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Transforming rural MSMEs through digital governance, legalization, and financial inclusion: evidence from Indonesia

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ABSTRACT

Purpose: to analyze the effectiveness of an integrated intervention model in strengthening rural MSME governance through business formalization, digital financial management adoption, and financial inclusion enhancement.
Method: this study used a participatory action research (PAR) approach, employing observation, mentoring, and pre-test–post-test evaluation to assess the impact of business legalization assistance, digital financial management training, and financial literacy programs on the transformation of rural MSMEs.
Findings: the intervention significantly improved MSME governance capacity, digital financial management practices, and formal financing readiness. Participants demonstrated increased compliance with business legalization, improved financial recording capabilities, and a greater understanding of digital tools and formal financing mechanisms. The findings indicate that an integrated approach combining legal formalization, digital transformation, and financial inclusion can strengthen the sustainability and competitiveness of rural MSMEs.
Implications: rural MSME development programs should integrate business formalization, digital financial governance, and financial literacy support to enhance institutional capacity, sustainability, and access to formal economic opportunities.
Originality: lies in developing an integrated rural MSME transformation model that simultaneously combines business legalization, digital financial governance, and financial inclusion support through a participatory mentoring approach.

Introduction

Micro, small, and medium enterprises (MSMEs) constitute one of the most important drivers of economic development in emerging economies, particularly in rural areas where they generate employment opportunities, stimulate local entrepreneurship, and strengthen household income resilience (Dasaraju & Tambunan, 2023; Tadeo et al., 2023; Tshikovhi et al., 2023). Beyond their economic contribution, MSMEs play a strategic role in reducing regional inequality and promoting inclusive growth by mobilizing local resources and supporting community-based production systems (Harsono et al., 2025; Noch & Rumasukun, 2024; Visiana, 2025). Nevertheless, the increasing number of rural MSMEs has not always been accompanied by improvements in business governance, institutional capacity, or financial management (Purnomo & Purwandari, 2025). Many rural enterprises continue to operate informally, relying on traditional business practices, weak administrative systems, limited adoption of digital technologies, and a lack of formal business registration (Rampaul, 2025). Consequently, these conditions reduce business competitiveness, limit market expansion, and weaken the long-term sustainability of rural MSMEs in an increasingly digitalized economy (Hermansyah et al., 2025; Rujitoningtyas et al., 2025).

Despite numerous government initiatives to promote MSME development, rural entrepreneurs continue to face persistent structural and behavioral barriers that constrain business formalization and financial inclusion. A significant proportion of micro-business owners still operate without a business identification number, lack proper financial records, and frequently mix household and business finances, resulting in poor financial transparency and weak managerial decision-making (Harianto & Andayani, 2025; Makatita, 2024). Furthermore, access to formal financial institutions remains limited because many entrepreneurs perceive banking procedures as excessively complicated and believe that formal credit is intended only for large businesses possessing substantial collateral (Ackah et al., 2024; Irene et al., 2025; Widyastuti et al., 2023). Such psychological barriers are reinforced by low financial literacy, inadequate understanding of digital bookkeeping systems, and limited awareness of government-supported financing programs such as government-subsidized credit. These interconnected challenges create a cycle in which informality, weak governance, and financial exclusion mutually reinforce one another, thereby restricting business growth and resilience.

Previous studies have consistently demonstrated that financial literacy, digital financial management, business legalization, and technology adoption positively influence MSME performance, financial accountability, and access to external financing (Choiruddin et al., 2025; Muslim, 2026; Nugraheni et al., 2025; Pranitasari et al., 2026; Tandilino et al., 2025). Other scholars have emphasized the importance of ownership of business identification numbers through the online single submission risk-based approach (OSS-RBA) system in improving legal certainty and market access (Koeswahyono et al., 2022; Setiawan, 2025; Yenny & Simbolon, 2025). Nevertheless, the existing literature predominantly examines these determinants independently, focusing either on digital financial literacy, business legalization, or financial inclusion as separate constructs. Empirical evidence integrating digital governance, business legalization, and financial inclusion within a single analytical framework, particularly in the context of rural MSMEs undergoing participatory community-based transformation, remains limited. Furthermore, previous research has paid insufficient attention to psychological barriers, administrative stigma, and behavioral factors that influence entrepreneurs' willingness to formalize their businesses and engage with formal financial institutions. Addressing this gap, the present study proposes an integrated perspective that combines digital governance, business legalization, and financial inclusion as complementary dimensions of rural MSME transformation, thereby extending existing literature on sustainable MSME development.

