

The Impact of Digital Financial Literacy on MSME Sustainability Performance through Green Investment among MSMEs in South Sulawesi

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Abstract

This study aims to analyze the influence of digital financial literacy on the sustainability performance of MSMEs, the influence of digital financial literacy on green investment, the influence of green investment on MSME sustainability performance, and the role of green investment as a mediating variable in the relationship between digital financial literacy and MSME sustainability performance within the context of the circular economy. A quantitative approach was employed, utilizing a survey method involving 343 MSME owners in South Sulawesi Province selected through purposive sampling. Data were collected via questionnaires and analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with the aid of SmartPLS 4.0. The results indicate that digital financial literacy has a positive and significant effect on both MSME sustainability performance and green investment. Green investment also positively and significantly affects MSME sustainability performance and mediates the relationship between digital financial literacy and MSME sustainability performance. The findings confirm that enhancing digital financial literacy encourages the adoption of green investment, which ultimately improves MSME sustainability performance. These results are expected to provide valuable insights for the government, financial institutions, and MSME owners in supporting digital transformation and the implementation of sustainable business practices.

INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) constitute one of the fundamental pillars of the Indonesian economy, contributing substantially to employment creation, income distribution, and local economic development. Their strategic importance has become increasingly pronounced amid a rapidly changing business environment characterized by accelerated digitalization, changing consumer behavior, resource constraints, environmental pressures, and growing demands for sustainable business practices. Under these circumstances, MSME performance can no longer be assessed solely through short-term financial outcomes such as sales growth and profitability. Instead, the ability of MSMEs to maintain long-term business continuity while simultaneously addressing economic, social, and environmental dimensions has become increasingly important. Digitalization has created substantial opportunities for MSMEs through the adoption of financial technology (*fintech*), digital payments, online marketplaces, cloud-based accounting systems, and various digital financial management applications. However, access to digital technologies does not automatically generate meaningful economic benefits. MSME owners and managers require adequate competencies to understand financial information, evaluate risks, manage digital transactions, assess financing alternatives, and make informed investment decisions. In this context, digital financial literacy (DFL) can be conceptualized as the combination of financial knowledge and digital capabilities that enable business actors to access, evaluate, and effectively utilize digital financial information and services. Evidence from 5,035 ultra-micro,

micro, and small enterprises across 17 Indonesian provinces indicates that digital adoption constitutes an important component of business transformation and is associated with business performance and financial literacy (Affandi et al., 2024).

Digital financial literacy has become increasingly important because MSME financial decisions are progressively embedded within digital financial ecosystems. Financially and digitally literate entrepreneurs are potentially better positioned to compare financing alternatives, manage cash flows, conduct digital payments and collections, identify financial risks, and utilize financial information in strategic decision-making. Recent evidence from Indonesian small businesses also indicates that financial literacy and digital financial literacy are associated with financial inclusion, suggesting that financial and digital capabilities constitute important foundations for improving MSMEs' access to formal financial systems (Al-Shami et al., 2024). Nevertheless, increasing access to digital financial technologies has not necessarily been accompanied by an equivalent improvement in MSMEs' ability to utilize such technologies strategically. This situation creates a technology access–capability gap. Digitalization should not be limited to the adoption of digital applications or payment systems; rather, it should translate into improved financial management, operational efficiency, innovation, and long-term strategic decision-making. Recent studies demonstrate that digitalization can contribute to efficiency, cost reduction, product quality, customer satisfaction, and environmental responsibility when supported by adequate organizational capabilities (Trueba-Castañeda et al., 2024; Miranda et al., 2024).

The sustainability challenge facing MSMEs is also closely associated with their ability to manage resources efficiently. Conventional linear business models based on a “take–make–use–dispose” logic are increasingly challenged by resource scarcity, rising production costs, and growing environmental concerns. In contrast, the circular economy (CE) promotes resource efficiency, reuse, recycling, product-life extension, waste reduction, and value creation from resources that would otherwise become waste. For MSMEs, the adoption of circular economy principles provides opportunities to improve operational efficiency while strengthening business resilience and long-term sustainability. Within this framework, green investment (GI) represents an important mechanism linking financial capabilities with sustainable business practices. Green investment may involve the acquisition of energy-efficient equipment, low-emission technologies, renewable energy systems, waste-treatment facilities, environmentally friendly production technologies, and resource-efficient processes. Such investments require rational financial decision-making because they frequently involve substantial initial expenditures while generating benefits over a longer time horizon. Recent international evidence suggests that financial constraints can negatively affect firms' green investment decisions, whereas access to appropriate financial resources can enhance their capacity to invest in environmentally sustainable technologies.

