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Empowering Local Food Industries through Decision Support System (DSS): A Strategic Model for Sustainable MSME Development in Rural Indonesia

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ABSTRACT

Background: Micro, Small, and Medium Enterprises (MSMEs) play a crucial role in driving local economic resilience and community empowerment in developing countries. However, traditional agro-based industries often face structural challenges such as weak management systems, limited access to technology, and unstructured financial documentation. The Home Industry *Pia Tape Syam* in Jember, Indonesia, exemplifies these constraints, operating within a competitive environment that demands digital adaptation and sustainable growth strategies. Integrating a Decision Support System (DSS) offers a transformative opportunity to improve managerial decision-making and enhance enterprise performance.

Aims: This study aims to analyze the business feasibility and development strategies of *Pia Tape Syam* using the DSS-UMKM version 2.0 model to support sustainable and data-driven decision-making for rural agro-industries.

Methods: A mixed-method approach combining qualitative and quantitative analyses was employed. Primary data were collected through structured interviews and financial documentation, followed by DSS-based computation assessing both non-financial (legal, marketing, production, management, and environmental) and financial aspects, including NPV, IRR, BCR, and Payback Period.

Results: Findings reveal that environmental and production aspects achieved high feasibility scores, while legal and marketing factors require significant improvement. Financially, the enterprise demonstrated strong viability with an NPV of IDR 246,807,083.26, IRR of 48.72%, and a BCR of 1.75. These results confirm that the DSS approach effectively enhances strategic evaluation and investment decision accuracy in small-scale food industries.

Conclusion: The study concludes that integrating DSS into rural MSMEs can significantly strengthen operational efficiency, financial sustainability, and adaptive capacity in a dynamic market environment. Beyond its economic benefits, DSS implementation fosters data literacy and managerial accountability, bridging the gap between traditional entrepreneurship and digital transformation. Hence, the DSS framework serves as a scalable model for empowering local food industries and advancing inclusive rural development across emerging economies.

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INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) serve as the foundation of inclusive economic development, particularly in rural and semi-urban communities where formal industries remain limited. In Indonesia, MSMEs contribute significantly to employment creation and local income distribution but are constrained by low digital literacy and weak managerial systems. The agro-based sector, especially food processing industries like Pia Tape Syam in Jember, reflects these challenges, where traditional production methods often coexist with inefficient financial and operational management. As sustainability becomes central to economic discourse, digital decision-making tools have emerged as key enablers for improving competitiveness and resilience in small enterprises. Integrating Decision Support Systems (DSS) aligns with the broader agenda of sustainable entrepreneurship that links innovation with social and environmental responsibility (Ge et al., 2024; Mutanov et al., 2023). Thus, this study situates the transformation of local food industries within the digital transition framework essential for rural empowerment.

The urgency of this research arises from the persistent performance gap among rural MSMEs that rely heavily on manual decision-making without structured analytical tools. Many home industries fail to translate their local resource advantages into scalable and sustainable enterprises due to the absence of strategic digital frameworks (Böttcher et al., 2024; Tim et al., 2021). In regions like Jember, where agriculture-based innovation has high potential, the lack of technological adaptation has created barriers to achieving economic resilience. A DSS-based model offers a systematic approach for data-driven planning, financial forecasting, and sustainability assessment. By combining computational modeling with qualitative judgment, DSS supports managers in choosing the most feasible growth strategies (Gadhave et al., 2025; Wei, 2025). The integration of such systems within MSMEs is therefore not merely technological but developmental in purpose.

Furthermore, sustainable rural development depends on the empowerment of community-based enterprises through innovation, learning, and digital inclusion. As sustainable entrepreneurship grows into a global paradigm (Esteves et al., 2021; Purnomo & Purwandari, 2025), empowering MSMEs through DSS can enhance productivity while aligning with environmental stewardship. The concept underscores the balance between profitability and sustainability, where digital intelligence enables ethical resource use and social value creation. Empirical evidence across developing economies shows that decision intelligence strengthens entrepreneurial performance, innovation adoption, and resilience under uncertainty (Keskin et al., 2025; Nobari et al., 2022). Consequently, this study addresses how DSS can serve as a strategic enabler for MSME competitiveness in rural Indonesia, contributing to both theoretical advancement and practical policy design.

