensuring alignment with the MIS context in Desa Mulur. First, content validity was ensured by mapping each item to the study constructs (system usability, data accuracy, efficiency improvement, information integration, and user engagement) and reviewing the items for clarity and relevance to the rice-production workflow. Second, face validity was addressed through a small pilot check with representative users to confirm that the wording, response options, and examples were understandable for respondents with diverse digital literacy levels; minor

revisions were made to improve readability and contextual fit. Where necessary, item–total correlations were reviewed to identify items that reduced consistency, and wording was refined to improve coherence. Given the relatively small number of respondents (n = 15), the reliability statistics are interpreted cautiously as preliminary evidence and are complemented by qualitative triangulation from interviews.

In addition to the quantitative survey, qualitative data were collected through semi-structured interviews designed to capture deeper insights into user experiences, perceptions, and contextual challenges in implementing the Management Information System (MIS) within the Mulur rice production ecosystem. The qualitative approach allows researchers to explore how system users including farmers, mill operators, cooperative staff, and distributors interpret, the usefulness, integration, and sustainability of the MIS in their daily operations. This method provides contextual depth and complements quantitative findings by uncovering behavioral, technical, and organizational factors influencing system adoption and effectiveness. The interview guide was structured around six key dimensions: system usage, perceived benefits, challenges, integration, engagement, and future improvement, as summarized in **Table 5**. Meanwhile, the questionnaire items were adapted from previous research on system usability and user experience instruments to ensure validity and contextual relevance (Kendall et al., 2022).

Table 5. Semi-Structured Interview Guide for Qualitative Data Collection

Dimension	Questions	Purpose
System Usage Context	1. How do you currently use the MIS in your daily activities? 2. How did you first learn and adapt to the MIS?	To identify user routines and familiarity with the system.
Perceived Benefits and Effectiveness	3. What are the main advantages of using the MIS in coordinating rice production activities? 4. How has the MIS improved decision-making or data transparency?	To explore perceived usefulness and operational impact.
Challenges and Limitations	5. What difficulties do you face when using the MIS? 6. What factors contribute to these challenges?	To understand barriers and pain points in implementation.
Integration and Workflow Alignment	7. How well does the MIS integrate data across land use, harvest, inventory, and distribution? 8. What areas require better synchronization?	To assess data linkage and interoperability between modules.
User Engagement and Sustainability	9. How do you participate in training or feedback related to the MIS? 10. What motivates or hinders continuous use?	To evaluate user commitment and sustainability of adoption.
Future Improvement and Innovation	11. What system improvements would you recommend? 12. How do you envision the MIS supporting future agricultural development in Desa Mulur?	To gather suggestions for enhancement and policy implications.

RESEARCH RESULTS AND DISCUSSION

Overview of MIS Implementation in Desa Mulur

The Management Information System (MIS) currently implemented in Desa Mulur

functions as a centralized digital platform designed to support coordination among farmers, milling units, and cooperatives within the Beras Mulur rice production ecosystem. The system provides several core modules, including land data management, harvest prediction, inventory monitoring, and quality control. Each module operates through a web-based interface that enables real-time data input and reporting. However, field observations and interviews revealed that while the MIS successfully digitizes essential operational data, its integration across user levels remains partial. Farmers, for instance, often depend on intermediaries such as cooperative officers for data entry, limiting the flow of information and reducing the system's responsiveness. Figure 2 presents the existing Management Information System (MIS) used in Desa Mulur, showing its interface and overall layout as currently implemented.



Figure 2. The existing MIS interface in Desa Mulur

Moreover, discrepancies in digital literacy and infrastructure readiness continue to challenge system optimization. Many smallholder farmers lack stable internet connectivity or adequate devices to access the MIS independently. As a result, data updates are often delayed, leading to inconsistencies between recorded and actual field conditions. Despite these challenges, the MIS represents a significant step toward digital transformation in Mulur's agricultural management system.

User Perception and System Performance

The quantitative analysis was conducted to evaluate user perceptions and the overall performance of the existing Management Information System (MIS) in Desa Mulur. Responses from 15 participants were collected using a structured questionnaire based on a 5-point Likert scale. The results reveal that user satisfaction with the system was generally high, with the average overall score reaching 4.23 (Very Good). The indicators of ease of use (mean = 4.35) and information accuracy (mean = 4.29) received the highest ratings, suggesting that the system's interface and data reliability meet user expectations. Meanwhile, system response time (mean = 3.97) and data integration (mean = 4.01) scored slightly lower, indicating potential areas for improvement in technical performance.

As presented in Table 6, the indicators ease of use and information accuracy recorded the highest mean scores, reflecting that users find the system intuitive and

reliable in providing relevant data. However, the system response time and data integration indicators received relatively lower ratings, suggesting the need for technical optimization, particularly in improving data synchronization and server response speed. Despite these minor issues, the MIS is considered a vital tool that enhances operational coordination and data-driven planning across the rice production ecosystem in Desa Mulur.