Digital financial literacy may therefore play a significant role in shaping green investment decisions. MSMEs possessing stronger financial and digital capabilities may be better able to obtain information regarding green technologies, identify financing opportunities, assess investment risks, estimate expected returns, and evaluate long-term environmental benefits. However, this relationship may not necessarily be direct. Digital financial literacy may first improve the quality of financial decision-making and resource allocation, which subsequently enables MSMEs to undertake green investments. This argument is supported by recent empirical evidence demonstrating that financial literacy does not always translate directly into sustainability outcomes. Molina-García et al. (2025), for example, found that CEO financial literacy contributes to

environmental sustainability among SMEs, but that the relationship operates through process innovation. This finding is particularly important because it suggests that financial capability alone may be insufficient to generate sustainability outcomes; rather, a specific organizational mechanism is required to translate financial capability into concrete environmental practices.

The finding creates an opportunity to investigate green investment as an alternative mediating mechanism linking digital financial literacy and sustainability performance. Unlike process innovation, which emphasizes changes in operational processes, green investment specifically represents the allocation of financial resources toward environmentally beneficial assets, technologies, and activities. Consequently, green investment provides a theoretically plausible mechanism through which financial-digital capabilities can be transformed into tangible sustainability outcomes. The proposed relationship is consistent with the Resource-Based View (RBV). RBV posits that sustainable competitive advantage and superior organizational performance depend on the possession and effective utilization of valuable internal resources and capabilities. Within MSMEs, digital financial literacy can be conceptualized as an organizational capability that enables entrepreneurs to acquire financial information, evaluate opportunities, manage resources, and make strategic decisions. From this perspective, digitalization is not merely a technological instrument but a means of developing internal capabilities that can contribute to sustainable business performance. Recent research further indicates that digital investment and digital capabilities can improve efficiency and environmental responsibility among SMEs, reinforcing the relevance of RBV for explaining the relationship between digital capabilities and sustainability.

At the same time, Stakeholder Theory provides an external perspective on MSME sustainability. According to this theory, organizational sustainability is shaped not only by owners' interests but also by the expectations and pressures of customers, employees, governments, financial institutions, communities, suppliers, and the natural environment. Increasing stakeholder pressure encourages firms to adopt more responsible business practices. Within the circular economy, such pressure becomes particularly relevant because firms are increasingly expected to reduce waste, improve resource efficiency, minimize environmental impacts, and generate value for a broader range of stakeholders. The interaction between financial capabilities, digitalization, and sustainability is also evident in the growing literature on green finance. Recent evidence indicates that green financing can encourage SMEs to adopt sustainable practices, while digitalization may strengthen the ability of enterprises to implement and communicate sustainability-related practices. These findings indicate that financial and digital dimensions should not be considered independently from the broader sustainability agenda. Instead, their interaction may constitute an important pathway through which MSMEs transition toward more environmentally responsible and circular business models.

The importance of this issue becomes particularly evident in the context of South Sulawesi Province, Indonesia. South Sulawesi is one of the major economic centers in Eastern Indonesia, with economic activities dominated by trade, agriculture, manufacturing, and services, sectors in which MSMEs play an important role. According to Statistics Indonesia (BPS), South Sulawesi's economy grew by 5.02% in 2024, while its gross regional domestic product (GRDP) at current prices reached approximately IDR 696.25 trillion. This economic development provides an important context for examining whether the quantitative growth of MSMEs has been accompanied by improvements in their digital-financial capabilities and sustainability practices. The number of MSMEs in South Sulawesi has also demonstrated a continuous upward trend.

Based on data from the Indonesian Ministry of MSMEs and the Integrated MSME Database System (SIDT UMKM), the number of MSMEs increased from approximately 1.001 million units in 2020 to 1,087,977 units in 2024. This substantial MSME base highlights the strategic importance of improving not only the quantity but also the quality, competitiveness, resilience, and sustainability of MSMEs in the province.

Table 1. Development of MSMEs in South Sulawesi Province, 2020–2024

Year	Number of MSMEs	Growth (%)
2020	1,001,000	–
2021	1,028,000	2.70
2022	1,054,000	2.53
2023	1,071,000	1.61
2024	1,087,977	1.59

Source: Ministry of MSMEs of the Republic of Indonesia and SIDT UMKM.

The data indicate a continuous increase in the number of MSMEs between 2020 and 2024. However, quantitative expansion cannot automatically be interpreted as evidence of improved sustainability performance. The increasing number of enterprises needs to be accompanied by stronger financial management capabilities, digital adoption, innovation, resource efficiency, and environmental responsibility. This situation indicates the existence of a potential quantity–quality gap, whereby the expansion of the MSME population has not necessarily been accompanied by an equivalent improvement in internal capabilities and sustainable business practices. This challenge is particularly relevant because MSMEs generally operate under constraints related to capital availability, managerial expertise, technological resources, and access to formal financing. Such constraints can limit their ability to invest in green technologies, particularly when green investments require relatively high initial expenditures. At the same time, inadequate financial knowledge may limit entrepreneurs' ability to evaluate investment returns, financial risks, financing alternatives, and long-term benefits associated with environmentally sustainable investments. Consequently, strengthening digital financial literacy may constitute an important prerequisite for enabling MSMEs to undertake green investments and transition toward sustainable business models.