This research is motivated by the need to bridge the gap between traditional microenterprise management and contemporary digital transformation frameworks. The use of DSS in rural MSMEs remains underexplored despite its potential to enhance strategic decisions, particularly in the agro-food sector that demands efficiency and sustainability. By analyzing Pia Tape Syam as a representative case, the study aims to illustrate how localized adoption of DSS can support innovation, optimize resource utilization, and promote sustainable entrepreneurship. The rationale also lies in expanding the literature on digital empowerment within community-level enterprises, where DSS is not only a technological tool but also a catalyst for inclusive growth. This aligns with global goals of sustainable development that emphasize innovation-driven social transformation (Omri & Almoshaigeh, 2025; Zada et al., 2025). Thus, the study contributes to knowledge by linking DSS modeling to the practical challenges and opportunities of MSME development in rural Indonesia.

Decision Support Systems have evolved into critical frameworks for improving managerial decision quality, particularly in uncertain and data-intensive environments. Mondal et al, (2024) emphasized that advanced DSS models integrating global information management enhance sustainable decision-making. Bickley et al., (2025) explored how artificial intelligence and big data transform sustainable entrepreneurship by facilitating real-time analysis and prediction. Ferreira & Ferreira, (2025) developed a multi-criteria approach to assess sustainability practices among SMEs, demonstrating how DSS helps identify causal relationships between internal initiatives. Shao et al., (2024) proposed a four-dimensional model of sustainable rural entrepreneurship—entrepreneur, economy, society, and environment—that provides a holistic foundation for evaluating MSME sustainability. Chowdhury et al., (2025) argued that AI-driven DSS frameworks foster resource orchestration and green servitization in small enterprises, illustrating the link between digitalization and environmental performance. These studies collectively highlight DSS as a strategic enabler of efficiency and sustainability within entrepreneurship ecosystems.

Complementary perspectives emerge from research connecting DSS with community and rural entrepreneurship. Niu, (2025) demonstrated that LSTM-based decision systems in smart rural contexts improve entrepreneurial path planning and adaptive learning. Mushtaq & Goswami, (2025) analyzed how agricultural extension services influence farm-based entrepreneurship and found that digital tools enhance decision precision and income stability. Mondal et al., (2024) identified enablers and barriers of community entrepreneurship ventures using a mixed-method DSS approach, emphasizing its social

implications. Wan Ali & Ali Othman, (2025) explored home-based business lifecycles, revealing that digital decision models empower women entrepreneurs to sustain operations through informed choices. Proença & Soukiazis, (2023) examined the process of sustainable entrepreneurship across countries, concluding that integrating data intelligence fosters long-term competitiveness. Together, these studies form the empirical and conceptual foundation supporting the integration of DSS into rural MSME development in Indonesia.

Despite extensive research on DSS and sustainable entrepreneurship, few studies focus on the intersection of digital decision systems and community-based food industries in rural Southeast Asia. Prior works have primarily addressed high-tech or manufacturing SMEs, overlooking traditional agro-industries where digital transformation remains minimal. Moreover, existing DSS models are often designed for large-scale operations, lacking contextual sensitivity to microenterprises with informal organizational structures Misra et al., (2025). There is also a scarcity of empirical evidence on how DSS influences long-term sustainability dimensions—economic, environmental, and social—within local food industries. Therefore, this study fills the gap by operationalizing DSS as a participatory decision-making framework tailored to rural MSMEs. By applying the DSS-UMKM version 2.0, the research contributes a practical model grounded in the realities of Indonesia's local entrepreneurship landscape.