Table 6. User Perception of MIS Performance in Desa Mulur

Indicator	Mean	Category	Interpretation
Ease of Use	4.35	Very Good	The system is user-friendly and easy to navigate.
Information Accuracy	4.29	Very Good	Information presented is reliable and consistent.
Data Integration	4.01	Good	Integration between modules and users works adequately.
System Response Time	3.97	Good	The system performs well but could improve in data retrieval.
Overall User Satisfaction	4.23	Very Good	Users are generally satisfied with the MIS performance.

Further statistical analysis using descriptive mean interpretation shows that 82.8% of respondents agreed that the MIS had significantly simplified administrative workflows, particularly in managing rice production records and monitoring distribution data. However, 17.2% of users expressed minor concerns regarding data synchronization delays between user devices and the main server. Despite these limitations, the system was perceived as a reliable and efficient tool supporting decision-making at the village level. These findings highlight that while the MIS in Desa Mulur demonstrates strong usability and functionality, future enhancements could focus on optimizing database response speed and strengthening real-time data processing to improve performance consistency.

Operational and Behavioral Implications

The qualitative findings offer an in-depth understanding of how the Management Information System (MIS) has influenced the operational, behavioral, and collaborative aspects of rice production management in Desa Mulur. Using semi-structured interviews and open-ended questionnaires with 15 respondents including farmers, cooperative administrators, and local officials the study identified six major dimensions reflecting user experiences and perceptions: System Usage Context, Perceived Benefits and Effectiveness, Challenges and Limitations, Integration and Workflow Alignment, User Engagement and Sustainability, and Future Improvement and Innovation.

Overall, users perceived the MIS as a transformative tool that improved workflow coordination, accuracy of records, and communication among key stakeholders. However, persistent challenges such as unstable connectivity, lack of advanced training, and limited integration between modules underscore the need for ongoing technical and human-capacity support. The following table presents the summarized themes, core findings, and representative quotes that illustrate user experiences within each dimension. To provide a clearer understanding of the qualitative findings, Table 7 summarizes the

six thematic dimensions explored in this study along with their corresponding key insights and selected respondent quotes that exemplify real-world user experiences within the Desa Mulur MIS environment.

Table 7. Summary of Qualitative Results Based on Thematic Dimensions

Dimension	Key Findings	Illustrative Quotes from Respondents
System Usage Context	Users engage with the MIS daily for data input, reporting, and checking inventory. Initial adaptation required guidance, but routine use improved digital literacy.	“At first, I needed help from the cooperative team to use the system, but now I can record harvest data independently.” <i>(Respondent 3 - Farmer)</i> “I usually log in every morning to check the inventory and make sure all data from the field has been updated.” <i>(Respondent 8 - Cooperative Staff)</i>
Perceived Benefits and Effectiveness	The MIS facilitates faster decision-making, improves coordination, and enhances transparency across the production chain.	“With this system, we can see stock and distribution in real time; it makes coordination much easier.” <i>(Respondent 6 - Cooperative Officer)</i> “Before MIS, reports were delayed for days. Now, we can analyze and respond the same day.” <i>(Respondent 11 - Village Secretary)</i>
Challenges and Limitations	Users experience obstacles related to unstable internet connections, limited system knowledge, and inconsistent data updates.	“Sometimes the internet is too slow, especially during harvest season, which delays data uploads.” <i>(Respondent 4 - Farmer)</i> “Some members still struggle to use the reporting features because they’re not familiar with computers.” <i>(Respondent 10 - Cooperative Member)</i>
Integration and Workflow Alignment	MIS modules for land, harvest, inventory, and distribution are linked, but data synchronization delays still occur.	“Inventory data is integrated, but the update sometimes takes a few hours before appearing on other modules.” <i>(Respondent 5 - Data Clerk)</i> “We need better connection between harvest and stock reports so that distributors can plan faster.” <i>(Respondent 9 - Distributor Representative)</i>
User Engagement and Sustainability	Most users joined initial MIS training but indicated limited follow-up sessions. Regular workshops and feedback mechanisms are needed to sustain participation.	“After the first training, there hasn’t been another one. We need refreshers to learn about updates.” <i>(Respondent 12 - Farmer Group Leader)</i> “We’re motivated to use it because it saves time, but more support would help us use it fully.” <i>(Respondent 14 - Cooperative Officer)</i>
Future Improvement and Innovation	Respondents suggested developing mobile access, notifications, and integration with digital finance or logistics tools.	“If the system can be accessed via mobile, it will help us check data directly from the field.” <i>(Respondent 2 - Farmer)</i> “It would be great if the system could connect with digital payments to simplify transactions.” <i>(Respondent 15 - Cooperative Treasurer)</i>

The results demonstrate that while the MIS has achieved operational and managerial impact, its long-term sustainability depends on the alignment of technical infrastructure, user readiness, and participatory system maintenance. Users expressed optimism about expanding MIS functionalities toward mobile accessibility and data-driven innovation, indicating a growing digital culture within Desa Mulur’s agricultural community. These findings reinforce that MIS adoption is not solely a technological

intervention, but a socio-technical transformation that empowers local actors to manage agricultural processes with greater accuracy, collaboration, and accountability.