Previous empirical studies provide important but inconclusive evidence regarding the relationship between financial literacy and sustainability. Some studies report that financial literacy has a positive direct effect on MSME sustainability, whereas others indicate that such effects occur through specific organizational mechanisms. Puspita et al. (2024), for instance, reported a positive relationship between financial literacy and MSME sustainability in Indonesia. In contrast, Molina-García et al. (2025) demonstrated that the contribution of financial literacy to environmental sustainability operates through process innovation rather than solely through a direct relationship. These inconsistent findings reveal an important empirical gap. Existing research has predominantly examined the direct effects of financial literacy, digitalization, green finance, or green innovation on MSME performance and sustainability. Comparatively limited attention has been given to whether digital financial literacy influences sustainability performance through green investment as a mediating mechanism. This omission is important because green investment

represents a more direct manifestation of financial resource allocation toward environmental objectives.

A contextual gap also remains. Much of the existing evidence concerning digitalization, financial literacy, green investment, and sustainability has been derived from large corporations, SMEs in developed economies, or specific industrial sectors. These findings may not be directly generalizable to Indonesian MSMEs because institutional conditions, financing structures, technological capabilities, market characteristics, and environmental pressures differ substantially across countries and regions. Even within Indonesia, studies on digital financial literacy have largely focused on financial inclusion, technology adoption, and financial performance, while the integration of digital financial literacy, green investment, and sustainability performance remains underexplored, particularly in the context of South Sulawesi. Furthermore, a theoretical gap exists regarding the mechanisms through which internal financial-digital capabilities are transformed into sustainability outcomes. RBV explains digital financial literacy as an internal capability that enables MSMEs to acquire and utilize resources effectively. However, RBV alone provides limited explanation of how such internal capabilities respond to external sustainability pressures. Conversely, Stakeholder Theory explains why firms respond to the demands of stakeholders but provides less emphasis on the internal capabilities required to implement such responses effectively. Integrating the two perspectives therefore provides a more comprehensive theoretical foundation for explaining the relationship between digital financial literacy, green investment, and MSME sustainability performance.

Accordingly, this study conceptualizes digital financial literacy as an internal strategic capability, green investment as a resource-allocation mechanism, and sustainability performance as an organizational outcome encompassing economic, social, and environmental dimensions. This conceptualization enables the study to move beyond the question of whether digital financial literacy affects sustainability and instead examine how and through what mechanism such an effect occurs. The circular economy perspective further strengthens the relevance of this framework. Circular economy principles require a transition from linear resource consumption toward systems that maintain the value of products and materials for as long as possible. For MSMEs, circular economy practices may involve reducing raw-material consumption, reusing materials, recycling waste, improving product durability, adopting cleaner production technologies, and developing innovative business models. Such practices require both managerial capabilities and financial resources. Therefore, green investment can function as a critical mechanism through which digitally and financially capable MSMEs translate their capabilities into circular and sustainable business practices.

From an Islamic perspective, the proposed framework is also consistent with fundamental principles of *maslahah* (public benefit), *tawazun* (balance), *'adl* (justice), and *amanah* (stewardship). Islamic economic principles emphasize that economic activities should generate benefits while avoiding excessive harm to society and the environment. This perspective provides a normative foundation for sustainable business practices that balance economic objectives with social and ecological responsibilities. The Qur'an states in Surah Al-A'raf [7]:56:

“And do not cause corruption upon the earth after its reformation.”

This verse provides a normative foundation for responsible resource utilization and environmental stewardship. Within the MSME context, the principle can be translated into efforts to improve resource efficiency, reduce waste, adopt environmentally friendly technologies, and

allocate investment toward activities that minimize ecological harm. A similar principle is emphasized in Surah Al-Baqarah [2]:205, which describes the destruction of crops and livestock as a form of corruption that is not favored by Allah. The verse reinforces the idea that economic activities should not pursue financial benefits at the expense of environmental sustainability. Instead, business activities should seek to establish an appropriate balance between economic development and environmental preservation.

The Islamic emphasis on professionalism is also relevant to digital financial literacy. The concept of *itqan*, commonly associated with performing work with excellence and quality, highlights the importance of competence and responsible execution. In the MSME context, this principle can be reflected in sound financial management, responsible use of digital technologies, informed investment decisions, and continuous improvement in business practices. Therefore, digital financial literacy can be understood not only as an economic capability but also as a means of strengthening responsible and professional business management. The integration of these Islamic values with sustainability principles indicates that digital financial literacy, green investment, and circular economy practices are not merely responses to contemporary economic and environmental pressures. They can also be interpreted as mechanisms for realizing responsible economic activity consistent with the principles of *maslahah*, *tawazun*, *'adl*, and *amanah*.