The primary purpose of this study is to evaluate the effectiveness of integrating a Decision Support System in enhancing the business feasibility and sustainability of rural food MSMEs. It hypothesizes that the application of DSS significantly improves non-financial and financial performance indicators by providing structured data analytics for decision-making. The study also posits that DSS implementation contributes to managerial empowerment, operational efficiency, and competitive advantage through informed strategic planning. Furthermore, it aims to establish a replicable model that can guide other rural enterprises in adopting digital decision frameworks for sustainable development. The hypothesis aligns with the broader goal of advancing inclusive innovation and community-based entrepreneurship in emerging economies. Ultimately, the study anticipates that digital decision tools will not only strengthen business outcomes but also reinforce the socio-economic resilience of rural communities across Indonesia.

METHOD

Research Design

This study employed a mixed-method research design that integrated quantitative DSS-based financial modeling with qualitative participatory evaluation to analyze the business feasibility and strategic empowerment of rural food MSMEs. The design aimed to assess how the integration of a Decision Support System (DSS) enhances managerial decision quality, operational efficiency, and sustainability performance. The mixed approach was chosen to capture both objective and contextual dimensions of decision-making in community-based enterprises (Mondal et al., 2024; Phukrongpet et al., 2022). Quantitative data were processed through the DSS-UMKM version 2.0, while qualitative data were gathered through interviews, focus group discussions, and direct observation of production, management, and marketing processes.

To visualize the methodological framework, Figure 1 illustrates the sequential stages of research, consisting of data collection, DSS modeling, feasibility assessment, and validation.

Figure 1. Research Framework of DSS-based MSME Empowerment Study

This structured framework ensures the reliability of findings and strengthens the empirical foundation for MSME empowerment through digital transformation. It also aligns with participatory innovation models in sustainable entrepreneurship research (Huang & Zhou, 2025).

Participant

The participants consisted of one local food MSME—the Pia Tape Syam home industry in Jember Regency—serving as a representative case of community-based agroindustry. The selection followed purposive sampling to ensure that the case reflected the realities of rural food enterprises undergoing digital transition. The participants included the owner, production workers, marketing agents, and administrative staff, totaling 12 respondents. Additional input was obtained from local cooperative officers and entrepreneurship mentors affiliated with the Politeknik Negeri Jember incubator program. This inclusion enriched the contextual analysis by integrating managerial, social, and institutional perspectives (Shao et al., 2024).

A summary of participant characteristics is presented in Table 1, showing demographic and professional profiles relevant to MSME digital readiness and empowerment potential.

Table 1. Participant Characteristics

Category	Description	Frequency
Ownership status	Business owner	1
Gender distribution	8 female, 4 male	12
Education level	Secondary (7), Diploma (3), Bachelor (2)	12
Role in enterprise	Production (5), Marketing (3), Finance (2), Administration (2)	12
Years of business operation	5–15 years	

These participants represent micro-scale business actors with diverse responsibilities, offering multidimensional insights into how DSS can support daily operations and long-term sustainability planning.

Instrument

The research employed a Decision Support System (DSS-UMKM version 2.0) as the main analytical instrument, which integrates both financial and non-financial assessment modules. The DSS was customized to accommodate five non-financial dimensions—legal, management, production, marketing, and environmental—and four financial indicators: Net Present Value (NPV), Internal Rate of Return (IRR), Benefit-Cost Ratio (BCR), and Payback Period (PP).

The DSS system was developed using Microsoft Excel-based computational modeling with visual dashboards and automated decision rules. Field data were collected using structured questionnaires and semi-structured interview guides aligned with sustainability assessment frameworks (Bickley et al., 2025). The questionnaire measured key indicators such as production efficiency, environmental compliance, digital literacy, and innovation capacity.

To ensure reliability and validity, instrument testing was conducted through triangulation between DSS results, expert judgment, and respondent feedback. This multi-layered validation was consistent with participatory decision support methodologies used in sustainable entrepreneurship studies (Chowdhury et al., 2025).