Accordingly, this study aims to examine how an integrated intervention consisting of digital financial governance, business legalization assistance, and financial inclusion initiatives contributes to strengthening the sustainability of rural MSMEs in Kedungotok village, Tembelang district, Jombang regency, Indonesia. Specifically, the research seeks to identify the principal obstacles faced by MSME owners in adopting digital bookkeeping, obtaining business legality through business identification number registration, and accessing formal financial services. In addition, the study evaluates the effectiveness of participatory mentoring in enhancing financial management capabilities, increasing legal compliance, reducing psychological barriers toward formal banking institutions, and encouraging the adoption of transparent and accountable business practices. Through this comprehensive approach, the research intends to provide empirical evidence regarding the mechanisms through which governance transformation can improve MSME competitiveness and resilience.

The importance of this research lies in its potential to enrich the theoretical and practical understanding of integrated MSME transformation in rural contexts. Theoretically, the study contributes to the literature by proposing a multidimensional framework that links digital governance, business legalization, and financial inclusion as interconnected determinants of MSME sustainability, moving beyond fragmented approaches commonly found in previous studies. Practically, the findings are expected to provide evidence-based recommendations for policymakers, local governments, financial institutions, and community empowerment practitioners in designing more effective MSME development programs. By demonstrating how participatory assistance can simultaneously strengthen governance capacity, legal compliance, and financial inclusion, this study is expected to support the development of more competitive, transparent, accountable, and sustainable rural MSMEs while contributing to broader regional economic development and inclusive growth.

Literature review

Institutional theory

Institutional theory serves as the primary theoretical foundation of this study by explaining that organizational behavior and long-term sustainability are largely influenced by the institutional environment, including formal regulations, normative expectations, and socially accepted practices. The theory argues that organizations gain legitimacy, improve credibility, and enhance access to valuable resources when they align their governance structures and operational activities with institutional requirements. (Kauppi, 2022) In the context of rural MSMEs, business legalization through the acquisition of a business identification number, the adoption of digital financial governance, and participation in formal financial systems represent institutional responses to regulatory and market pressures (Rahayu et al., 2023). Conversely, the persistence of informal business operations, weak financial governance, and limited access to formal financing reflects institutional constraints caused by low financial literacy, insufficient knowledge of legal procedures, and psychological barriers toward formal institutions. Therefore, institutional theory provides a comprehensive framework for explaining how digital governance, business legalization, and financial inclusion collectively facilitate the transformation of rural MSMEs into legitimate, transparent, accountable, and sustainable business entities capable of improving their competitiveness and long-term performance (Nahar & Alam, 2026).

Business sustainability theory and formal legality

Business sustainability theory emphasizes that long-term organizational sustainability depends not only on economic performance but also on firms' ability to establish legitimacy, comply with regulatory requirements, and adapt to institutional changes (Mamash et al., 2025). In the context of rural MSMEs, formal business legality is a fundamental prerequisite for sustainable business development by providing legal certainty, reducing operational risks, and strengthening organizational credibility (M. Hidayat et al., 2026). The acquisition of a business identification number through the online single submission system is more than regulatory compliance; it serves as a strategic governance mechanism that enables MSMEs to formalize their operations, strengthen legal protection, and enhance stakeholder confidence. Formal business status also increases opportunities to access government support programs, formal financial institutions, wider market networks, and strategic partnerships with larger enterprises (Saifurrahman & Kassim, 2024). Conversely, MSMEs operating without legal recognition remain within the informal sector, where they face greater legal uncertainty, limited access to financing, restricted participation in public procurement, and weaker bargaining power in competitive markets (Guliwe & Bulelwa, 2023). Therefore, business formalization through the issuance of a business identification number constitutes a critical institutional transformation that shifts MSMEs from informal economic actors into legally recognized business entities, thereby strengthening their resilience, competitiveness, and long-term sustainability (A. A. Hidayat et al., 2025).

Digitalization of financial management and financial literacy

The digitalization of financial management, supported by adequate financial literacy, represents a critical driver of sustainable MSME development by improving financial transparency, accountability, and managerial decision-making (Choiruddin et al., 2025). The transition from manual bookkeeping to digital accounting applications enables business owners to record financial transactions systematically, generate real-time financial reports, and clearly distinguish business finances from personal household expenditures (Kuntoro, 2025). This separation enhances the accuracy and reliability of financial information, which is essential for evaluating business performance and maintaining effective internal governance (Auliyah & Agit, 2024). Moreover, transparent digital financial records enhance the credibility of MSMEs in the eyes of formal financial institutions, thereby facilitating access to external financing, including government-subsidized credit programs. Conversely, limited financial literacy and the absence of structured financial records often lead entrepreneurs to misinterpret cash inflows as business profits, creating distorted financial perceptions that may result in poor investment decisions, inefficient cash flow management, and an increased risk of business failure. By integrating digital bookkeeping with financial literacy, MSMEs are better equipped to produce accurate profit and loss statements, balance sheets, and cash flow reports, enabling evidence-based managerial decisions, minimizing financial leakage, and strengthening business resilience and long-term sustainability.