Despite government efforts to promote digital transformation, financial inclusion, sustainable finance, green economic development, and circular economy practices, MSMEs in South Sulawesi continue to face challenges associated with digital financial capabilities, access to financing, green investment, and sustainable business practices. This situation reflects a persistent gap between *das sein* (the existing condition) and *das sollen* (the expected condition). The existing condition demonstrates the quantitative expansion of MSMEs, whereas the expected condition requires such expansion to be accompanied by stronger financial-digital capabilities, environmentally responsible investments, efficient resource utilization, and improved sustainability performance. Therefore, the central issue is not merely whether digital financial literacy affects MSME sustainability performance. More importantly, it is necessary to determine whether digital financial literacy encourages MSMEs to undertake green investments and whether such investments constitute the mechanism through which digital financial capabilities are translated into improved sustainability outcomes. This issue becomes particularly significant within the circular economy because sustainable MSME development requires a transition from resource-intensive linear business practices toward systems emphasizing efficiency, reuse, waste reduction, resource recovery, and long-term value creation.

Based on the identified phenomenon, theoretical foundations, previous empirical evidence, research gaps, and proposed theoretical integration, this study develops an integrative model in which green investment mediates the relationship between digital financial literacy and MSME sustainability performance within the circular economy context. The study extends the existing literature by connecting digital financial capabilities with a concrete environmental investment mechanism and by examining the model within the specific institutional and economic context of MSMEs in South Sulawesi, Indonesia. The novelty of this study lies in three main aspects. First, it conceptualizes digital financial literacy as a strategic capability rather than merely an instrument of financial inclusion or technology adoption. Second, it positions green investment as a mediating mechanism through which financial-digital capabilities can generate sustainability outcomes. Third, it integrates RBV and Stakeholder Theory within a circular economy context to explain how internal capabilities and external sustainability pressures jointly shape MSME

sustainability performance. Empirically, the study provides evidence from South Sulawesi, a region characterized by a large and rapidly expanding MSME population.

The study is therefore expected to contribute to the literature in several ways. Theoretically, it extends RBV and Stakeholder Theory by explaining how internal financial-digital capabilities interact with sustainability-oriented resource allocation. Empirically, it expands the literature on digital financial literacy by connecting it with green investment and sustainability performance rather than focusing exclusively on financial inclusion or financial outcomes. Practically, the findings may assist policymakers, financial institutions, MSME development agencies, and business owners in designing integrated programs that combine digital financial literacy, sustainable financing, green investment, and circular economy practices. Accordingly, the central research problem is whether digital financial literacy can encourage green investment and whether green investment mediates the relationship between digital financial literacy and the sustainability performance of MSMEs. Addressing this question is important because sustainable MSME development requires more than technological adoption; it requires the capacity to transform financial and digital knowledge into strategic investment decisions that generate economic, social, and environmental value.

Based on the identified phenomenon, theoretical perspectives, empirical inconsistencies, contextual conditions, and research gaps, this study aims to examine the effect of digital financial literacy on MSME sustainability performance through green investment within the circular economy context in South Sulawesi Province, Indonesia. The proposed framework is expected to provide a more comprehensive explanation of how financial-digital capabilities can be transformed into green investment decisions and, ultimately, sustainable MSME performance.

METHODS

Research Design

This study employs a quantitative explanatory research design to empirically examine the relationships among digital financial literacy, green investment, and sustainability performance of Micro, Small, and Medium Enterprises (MSMEs). The explanatory approach is appropriate because the study aims to test theoretically derived causal relationships among the constructs, including both direct effects and indirect effects through green investment as a mediating variable. A cross-sectional research design was adopted, whereby data were collected from eligible MSME owners or managers during a single research period. The empirical model was analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS). SEM-PLS was selected because it enables the simultaneous estimation of multiple relationships among latent constructs, accommodates relatively complex predictive models, and is appropriate for exploratory and explanatory research involving latent variables measured through multiple indicators (Hair et al., 2022).

The conceptual model positions digital financial literacy (DFL) as the exogenous construct, green investment (GI) as the mediating construct, and sustainability performance (SP) as the endogenous construct. The model is designed to examine both the direct effect of DFL on SP and the indirect effect of DFL on SP through GI.

Research Setting and Period

The study was conducted among MSMEs operating in South Sulawesi Province, Indonesia. South Sulawesi was selected as the research setting because of its substantial MSME population and its strategic position as one of the major economic centers in Eastern Indonesia.

The data collection process was conducted from December 2025 to February 2026. The research activities included instrument development, questionnaire preparation and refinement, respondent identification, questionnaire distribution, data screening, data collection, and statistical analysis.

Population and Sample

Population

The target population consisted of MSMEs operating in South Sulawesi Province. Based on data from the South Sulawesi Office of Cooperatives and SMEs, the MSME population was reported to comprise 1,574,546 business units in 2023. This population was used as the basis for determining the minimum required sample size. Because the research focuses specifically on MSMEs that have experience with digital financial services and environmentally oriented business practices, not all members of the population were considered eligible respondents. Therefore, the study applied predetermined inclusion criteria through purposive sampling.