Data Analysis Plan

Data analysis followed two main stages: quantitative feasibility modeling and qualitative interpretive analysis. Quantitative analysis utilized DSS computation results to determine the financial feasibility of the MSME. Parameters included NPV, IRR, BCR, and PP, which were benchmarked against industry standards and policy thresholds from Indonesia's Ministry of Cooperatives and MSMEs. The model used a discount rate of 10%, assuming standard inflation and market risk conditions. Table 2 summarizes the key DSS-generated indicators for the Pia Tape Syam enterprise.

Table 2. Financial Feasibility Indicators from DSS Analysis

Indicator	Formula	DSS Result	Feasibility Interpretation
NPV	∑(Bt–Ct)/(1+i)^t	IDR 246,807,083.26	Financially feasible
IRR	r where NPV=0	48.72%	Strong return rate
BCR	∑Bt / ∑Ct	1.75	Profitable
PP	Investment / Annual Net Cash Flow	2.7 years	Fast payback

These results were triangulated with qualitative insights gathered from in-depth interviews regarding business challenges, innovation perception, and sustainability awareness. The integration of both analyses enabled the study to formulate an empowerment model combining financial performance with social and environmental dimensions (Proença and Soukiazis, 2023).

The qualitative component employed thematic analysis to identify recurring patterns related to digital transformation readiness, managerial adaptation, and local innovation capability. Coding and categorization were carried out manually, cross-validated by two independent experts to ensure analytical consistency. The merged dataset was then interpreted using a convergent parallel design, integrating numerical DSS findings with narrative-based managerial insights (Ferreira and Ferreira, 2025).

Additional Methodological Considerations

To enhance robustness, this study incorporated sensitivity analysis and scenario testing within the DSS model. Sensitivity analysis simulated changes in key input variables such as raw material prices, labor costs, and market demand fluctuations to assess the resilience of the enterprise's financial outcomes (Huang & Zhou, 2025). Scenario testing included three operational conditions—baseline, moderate growth, and expansion—to evaluate DSS adaptability under different business environments.

Moreover, the research framework adhered to ethical research protocols, ensuring informed consent, confidentiality, and fair representation of participants. The participatory nature of the study provided a sense of ownership among local entrepreneurs, fostering empowerment beyond data collection. The design thus aligns with the ethos of sustainable community development and responsible innovation (Shao et al., 2024).

Results and Discussion

Results

The DSS-based analysis produced quantitative and qualitative insights into the sustainability and financial feasibility of the Pia Tape Syam enterprise. The overall non-financial assessment revealed that production and environmental aspects achieved the highest scores, indicating strong operational stability and environmental awareness. Conversely, legal compliance and marketing dimensions scored lower, suggesting the need for capacity-building programs and digital marketing support. Financially, the DSS output confirmed the enterprise's viability, with an NPV of IDR 246,807,083.26, IRR of 48.72%, BCR of 1.75, and Payback Period of 2.7 years, all surpassing the minimum investment standards for small-scale agroindustries in Indonesia.

Figure 2 below visualizes the comparative performance of the five non-financial dimensions assessed through DSS, highlighting managerial and environmental strengths as key competitive assets.

Figure 2. Non-Financial Feasibility Scores of Pia Tape Syam

The DSS simulation also demonstrated that sensitivity to input cost fluctuations remained stable up to a 15% increase in raw material prices before feasibility margins began to decline. This resilience reflects the enterprise's efficient cost structure and adaptive production process. Additionally, scenario testing under moderate growth conditions showed a potential NPV increase of 22%, indicating that digital interventions and improved marketing could further strengthen profitability. These findings validate the

DSS framework's ability to integrate economic, social, and environmental indicators, providing a comprehensive decision-making foundation for sustainable MSME development (Ferreira and Ferreira, 2025).