Access to formal financing and bankability

Access to formal financing and bankability are fundamental components of MSME sustainability, as they reflect a business's credibility, transparency, and governance quality (Siame & Chisenga, 2025). Bankability extends beyond the ability to obtain credit; it reflects MSMEs' capacity to demonstrate sound financial management through reliable financial records, regulatory compliance, and transparent business operations. The consistent use of digital bookkeeping systems enables entrepreneurs to maintain accurate financial records by systematically documenting cash flows, revenues, expenses, and business performance (Chimucheka et al., 2025). This transparency reduces information asymmetry between MSMEs and formal financial institutions, allowing banks to assess creditworthiness and repayment capacity more effectively, particularly under government-supported financing schemes such as government-subsidized credit. In addition, proper financial documentation strengthens tax accountability by ensuring that fiscal obligations are accurately recorded and reported, thereby enhancing business legitimacy and increasing the confidence of financial institutions, investors, and other stakeholders (Abed et al., 2022). Consequently, bankability and tax compliance should not be perceived merely as administrative obligations but as strategic assets that improve organizational credibility, expand access to formal financing, strengthen market competitiveness, and support the long-term sustainability of rural MSMEs.

Method

This study employed a participatory action research (PAR) approach combined with community-based action learning to examine and facilitate the transformation of rural MSMEs through digital governance, business legalization, and financial inclusion. The PAR approach was selected because it enables researchers and participants to collaboratively identify existing challenges, implement practical interventions, and evaluate changes throughout the research process. This approach is particularly appropriate for rural MSMEs, whose business characteristics vary considerably in terms of educational background, digital literacy, financial management practices, and institutional readiness. Rather than positioning entrepreneurs as passive recipients of knowledge, the study actively involved them as collaborative partners in diagnosing business problems, developing appropriate solutions, and strengthening their managerial capacities through continuous mentoring. The research was conducted in Kedungotok village, Tembelang district, Jombang regency, East Java, Indonesia, and involved rural MSME owners from various business sectors.

The research was implemented in four sequential stages. The first stage consisted of a comprehensive baseline assessment conducted through direct observation, semi-structured interviews, and participatory discussions at participants' business locations. Field observations focused on identifying existing business governance practices, financial management systems, business legality status, and the use of digital technologies in daily operations. Particular attention was given to understanding how entrepreneurs managed cash flows, separated personal and business finances, maintained financial records, and perceived formal financial institutions. In addition, interviews explored psychological and institutional barriers affecting business formalization, including concerns regarding administrative complexity, limited knowledge of government regulations, low financial literacy, and misconceptions about bank financing requirements. To establish baseline conditions, participants completed a structured pre-test questionnaire adapted from OECD financial literacy indicators and digital readiness assessment frameworks, providing quantitative measures of their initial competencies in financial management, digital technology adoption, and business formalization.

Based on the baseline findings, the second stage involved designing and implementing tailored capacity-building interventions. Training materials were developed using simple, practice-oriented learning modules to ensure accessibility for participants with diverse educational backgrounds. The intervention emphasized experiential learning through intensive mentoring, practical demonstrations, and individual guidance. Participants received direct assistance in registering their businesses through the Online Single Submission system to obtain a business identification number, including preparation of administrative requirements and selection of appropriate Indonesian standard industrial classification codes. Simultaneously, participants were introduced to smartphone-based digital bookkeeping applications, including BukuWarung, CrediBook, and SIAPIK, and were guided in configuring business profiles, recording daily transactions, categorizing revenues and expenditures, managing receivables and payables, and generating basic financial statements such as cash flow reports and profit-and-loss statements. This practical approach was intended to improve financial transparency while encouraging the separation of personal and business finances.

The third stage focused on strengthening financial inclusion and improving participants' readiness to access formal financing. Interactive workshops introduced the concept of responsible financial management, productive borrowing, and the strategic use of government-supported financing programs, particularly government-subsidized credit. Participants learned how financial records generated through digital bookkeeping applications could serve as credible evidence of business performance for formal financial institutions. Practical simulations enabled entrepreneurs to calculate repayment capacity, estimate working capital requirements, and understand the relationship between financial transparency and creditworthiness. In addition, demonstrations of official digital banking platforms and licensed financial technology services were conducted to familiarize participants with secure and transparent financing procedures and to reduce misconceptions about formal lending institutions. These activities were designed to strengthen entrepreneurs' confidence in engaging with formal financial systems and to improve their overall bankability.