Sampling Technique

The study employed purposive sampling, a non-probability sampling technique in which respondents are selected based on predefined characteristics relevant to the research objectives. This technique was considered appropriate because the study required respondents who possessed specific experience with digital financial services and environmentally oriented business activities. Accordingly, the minimum sample requirement was 384 MSMEs. Given the large population size, the calculated Cochran sample was considered sufficient for the initial sampling requirement. However, because the study employed SEM-PLS, the adequacy of the final sample should also be evaluated based on the complexity of the structural model and the statistical power required to detect meaningful effects. Therefore, the study targeted a minimum of 384 eligible MSME respondents.

Eligibility Criteria

To ensure that respondents possessed sufficient experience and knowledge to evaluate the research constructs, the following inclusion criteria were applied:

1. The MSME must have used at least one digital financial platform for a minimum of six months, including electronic wallets (*e-wallets*), mobile banking, digital payment systems, or fintech-based financing. The six-month criterion was established to ensure that respondents had sufficient practical experience with digital financial services. Such experience enables respondents to evaluate not merely their awareness of digital financial products but also their ability to use, understand, and assess these services in actual business decision-making.
2. The MSME must have been operational for at least one year. This criterion was established to ensure that respondents had sufficient experience in managing business operations, financial resources, digital transactions, and business decision-making. MSMEs operating for at least one year are also more likely to have accumulated sufficient operational experience to evaluate the consequences of their financial and investment decisions.
3. The MSME must have undertaken at least one environmentally oriented business activity during the previous 12 months. Such activities include energy-efficiency initiatives, environmentally friendly technology adoption, resource-efficiency measures, waste reduction, waste management, recycling, or other environmentally responsible practices. This criterion was necessary because the study examines green investment and sustainability performance

and therefore requires respondents with actual exposure to environmentally oriented business practices.

The respondent should preferably be the owner, manager, or individual directly responsible for financial and operational decision-making, as these individuals are considered sufficiently knowledgeable about the firm's financial practices, digital financial activities, investment decisions, and sustainability performance.

Data Collection

Data Type and Source

The study used primary quantitative data collected directly from MSME owners or managers through a structured questionnaire. Primary data were selected because the research constructs—digital financial literacy, green investment, and sustainability performance—represent organizational capabilities, practices, and perceptions that are not fully observable through secondary databases. The questionnaire was designed to capture respondents' assessments of their MSMEs' digital financial capabilities, environmentally oriented investment activities, and economic, environmental, and social performance.

Data Collection Procedure

Data were collected using a structured, self-administered questionnaire. Prior to the main survey, the questionnaire should be reviewed for clarity, relevance, and comprehensibility to ensure that each item appropriately represents its intended construct. Where applicable, the instrument may be subjected to a pilot assessment before full-scale distribution. The questionnaire was distributed to eligible MSME owners or managers in South Sulawesi. Respondents were informed of the academic purpose of the study and that their responses would be used exclusively for research purposes. Participation was voluntary, and respondents were expected to provide informed responses based on their actual business conditions.

Measurement Scale

All construct indicators were measured using a five-point Likert scale:

Score	Response
1	Strongly disagree
2	Disagree
3	Neither agree nor disagree
4	Agree
5	Strongly agree

The five-point Likert scale was selected because it provides a relatively simple and consistent response format for measuring perceptions, capabilities, practices, and organizational outcomes. All questionnaire items were formulated as statements corresponding to the operational definitions of the respective constructs.

Operationalization of Variables

The study consists of three principal constructs: digital financial literacy as the independent variable, green investment as the mediating variable, and sustainability performance as the dependent variable.

Digital Financial Literacy

Digital financial literacy (DFL) represents the ability of MSME owners or managers to understand, use, evaluate, and manage digital financial products, services, and information for business-related financial decision-making. The construct reflects the integration of financial knowledge and digital capability within the MSME context.

Digital financial literacy was operationalized through four dimensions:

1. Understanding of digital financial and fintech platforms;
2. Ability to conduct digital financial transactions;
3. Digital financial management capability; and
4. Ability to interpret and utilize digital financial information and data.

These dimensions capture both the knowledge and practical capabilities required to use digital financial services effectively in business activities.

Green Investment

Green investment (GI) refers to the allocation of business resources toward technologies, equipment, processes, and activities intended to improve resource efficiency and reduce negative environmental impacts while supporting long-term business sustainability.

The construct was measured through four dimensions:

1. Investment in renewable or cleaner energy;
2. Adoption of environmentally friendly technologies;
3. Investment in resource efficiency; and
4. Investment in waste reduction and management.

These dimensions reflect the extent to which MSMEs allocate financial resources toward environmentally beneficial activities.