Discussion

The findings reveal that integrating a Decision Support System (DSS) into rural MSME operations offers tangible improvements in both financial and non-financial performance. The high IRR and NPV values indicate not only business feasibility but also strategic potential for scaling up operations in rural agroindustries. DSS implementation allowed the enterprise to transition from intuitive decision-making to data-driven management, enhancing operational precision and investment confidence (Huang & Zhou, 2025). This transition aligns with global shifts toward digital empowerment in small enterprises where decision automation supports adaptive planning and sustainability (Bickley et al., 2025). By providing real-time insights, the DSS facilitated transparent decision processes that strengthen accountability within microenterprises, consistent with principles of sustainable entrepreneurship (Proença and Soukiazis, 2023).

In addition to economic outcomes, DSS adoption significantly influenced social empowerment within the enterprise. Employees reported improved understanding of business metrics and higher confidence in production and marketing decisions, illustrating the democratization of digital literacy at the community level (Shao et al., 2024). Such empowerment contributes to the inclusive innovation model where technology serves as both a learning and growth enabler (Mondal et al., 2024). The participatory element of this research, involving local actors in data interpretation and validation, aligns with the bottom-up empowerment framework advocated in sustainable entrepreneurship studies (Niu, 2025). Hence, the DSS operates not merely as a computational tool but as a catalyst for transforming social behavior within MSME ecosystems.

Environmentally, the DSS framework facilitated the identification of cost-effective strategies for waste reduction and energy optimization in production processes. This digital monitoring capability enhances the sustainability profile of local food industries, aligning with the circular economy paradigm (Chowdhury et al., 2025). The environmental feasibility score of 87% reflects conscious efforts to integrate eco-friendly practices, reinforcing the concept that digital intelligence can support both profitability and ecological responsibility. Similar patterns were reported by Fleck-Baustian et al., (2025), who found that green-oriented entrepreneurship thrives when supported by data systems that translate sustainability metrics into actionable strategies. The Pia Tape Syam case thus exemplifies how localized digitalization strengthens the interconnection between sustainability, efficiency, and rural economic resilience.

At the managerial level, DSS implementation improved the accuracy of production planning, cost allocation, and marketing decisions. Through data visualization and predictive modeling, managers gained a clearer understanding of performance drivers, enabling evidence-based prioritization (Bickley et al., 2025). The ability to simulate financial outcomes under various conditions empowered MSME leaders to assess risks and optimize investment timing, a capability traditionally absent in small enterprises. This finding corroborates Ferreira and Ferreira (2025), who observed that multi-criteria DSS enhances causal decision-making in SMEs by integrating financial and behavioral indicators. Ultimately, the system reduced uncertainty in strategic planning and provided a structured pathway for sustainable business scaling.

From a community development perspective, the DSS model represents a replicable approach to empowering local entrepreneurs through accessible digital innovation. The findings confirm that DSS can be adapted to small-scale enterprises without extensive infrastructure, aligning with rural digital inclusion objectives (Wan Ali and Othman, 2025). The system's participatory design fosters ownership, encouraging entrepreneurs to view data as a strategic resource rather than a bureaucratic burden. Such transformation aligns with sustainable rural entrepreneurship models where knowledge sharing and technology adoption co-evolve to produce long-term social impact (Mushtaq and Goswami, 2025). In

essence, DSS-driven empowerment bridges the gap between traditional craftsmanship and modern analytics, redefining the role of local MSMEs in Indonesia's inclusive digital economy.

Implications

The study provides both theoretical and practical implications for sustainable MSME development. Theoretically, it reinforces the argument that DSS represents a key enabler of entrepreneurial resilience by merging computational intelligence with participatory empowerment frameworks. Practically, the DSS-UMKM model offers policymakers a scalable approach for designing digital training and support programs tailored to microenterprises. It also demonstrates that data-driven empowerment can strengthen the autonomy of rural entrepreneurs while aligning with Sustainable Development Goals (SDG 8 and SDG 9). Furthermore, educational institutions and local incubators can adopt similar DSS tools for entrepreneurship mentoring, linking academic research with real-world social impact (Ferreira and Ferreira, 2025). Thus, this study contributes to redefining MSME empowerment from a purely economic endeavor to a digital-ecological transformation process.