The final stage consisted of monitoring and evaluating the effectiveness of the intervention. Periodic follow-up visits were conducted to assess participants' consistency in applying digital bookkeeping practices, maintaining legal compliance, and independently using financial management tools. During these visits, researchers provided technical assistance to address implementation challenges, including application usage, transaction classification, and digital platform accessibility. A post-test questionnaire, identical in structure and measurement to the pre-test, was administered to evaluate changes in participants' financial literacy, digital governance capability, business legalization awareness, and readiness to access formal financial services. Descriptive and comparative analyses were subsequently employed to examine improvements between pre-intervention and post-intervention conditions. The findings were further synthesized into policy recommendations for local governments, MSME development agencies, and financial institutions to support the sustainable transformation of rural MSMEs through integrated digital governance, formal legalization, and financial inclusion initiatives.

Results and discussion

The results of this study demonstrate that the participatory action research (PAR) intervention successfully improved the institutional capacity, digital governance capability, and financial readiness of rural MSMEs in Kedungotok village, Tembelang district, Jombang regency. The findings were obtained through a systematic process consisting of baseline observation, semi-structured interviews, pre-test assessment, participatory mentoring activities, monitoring and evaluation, and post-test measurement. The results are presented according to three analytical stages: (1) the initial conditions and challenges faced by MSMEs before intervention, (2) the transformation of business governance practices following the intervention program, and (3) the measured improvement in MSME competencies after the implementation of the program.

The baseline assessment conducted during the initial observation phase revealed that most MSMEs in Kedungotok village operated under informal and vulnerable business governance conditions. Although business owners demonstrated strong entrepreneurial motivation and the ability to maintain daily business operations, their managerial practices were still dominated by traditional approaches with limited administrative documentation. Most entrepreneurs managed their businesses based on daily cash availability rather than structured financial information. Business transactions were commonly recorded manually in notebooks or remembered only through cash movements, resulting in difficulties in identifying actual profitability, controlling operational expenses, evaluating financial performance, and preparing reliable financial information for external stakeholders.

The assessment further revealed substantial weaknesses in business formalization, financial management, and digital technology adoption. Approximately 85% of participating MSMEs lacked a business identification number, indicating a high level of business informality and limited integration with formal economic institutions. The absence of legal recognition restricted entrepreneurs' ability to participate in government support programs, establish formal partnerships, and access structured financing opportunities. In addition, many MSME owners frequently mixed household expenditures with business operational funds, reducing financial transparency and weakening their ability to assess business sustainability.

The pre-intervention assessment also identified psychological and administrative barriers as major constraints in MSME transformation. Based on semi-structured interviews, many entrepreneurs perceived business legalization procedures as complicated, time-consuming, and better suited to large enterprises than to micro-scale businesses. Similarly, formal financial institutions were often considered difficult to access due to concerns regarding administrative requirements, collateral obligations, and possible rejection of loan applications. Although most participants owned smartphones and had access to internet services, their utilization of digital technology for financial management remained limited. These findings demonstrated the need for an integrated intervention approach combining business legalization assistance, digital financial management training, and financial inclusion education. The baseline conditions of MSMEs before intervention are summarized in Table 1.

Table 1 baseline conditions of MSMEs before intervention

Nu.	Indicators	Initial conditions before intervention	Conditions
1	Business legality ownership	Most MSMEs operated without formal business identification documents	85% did not possess business identification documents
2	Financial recording practices	Financial transactions were recorded manually or based on memory	Majority used simple notebooks or informal records
3	Separation of business and household finances	Business capital was frequently mixed with personal consumption expenses	High level of financial mixing identified

Nu.	Indicators	Initial conditions before intervention	Conditions
4	Digital bookkeeping adoption	Limited knowledge and experience in using financial applications	Low digital adoption capability
5	Financial reporting capability	Entrepreneurs were unable to prepare systematic profit, loss, and cash flow reports	Limited financial analysis ability
6	Access to formal financing	Entrepreneurs perceived banking procedures as complicated and difficult	Low financing readiness
7	Business governance orientation	Decision-making was primarily based on estimated turnover rather than financial data	Low strategic planning capability

Source: primary data, processed

Following the identification of these challenges, the participatory mentoring program was implemented through three integrated intervention components: business legalization assistance, digital financial management training, and financial inclusion strengthening. The first intervention focused on improving legal compliance by providing direct assistance with registering businesses through the online single submission system. During this process, MSME owners were guided to create business accounts, complete enterprise profiles, select appropriate Indonesian standard industrial classification codes, and submit registration information until a business identification number was issued.