Sustainability Performance

Sustainability performance (SP) refers to the extent to which an MSME achieves balanced economic, environmental, and social outcomes through its business activities. The construct follows the multidimensional sustainability perspective reflected in established sustainability reporting frameworks, including the Global Reporting Initiative (GRI).

Sustainability performance was operationalized across three dimensions:

Economic dimension

1. Revenue growth;
2. Profitability; and
3. Improvement in business efficiency.

Environmental dimension

1. Reduction in environmental impacts;
2. Energy efficiency; and
3. Waste reduction or resource conservation.

Social dimension

1. Employee satisfaction and well-being;

2. Contribution to the local community; and
3. Responsible relationships with stakeholders.

The multidimensional operationalization is intended to ensure that sustainability performance is not reduced to financial outcomes alone but reflects the broader economic, environmental, and social consequences of MSME activities.

Research Instrument

The questionnaire was structured into several sections. The first section collected respondent and business characteristics, including business sector, business age, number of employees, and relevant digital financial experience. The subsequent sections measured digital financial literacy, green investment, and sustainability performance. The questionnaire items were developed based on established conceptual definitions and adapted to the MSME context. Particular attention was given to ensuring that each item was clearly associated with a single construct and could be understood by respondents with different educational and business backgrounds. Because the study uses latent constructs, the measurement instrument was assessed statistically through the measurement model evaluation before testing the structural relationships.

Data Analysis

Data analysis was performed using SmartPLS 4 through the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. PLS-SEM was selected because the research model involves latent constructs, multiple indicators, a mediation relationship, and an explanatory-predictive objective. The analysis followed two sequential stages: measurement model assessment and structural model assessment.

Descriptive Statistics

Descriptive statistics were first used to summarize respondent and business characteristics and to describe the distribution of responses for each research construct.

The descriptive analysis included:

1. frequency distributions;
2. percentages;
3. means;
4. standard deviations; and
5. minimum and maximum values where appropriate.

The results provide an overview of the characteristics of the participating MSMEs and the general tendency of responses before inferential analysis.

Measurement Model Assessment

The measurement model was assessed to establish the reliability and validity of the constructs before evaluating the structural relationships. Because the constructs are measured using reflective indicators, the assessment focused on indicator reliability, internal consistency reliability, convergent validity, and discriminant validity.

Indicator Reliability

Indicator reliability was evaluated through the outer loading of each indicator. An outer loading of approximately 0.70 or higher is generally considered satisfactory because it indicates

that the indicator shares substantial variance with its underlying construct. Indicators with lower loadings may be considered for removal when their exclusion improves construct reliability and validity, provided that such removal is theoretically justified (Hair et al., 2022).

Convergent Validity

Convergent validity was assessed using the Average Variance Extracted (AVE). An AVE value of 0.50 or higher indicates that the construct explains at least half of the variance of its indicators on average. Therefore, constructs with AVE values ≥ 0.50 are considered to demonstrate adequate convergent validity.

Internal Consistency Reliability

Internal consistency reliability was evaluated using Cronbach's alpha and composite reliability (CR). Values above 0.70 were considered indicative of satisfactory reliability, although interpretation should take into account the number of indicators and the exploratory nature of the research. Composite reliability was given particular consideration because PLS-SEM literature recognizes it as an appropriate measure for evaluating internal consistency in latent-variable models.

Discriminant Validity

Discriminant validity was evaluated using the Heterotrait–Monotrait ratio (HTMT) and, where appropriate, the Fornell–Larcker criterion. The HTMT criterion was emphasized because it provides a more sensitive assessment of discriminant validity than traditional correlation-based approaches. HTMT values below the recommended threshold indicate that the constructs are empirically distinguishable. The Fornell–Larcker criterion was used as an additional diagnostic rather than as the sole basis for establishing discriminant validity.

Structural Model Assessment

Following satisfactory evaluation of the measurement model, the structural model was assessed to examine the hypothesized relationships among digital financial literacy, green investment, and sustainability performance.

Collinearity Assessment

Prior to interpreting the structural paths, potential multicollinearity among predictor constructs was examined using the Variance Inflation Factor (VIF). VIF values should remain below the recommended threshold to ensure that excessive collinearity does not distort the estimated path coefficients.

Coefficient of Determination (R^2)

The coefficient of determination (R^2) was used to evaluate the explanatory power of the structural model. R^2 represents the proportion of variance in an endogenous construct explained by its predictor constructs.

In this study, R^2 was evaluated for:

1. green investment; and
2. sustainability performance.

Higher R^2 values indicate greater explanatory capability of the predictor constructs, although the interpretation should be considered relative to the research context and model complexity.

Predictive Relevance (Q^2)

The model's predictive relevance was assessed using Q^2 , particularly through an appropriate out-of-sample or omission-distance procedure where applicable. A Q^2 value greater than zero indicates predictive relevance for the endogenous construct under the relevant assessment procedure. Because contemporary PLS-SEM research increasingly emphasizes predictive assessment, the interpretation of predictive relevance was considered alongside the explanatory measures rather than relying exclusively on R^2 .