Limitations

Despite its significant contributions, this study is constrained by certain limitations. The case study approach, focusing on a single MSME, restricts the generalizability of findings across broader industry contexts. The DSS model used was adapted to a specific enterprise and may require recalibration for different business types or regions. Additionally, the absence of longitudinal data limits the ability to assess the long-term effects of DSS adoption on enterprise resilience. Resource constraints also restricted the integration of advanced predictive analytics such as machine learning algorithms that could enhance the accuracy of forecasts (Gupta and Panigrahi, 2023). Future research should expand the scope to include comparative multi-case analysis and time-series validation to strengthen external validity.

Suggestions

Future studies should explore multi-enterprise DSS implementation across various rural sectors to test scalability and cross-sector adaptability. Researchers may also incorporate AI-based learning modules to enhance DSS responsiveness to dynamic market conditions (Bickley et al., 2025). Policymakers should collaborate with academic institutions to create open-access DSS platforms for rural entrepreneurs, ensuring technology democratization. From an educational standpoint, integrating DSS training into entrepreneurship curricula can foster a new generation of data-literate entrepreneurs. Furthermore, sustainability metrics such as carbon footprint, waste efficiency, and social capital should be embedded within DSS models to support holistic community empowerment (Shao et al., 2024). These directions will strengthen the alignment between digital transformation and sustainable development in the rural MSME ecosystem.

CONCLUSION

This study concludes that integrating a Decision Support System (DSS) into the management of rural food MSMEs significantly strengthens both operational and strategic dimensions of enterprise sustainability. The DSS framework enables local entrepreneurs to transition from intuition-based to data-driven decision-making, fostering financial accountability, process efficiency, and environmental responsibility. The findings demonstrate that DSS implementation leads to measurable improvements in financial feasibility, as evidenced by a high NPV, IRR, and BCR, coupled with a short payback period. Beyond economic performance, the system promotes managerial learning, participatory empowerment, and digital literacy, thereby transforming traditional home industries into adaptive, innovation-oriented enterprises.

Furthermore, the DSS-UMKM model contributes to the broader discourse of sustainable entrepreneurship by aligning micro-level business practices with macro-level development goals such as inclusive growth and environmental stewardship. The Pia Tape Syam case exemplifies how technology integration can serve as a catalyst for community empowerment, bridging the digital divide and enabling

equitable participation in the modern economy. The results affirm that digital transformation in MSMEs is not solely about technological adoption but about cultivating a culture of informed decision-making and continuous learning within rural communities. Thus, the DSS framework represents a scalable and replicable model for policymakers, educators, and development practitioners aiming to empower local industries through responsible and sustainable digital innovation.

Overall, this study positions DSS as a strategic instrument for achieving the dual objectives of profitability and sustainability in the context of rural entrepreneurship. It underscores the necessity for institutional collaboration among government agencies, academia, and local enterprises to expand DSS implementation across sectors. By doing so, it redefines MSME empowerment as a multidimensional process that integrates technology, knowledge, and community participation into a cohesive model of sustainable economic transformation.

AUTHOR CONTRIBUTIONS STATEMENT

Viona Rahmadhani Dynasti led the conception of the study, designed the methodological framework, and carried out the field data collection and DSS-based analysis. Paramita Andini contributed to refining the theoretical foundation, supervised the analytical procedures, and ensured the coherence of the manuscript with international publication standards. Haji Shaban Maligisa provided critical insights during the interpretation of findings, offered comparative perspectives from international community-based entrepreneurship studies, and enhanced the discussion to strengthen its global relevance. All authors jointly reviewed, revised, and approved the final manuscript, agreeing to be accountable for the accuracy, originality, and integrity of the entire scholarly work.

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