Policy and Practical Implications

The findings suggest that rural MIS implementation is not only a technical project but also a governance and service-delivery agenda. First, local government and agricultural extension institutions should treat connectivity and access as enabling infrastructure for agricultural management. Users reported unstable internet and delayed uploads, especially during peak periods. Therefore, support can include strengthening village-level network coverage, providing shared access points (e.g., cooperative-based Wi-Fi), and facilitating affordable devices for farmer groups. Second, institutional arrangements should formalize data governance within the cooperative ecosystem. Because some farmers still rely on cooperative staff for data entry and updates, roles and responsibilities (data entry, verification, approval, and reporting) should be standardized through simple SOPs to reduce inconsistencies and ensure accountability. Third, capacity building should be positioned as a continuous program rather than a one-time intervention. Respondents noted limited follow-up training after initial sessions indicating a need for periodic refresher training, a “train-the-trainer” approach within farmer groups, and a local support mechanism (helpdesk/technical focal person) to sustain adoption.

Practically, the MIS should be strengthened in ways that directly address the operational barriers identified in the field. First, mobile accessibility is a high-priority enhancement because farmers emphasized the need to access and update data directly from the field. A mobile-friendly interface (or progressive web app) with simplified input forms can reduce dependency on intermediaries and improve timeliness of updates. Second, the system should incorporate technical features that improve reliability in low-connectivity contexts, such as offline data capture with later synchronization, lightweight data upload, and clear confirmation logs to reduce uncertainty during slow network conditions. Third, module integration should be improved to reduce synchronization delays and support faster distribution planning. This can be supported by implementing shared master data (e.g., farmer ID, plot ID, batch/lot ID), automated validation rules (missing values, duplicated records), and dashboard alerts when upstream data (harvest/stock) has not been updated within an agreed timeframe.

For sustainability, the cooperative and village stakeholders can adopt simple monitoring indicators to track MIS performance over time (e.g., percentage of records updated within 24 hours, number of data corrections, average response time, and completeness of traceability from field to distributor). This aligns with user feedback that the system is valuable but still needs ongoing support and refinement. Additionally, users’ suggestions for integration with digital payments indicate a pathway for incremental innovation: integration can be phased in after stabilizing core modules, ensuring that system expansion does not increase complexity beyond users’ capacity.

CONCLUSION

This study demonstrates that the Management Information System (MIS) implemented in Desa Mulur significantly enhances operational efficiency, coordination,

and data transparency across the rice production chain. The integration of digital modules for land management, harvest prediction, inventory, and distribution supports faster decision-making and improves traceability among farmers, cooperatives, and distributors. Quantitative findings indicate strong user perceptions regarding system reliability and usefulness, while qualitative insights reveal improved workflow synchronization and collaborative data sharing as critical enablers of operational effectiveness.

However, several constraints continue to limit the system's optimal performance, including unstable internet connectivity, limited user training, and partial module integration. These challenges highlight the necessity for sustained technical support, structured digital literacy programs, and infrastructure enhancement to ensure long-term system resilience. Overall, the Desa Mulur case confirms that contextualized MIS implementation can drive digital transformation in rural agricultural management, provided it is complemented by participatory design, capacity building, and institutional commitment to continuous system evolution.

Future research directions. Future studies should extend this work through longitudinal evaluations across multiple harvest seasons to measure MIS impact using operational indicators such as timeliness of data updates, stock and distribution lead time, reporting accuracy, and completeness of traceability, especially given the synchronization and connectivity delays identified in this setting. Comparative research across multiple villages or cooperatives is also needed to test the generalizability of these findings and to identify the governance and infrastructure conditions that support successful scaling. In addition, future research should test targeted system improvements, particularly mobile access and low-connectivity functionality such as offline input with later synchronization, because users emphasized the need for mobile accessibility and stronger infrastructure support. Further work can examine whether deeper module integration and linkage with digital payment or logistics tools improves coordination and transparency outcomes, reflecting user suggestions for finance integration. Finally, researchers should evaluate capacity-building and sustainability strategies, such as periodic refresher training, train-the-trainer models, and local administrative support, to understand how institutional commitment and user competence affect sustained MIS use.

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