Effect Size (f^2)

The f^2 effect size was examined to determine the contribution of individual exogenous constructs to the R^2 of endogenous constructs. This analysis allows the study to determine whether a predictor has a negligible, small, moderate, or substantial contribution to the explained variance of an endogenous construct.

Path Coefficients

The estimated path coefficients (β) were examined to determine the direction and magnitude of the hypothesized relationships. Positive coefficients indicate positive relationships, whereas negative coefficients indicate inverse relationships between constructs.

Hypothesis Testing

Hypothesis testing was performed using the bootstrapping procedure in SmartPLS 4. Bootstrapping generates empirical sampling distributions of the estimated coefficients and allows statistical significance to be assessed without requiring multivariate normality.

The analysis considered:

1. path coefficients (β);
2. standard errors;
3. t-statistics;
4. p-values; and
5. confidence intervals.

At a 5% significance level, a hypothesis was considered statistically supported when the corresponding p-value was below 0.05. For a two-tailed test, a t-statistic greater than approximately 1.96 indicates statistical significance at the 5% level.

The direct hypotheses examined the relationships:

1. Digital financial literacy $\rightarrow$ Green investment;
2. Digital financial literacy $\rightarrow$ Sustainability performance; and
3. Green investment $\rightarrow$ Sustainability performance.

Mediation Analysis

Because green investment is hypothesized to mediate the relationship between digital financial literacy and sustainability performance, an explicit mediation analysis was conducted using the bootstrapping procedure. The significance of the indirect effect was determined based on its bootstrapped confidence interval and p-value. Mediation was considered statistically

supported when the confidence interval for the indirect effect did not include zero. The mediation analysis allows the study to distinguish between:

- direct effects, representing the effect of digital financial literacy on sustainability performance without considering the mediator;
- indirect effects, representing the effect transmitted through green investment; and
- total effects, representing the combined direct and indirect effects.

The mediation type was subsequently interpreted based on the significance and direction of the direct and indirect effects. This approach enables the study to determine whether green investment functions as a complementary or alternative mechanism through which digital financial literacy contributes to MSME sustainability performance.

Research Ethics and Data Quality

The study adhered to fundamental principles of research ethics. Participation was voluntary, and respondents were informed about the purpose of the study before completing the questionnaire. Respondents were not required to disclose personally identifying information beyond information necessary for research classification. The collected data were treated confidentially and were used exclusively for academic research purposes. Data screening was performed before the SEM-PLS analysis. Incomplete responses, responses that did not meet the predetermined eligibility criteria, and observations demonstrating substantial response inconsistencies were excluded from the final dataset where appropriate. This procedure was implemented to improve the quality and reliability of the empirical analysis. Overall, the methodological framework combines a quantitative explanatory design, purposive sampling of eligible MSMEs, structured Likert-scale measurement, and PLS-SEM analysis to provide a rigorous empirical assessment of the proposed relationship between digital financial literacy, green investment, and sustainability performance. The explicit mediation analysis further enables the study to identify whether green investment constitutes the mechanism through which digital financial literacy contributes to sustainable MSME development within the circular economy context of South Sulawesi.

RESULTS AND DISCUSSION

4.1 Respondent Characteristics

4.1.1 Questionnaire Response Rate

A total of 360 questionnaires were distributed to MSME owners/managers in South Sulawesi Province. Of these, 353 questionnaires were returned and completed, representing a response rate of 98.06%. After screening, 10 respondents were excluded because they were not domiciled in South Sulawesi Province. Consequently, 343 valid responses (97.17% of the distributed questionnaires) were used for analysis. This sample size was considered adequate for PLS-SEM analysis and bootstrapping procedures.

Table 4.1. Questionnaire Response Rate

No.	Description	Number	Percentage (%)
1	Questionnaires distributed	360	100.00
2	Returned/completed	353	98.06
3	Not returned/not completed	7	1.94
4	Excluded	10	2.83
5	Valid questionnaires	343	97.17

Source: Primary data processed, 2026.

4.1.2 Frequency Distribution of Questionnaire Responses

The responses indicate generally positive perceptions of Digital Financial Literacy (DFL) and Sustainability Performance (SP), as most indicators were dominated by Agree responses. SP1 recorded the highest frequency, with 154 respondents agreeing that business revenue and profit had shown positive growth. In contrast, several Green Investment (GI) indicators, including GI1, GI2, GI5, GI6, and GI8, were dominated by Neutral responses, indicating that green investment practices remain relatively limited. DFL10 had the lowest Agree frequency (102 respondents), suggesting that respondents' ability to interpret digitally generated financial statements still requires improvement.

4.1.3 Gender

Of the 343 respondents, 246 (71.7%) were female and 97 (28.3%) were male. Thus, the sample was predominantly female, indicating substantial female participation in MSME ownership and management in South Sulawesi.