The legalization assistance process resulted in improved administrative confidence among participants. Entrepreneurs who previously perceived formal registration as complicated were able to complete the process independently after receiving practical guidance. The issuance of a business identification number provided participants with formal business recognition and increased awareness regarding the importance of legal identity as a foundation for accessing government programs, business partnerships, and formal economic opportunities. The second intervention focused on transforming conventional bookkeeping practices into digital financial management systems. Before the program, most entrepreneurs relied on manual record-keeping and struggled to distinguish business transactions from household expenditures. Through practical training using smartphone-based accounting applications, participants were guided to create business profiles, record daily sales, classify operational expenses, monitor cash inflows and outflows, manage customer receivables, and generate simple financial reports.

Following the digital bookkeeping intervention, MSMEs demonstrated improved financial management discipline. Participants became more capable of separating business capital from personal consumption, monitoring operational costs, and evaluating business performance based on financial information rather than assumptions. Digital financial applications also improved accessibility to business records, allowing entrepreneurs to review daily turnover, expenses, and estimated profits more systematically. The third intervention component focused on strengthening financial inclusion and bankability. Prior to the program, many MSME owners perceived formal financing as inaccessible due to limited knowledge of credit mechanisms and concerns regarding repayment obligations. Through financial literacy sessions and practical simulations, participants were introduced to productive financing concepts, credit assessment procedures, repayment calculations, and government-supported financing schemes such as government-subsidized credit.

The mentoring process improved participants' understanding of the relationship between financial transparency and access to external financing. Entrepreneurs began to recognize that proper financial records could serve as evidence of business performance and repayment capacity. Consequently, formal financial institutions were increasingly perceived as potential partners for business development rather than as institutions associated with excessive administrative barriers. The transformation of MSME governance capacity after the intervention is presented in Table 2.

Table 2 changes in MSME governance capacity before and after the intervention

Nu.	Measurement indicators	Pre-intervention condition	Post-intervention condition	Main improvement
1	Business legalization status	Most MSMEs lacked business identification number and formal business recognition	Participants successfully obtained business identification number through online single submission assistance	Increased legal compliance and institutional recognition
2	Financial recording practices	Manual recording and memory-based transaction management	Digital bookkeeping applications were adopted for daily transactions	Improved financial transparency and accuracy
3	Financial reporting capability	Limited ability to calculate profit, cost, and cash flow	Participants generated basic financial reports digitally	Improved managerial decision-making
4	Digital financial literacy	Low understanding of financial technology applications	Participants demonstrated confidence in using digital tools	Increased technology adoption capacity
5	Financial management discipline	Business and household finances were frequently mixed	Participants separated business and personal financial flows	Improved financial control
6	Financing readiness	Limited understanding of formal credit mechanisms	Participants understood government-subsidized credit requirements and credit assessment	Improved bankability and financing readiness
7	Business planning capability	Decisions were based mainly on estimated turnover	Entrepreneurs utilized financial data for planning	Increased strategic business orientation

Source: primary data, processed

The effectiveness of the intervention was further evaluated through a comparative analysis of pre- and post-test assessments. The evaluation instrument measured eight transformation dimensions: financial literacy, digital financial management capability, business legalization awareness, financial reporting capability, separation of business and personal finances, formal financing readiness, digital technology adoption, and business governance orientation. The evaluation results showed significant improvements across all measured indicators. The average competency score increased from 2.16 before intervention to 4.29 after intervention, representing an overall improvement of 98.61% (Table 3). The largest improvements occurred in financial reporting and digital financial management capabilities, indicating that practical training effectively strengthened participants' ability to manage business information systematically. Improvements in business legalization awareness also demonstrated that direct assistance through online single submission reduced administrative barriers and increased entrepreneurs' willingness to formalize their businesses.

Table 3 pre-test and post-test improvement of MSME transformation indicators

Nu.	Transformation indicators	Pre-test mean score	Post-test mean score	Improvement (%)
1	Financial literacy	2.31	4.26	84.42
2	Digital financial management capability	1.98	4.18	111.11
3	Business legalization awareness	2.15	4.52	110.23
4	Separation of Business and Personal Finance	2.08	4.35	109.13
5	Financial reporting capability	1.87	4.12	120.32
6	Formal financing readiness (bankability)	2.24	4.21	88.00
7	Digital technology adoption	2.42	4.38	80.99
8	Business governance orientation	2.19	4.31	96.80
	Average score	2.16	4.29	98.61

Source: primary data, processed

Overall, the findings confirm that the integrated participatory intervention successfully transformed MSME governance practices from informal, experience-based management toward more structured, transparent, and digitally supported business administration. The combination of legal formalization assistance, digital financial management training, and financial inclusion education generated measurable improvements in administrative capacity, financial control, and institutional readiness. These results demonstrate that rural MSME transformation can be accelerated through an integrated empowerment model that combines technological adoption, regulatory support, and financial capability development.

Discussion

The findings of this study demonstrate that the transformation of rural MSMEs requires a comprehensive institutional approach that integrates business formalization, digital financial governance, and financial inclusion. The improvement observed among MSMEs in Kedungotok Village indicates that limited business sustainability is caused not only by a lack of entrepreneurial motivation but also by institutional constraints, weak governance structures, and limited access to formal economic systems. This finding supports the perspective of institutional theory, which explains that organizations achieve legitimacy and sustainability by adapting their structures and practices to prevailing institutional expectations. In the context of rural MSMEs, obtaining a business identification number, implementing systematic financial recording, and engaging with formal financial institutions represent institutional adaptation processes that enable businesses to move from informal economic activities toward recognized and sustainable entities. The results confirm that institutional transformation at the micro-business level requires not only regulatory access but also continuous capacity-building interventions that reduce knowledge gaps and psychological resistance among entrepreneurs.

The high proportion of MSMEs lacking formal legal status prior to the intervention reflects the persistence of informal economic practices in rural areas. Although government policies have simplified business registration procedures through the online single submission system, administrative accessibility alone is insufficient to encourage widespread formalization. Many entrepreneurs still perceive legality as an additional burden rather than as a strategic business asset. This finding extends previous research by Lubis et al. (2025); Sarjito (2025), who emphasized that ownership of a business identification number through OSS-RBA can accelerate MSME formalization and improve institutional recognition. However, this study provides additional evidence that the effectiveness of legalization programs depends strongly on intensive mentoring and behavioral transformation. The successful issuance of business identification numbers among participants after direct assistance demonstrates that the primary barrier is not merely technological availability but also limited understanding, confidence, and familiarity with formal administrative systems. Therefore, business legalization should be viewed as an institutional empowerment mechanism that strengthens legal protection, improves market credibility, and expands opportunities for participation in government and private-sector business networks.

The findings regarding digital bookkeeping adoption highlight the important role of financial governance transformation in improving MSME sustainability. Before the intervention, most participants relied on memory-based or simple manual records, resulting in difficulties in identifying actual profits, controlling operational costs, and separating business assets from household expenditures. The implementation of digital financial applications improved participants' ability to generate structured financial information and conduct more accurate business evaluations. This result is consistent with Rahayu et al. (2023); Tandilino et al. (2025), who found that digital financial systems improve financial transparency and strengthen MSME management capacity. Furthermore, the findings support Zhou & Pacala (2025), who demonstrated that financial digitalization contributes positively to MSME sustainability by improving efficiency and decision-making quality. However, this study advances previous research by showing that digital adoption among rural MSMEs is more effective when combined with direct mentoring and practical application using real business transactions. Digital transformation is therefore not merely a technological process but also a learning process that requires behavioral adaptation and continuous institutional support.

The improvement in financial literacy and business decision-making observed after the intervention further reinforces the importance of integrating digital tools with managerial capability development. Many rural entrepreneurs initially experienced what can be described as a "turnover illusion," in which high cash flow was interpreted as business profitability without accounting for operational costs, inventory replacement, or household withdrawals. Through digital bookkeeping training, participants gained the ability to evaluate financial conditions based on actual data rather than subjective estimation. This finding supports Dewi & Candraningrat (2022), who emphasized that financial literacy significantly influences MSME performance and sustainability. Similarly, Mintah et al. (2022) highlighted that training in financial recording improves entrepreneurs' ability to manage business resources effectively. The current study contributes to this literature by demonstrating that financial literacy development becomes more impactful when combined with digital financial systems that provide real-time financial information and practical decision-support mechanisms.

The findings also reveal that digital financial governance plays an important role in improving MSME bankability and access to formal financing. Prior to the intervention, participants perceived formal credit institutions as difficult to access due to concerns regarding administrative requirements, collateral demands, and potential rejection. After receiving financial inclusion education and credit readiness training, entrepreneurs demonstrated improved understanding of the relationship between financial transparency and creditworthiness. This result supports the argument of Susan & Natu (2022); Rahayu et al. (2023), who stated that digital bookkeeping can reduce information asymmetry between informal businesses and financial institutions. From the perspective of financial institutions, reliable financial records provide measurable indicators of business performance and repayment capacity, making MSMEs more attractive as potential borrowers. Therefore, bankability should not be interpreted merely as the ability to obtain loans but as the outcome of improved governance quality, financial accountability, and institutional credibility.

Furthermore, the findings underscore the relevance of Business Sustainability Theory by demonstrating that long-term MSME survival depends on integrating economic, institutional, and managerial capabilities. Sustainable businesses require more than increased sales volume; they require effective governance mechanisms that enable entrepreneurs to control resources, manage risks, comply with regulations, and access strategic opportunities. The transformation experienced by MSMEs in Kedungotok Village illustrates that formal legality, digital financial management, and financial inclusion function as complementary sustainability mechanisms. Formal legality provides institutional recognition, digital governance strengthens operational efficiency, and financial inclusion expands access to growth resources. This integrated relationship supports the argument of Purnomo & Purwandari (2025), who emphasized that strengthening formal governance and legal protection enhances the competitiveness of rural MSMEs.

Compared with previous studies that often examine financial literacy, digitalization, or legalization as separate variables, this research contributes a more integrated understanding of rural MSME transformation. Previous studies by Bi et al. (2024) primarily focused on the relationship between financial transparency and credit access, while Liu & Wang (2025) emphasized the impact of business formalization on market opportunities. This study extends these perspectives by demonstrating that digital governance, legal formalization, and financial inclusion function as interconnected mechanisms of transformation rather than isolated interventions. The participatory action research approach also provides additional empirical insight by showing how behavioral barriers and institutional constraints can be addressed through continuous engagement between researchers, local government, and business actors.

From a practical perspective, the findings indicate that rural MSME development policies should move beyond short-term training programs toward integrated institutional empowerment models. The establishment of continuous support mechanisms, such as village-level MSME service centers, digital mentoring facilities, and collaboration between local governments, financial institutions, and universities, is necessary to maintain long-term transformation outcomes. Without continuous institutional support, MSMEs may return to informal practices after initial interventions are completed. Therefore, sustainable MSME development requires a collaborative ecosystem that combines regulatory facilitation, technological assistance, financial education, and market linkage development. Overall, this study demonstrates that transforming rural MSMEs requires simultaneous improvements in institutional legitimacy, governance capability, and financial accessibility. The evidence from Kedungotok village confirms that digital governance and formal legality are not merely administrative requirements but strategic resources that enhance business resilience and competitiveness. By integrating institutional theory and business sustainability theory, this research provides conceptual and empirical insights into how rural MSMEs can transition from vulnerable informal enterprises to transparent, accountable, and sustainable economic actors in the modern digital economy.

Practical implications and policy recommendations

The findings of this study provide several important practical implications for policymakers, local governments, financial institutions, and MSME development stakeholders in strengthening the sustainability of rural enterprises. The evidence from Kedungotok village demonstrates that MSME transformation cannot be achieved through isolated interventions focusing only on business training or financial assistance. Instead, sustainable development requires an integrated ecosystem that simultaneously addresses institutional legitimacy, digital capability, financial governance, and access to formal economic resources. Therefore, rural MSME development policies should shift from conventional capacity-building programs toward a continuous empowerment model that combines business formalization assistance, digital transformation support, and financial inclusion strategies.

At the village government level, establishing a permanent MSME support mechanism is recommended to ensure continuity of transformation after external mentoring programs conclude. The Kedungotok Village Government can institutionalize an “MSME Corner” or village-based MSME service center that functions as an accessible one-stop facility for business owners requiring assistance with business legalization, digital bookkeeping, financial administration, and access to government programs. This facility should be supported by basic digital infrastructure, including computers, internet connectivity, document-scanning facilities, and trained local facilitators. The involvement of village youth organizations (karang taruna), village economic cadres, or trained administrative staff can ensure that MSME assistance becomes locally managed and sustainable. Such a model can reduce dependence on temporary intervention programs and strengthen the institutional capacity of rural communities to manage their business development processes independently.

For local governments and MSME development agencies, the findings suggest the importance of redesigning MSME empowerment programs from fragmented assistance toward an integrated transformation roadmap. Government programs should not only encourage business registration but also ensure that improvements follow formalization in financial governance, digital literacy, and market access. The ownership of a business identification number should be treated as the initial stage of institutional development rather than the final achievement of MSME empowerment. After obtaining legal status, MSMEs should receive structured follow-up programs on financial reporting, tax compliance, product standardization, certification, intellectual property protection, and business networking. This approach will enable formally registered MSMEs to obtain greater benefits from their legal status and increase their ability to participate in formal supply chains.

Financial institutions and banking stakeholders also have an important role in expanding MSME financial inclusion. The findings indicate that many rural entrepreneurs remain excluded from formal financing not because they lack business potential, but because they cannot provide the reliable financial information lenders require. Therefore, banks and microfinance institutions should consider developing more inclusive assessment mechanisms that recognize digitally recorded business performance as an additional indicator of creditworthiness. Collaboration between financial institutions and village MSME centers can facilitate financial literacy programs, credit readiness assessments, and responsible financing education. In particular, government-supported financing schemes, such as government-subsidized credit, can be strengthened by integrating digital bookkeeping adoption into MSME preparation before accessing productive loans. This approach can reduce information asymmetry between lenders and borrowers while simultaneously minimizing credit risks.

For MSME entrepreneurs, the findings emphasize that digital governance and formal legality should be perceived as strategic business assets rather than administrative burdens. Business owners are encouraged to continuously maintain accurate financial records, separate personal and business finances, and utilize digital applications to monitor operational performance. The ability to produce transparent financial information provides entrepreneurs with stronger bargaining positions when accessing financing, establishing partnerships, and expanding market opportunities. Furthermore, MSMEs should gradually shift from survival-oriented management practices to growth-oriented strategies by using financial data to plan production capacity, control costs, improve profitability, and identify business opportunities.

Higher education institutions and community service organizations can contribute by developing long-term mentoring models that combine research-based intervention with practical business assistance. Rather than conducting one-time training activities, universities should establish continuous collaboration with villages and local governments through entrepreneurship incubators, digital literacy programs, and applied research initiatives. The participatory action research model implemented in this study demonstrates that meaningful transformation occurs when entrepreneurs are actively involved in identifying problems and implementing solutions. Therefore, future community empowerment programs should prioritize collaborative learning approaches that recognize local knowledge while introducing appropriate technological and managerial innovations.

At the regional policy level, multi-stakeholder collaboration is essential to ensure that rural MSMEs become integrated into broader economic development systems. Local governments should develop comprehensive MSME databases containing information on business legality status, financial readiness, sector potential, and digital capability. This database can support targeted policy interventions, including access to business certification programs, product development assistance, regional trade exhibitions, digital marketplaces, and industrial supply-chain integration. Collaboration between village governments, cooperative offices, trade agencies, financial institutions, and private-sector partners will enable MSMEs to move beyond informal local markets and participate in more competitive regional and national economic networks. Overall, this study recommends a sustainable rural MSME transformation framework based on three interconnected pillars: institutional strengthening through business legalization, governance improvement through digital financial management, and economic empowerment through financial inclusion. The experience of Kedungotok village demonstrates that when these three dimensions are implemented simultaneously, MSMEs can develop stronger legitimacy, improved managerial capacity, and greater resilience against economic uncertainty. Consequently, the proposed policy direction provides a practical model for rural MSME development that can be adapted and replicated in other regions facing similar challenges of informality, limited digital adoption, and restricted access to formal financial systems.

Conclusions

The integrated participatory action research intervention effectively strengthened the governance capacity, digital financial management capability, and formal institutional readiness of rural MSMEs in Kedungotok village, Jombang regency. The main findings demonstrate that MSMEs initially faced substantial challenges related to business informality, weak administrative practices, limited financial literacy, inadequate bookkeeping systems, and restricted access to formal financing. Through a combination of business legalization assistance, digital financial management training, and financial inclusion education, MSME participants experienced significant improvements in their ability to obtain business legality through the online single submission system, manage financial records using digital applications, separate business and household finances, and understand formal financing mechanisms. The improvement in pre-test and post-test scores confirms that a practical and participatory mentoring model can effectively transform traditional MSME management practices into more structured, transparent, and digitally supported governance systems.

The findings provide important theoretical and practical contributions to the development of rural MSME empowerment strategies. Theoretically, this study enriches the understanding of business sustainability theory by demonstrating that formal legality, digital financial governance, and financial inclusion readiness represent interconnected institutional foundations for improving MSME resilience and competitiveness. In practice, the study provides evidence that MSME development programs should not focus solely on entrepreneurship training but should also integrate regulatory assistance, digital capability building, and access-to-finance preparation. The implementation model developed in this research can serve as a reference for village governments, MSME development agencies, and financial institutions in designing more inclusive empowerment programs. However, this study has several limitations. First, the research was conducted in only one rural village, which limits the generalizability of the findings to other geographical and socio-economic contexts. Second, the evaluation focused primarily on short-term improvements in governance capacity and behavioral changes following the intervention, without examining long-term impacts on business growth, profitability, survival rates, or actual access to financing.

Future research should address these limitations by conducting longitudinal studies that monitor MSME development over a longer period following digital governance and formalization interventions. Further studies could broaden the scope by involving multiple villages or regions with varying economic characteristics to validate the effectiveness and adaptability of the proposed intervention model. In addition, future research is encouraged to incorporate more comprehensive quantitative approaches, such as structural equation modeling, quasi-experimental designs, or comparative studies between intervention and non-intervention groups, to examine the causal relationship between business formalization, digital financial capability, financial inclusion, and MSME sustainability performance. Such research would provide stronger empirical evidence to inform the development of scalable policies to accelerate the transformation of rural MSMEs in Indonesia and other developing economies.

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