4.1.4 Business Age

Most respondents operated businesses that had been established for more than two years (227 respondents; 66.2%). Meanwhile, 66 respondents (19.2%) had operated for 1–2 years, and 50 respondents (14.6%) had operated for more than one year. The dominance of established businesses indicates that most respondents had sufficient operational experience to provide relevant information regarding digital financial literacy, green investment, and sustainability practices.

4.1.5 Business Type

The largest proportion of respondents operated in the culinary/food and beverage sector (114; 33.2%), followed by trade/retail (74; 21.6%) and other business sectors (70; 20.4%). Fashion accounted for 23 respondents (6.7%), mobile phone retail and digital services for 20 (5.8%), cosmetics and accessories for 13 (3.8%), printing and office supplies for 13 (3.8%), repair services for 9 (2.6%), and laundry for 7 (2.0%). The diversity of business sectors indicates that the sample represents various MSME activities in South Sulawesi.

4.1.6 Number of Employees

Most MSMEs employed one person (161; 46.9%), followed by those employing 2–4 people (143; 41.7%). Businesses with 5–19 employees accounted for 36 respondents (10.5%), while only 3 respondents (0.9%) had 20 or more employees. These findings indicate that the sample was predominantly composed of micro- and small-scale businesses with relatively limited human resources.

4.1.7 Regency/City of Origin

The 343 respondents were distributed across 24 regencies/cities in South Sulawesi. The largest contributions came from Makassar (107; 31.2%), Bantaeng (67; 19.5%), Bulukumba (39; 11.4%), and Enrekang (22; 6.4%). The broad geographical distribution indicates that the study captured MSMEs from diverse locations within South Sulawesi.

4.2 Descriptive Analysis

Descriptive statistics were used to summarize the characteristics of the three research variables based on 343 valid observations. The analysis included minimum, maximum, mean, and standard deviation values.

Table 4.8. Descriptive Statistics of Research Variables

Variable	N	Min.	Max.	Mean	Std. Deviation	Category
Digital Financial Literacy	343	1.00	5.00	3.527	0.936	High
Green Investment	343	1.00	5.00	3.213	0.942	Moderate
MSME Sustainability Performance	343	1.00	5.00	3.522	0.857	High

Source: Primary data processed by the authors, 2026.

Digital Financial Literacy obtained a mean of 3.527, indicating a high level of digital financial literacy. Green Investment recorded a mean of 3.213, indicating a moderate level and suggesting that environmentally oriented investment practices remain an area requiring improvement. Sustainability Performance had a mean of 3.522, indicating a high level of sustainability performance among the sampled MSMEs.

4.3 Instrument Requirement Testing

4.3.1 Instrument Validity

The validity test was conducted using SPSS by comparing the calculated r-values with the r-table value of 0.106 at the 5% significance level. All indicators of Digital Financial Literacy, Green Investment, and MSME Sustainability Performance had calculated r-values greater than 0.106. Therefore, all measurement items were valid and suitable for further analysis.

4.3.2 Instrument Reliability

Table 4.10. Instrument Reliability Test

Variable	Cronbach's Alpha	Conclusion
Digital Financial Literacy	0.947	Reliable
Green Investment	0.930	Reliable
MSME Sustainability Performance	0.918	Reliable

Source: Data processing using SPSS, 2026.

All Cronbach's Alpha values exceeded the 0.70 threshold, confirming that the instruments demonstrated adequate internal consistency and reliability.

4.4 Measurement Model Assessment

4.4.1 Convergent Validity

Convergent validity was assessed through outer loading and Average Variance Extracted (AVE). All 28 indicators recorded outer loading values above 0.70. Digital Financial Literacy indicators ranged from 0.788 to 0.868, Green Investment from 0.808 to 0.874, and Sustainability Performance from 0.791 to 0.872. Thus, all indicators met the required convergent validity criterion and were retained. The AVE values were 0.698 for Digital Financial Literacy, 0.727 for Green Investment, and 0.712 for Sustainability Performance. Since all values exceeded 0.50, the constructs demonstrated adequate convergent validity.

4.4.2 Discriminant Validity

Discriminant validity was assessed using cross-loadings, latent variable correlations, and the Fornell–Larcker criterion. Each indicator had the highest loading on its respective construct, confirming satisfactory discriminant validity. The correlations between Digital Financial Management (DFM), Green Investment (GI), and Sustainability Performance (SP) were 0.613, 0.669, and 0.758, respectively. The square roots of AVE were higher than the corresponding inter-construct correlations. Therefore, the Fornell–Larcker criterion was satisfied, indicating that the constructs were empirically distinguishable.

4.4.3 Construct Reliability

Table 4.16. Cronbach's Alpha

Variable	Cronbach's Alpha	Conclusion
Digital Financial Management	0.961	Reliable
Green Investment	0.946	Reliable
Sustainability Performance	0.942	Reliable

Table 4.17. Composite Reliability

Variable	Composite Reliability	Conclusion
Digital Financial Management	0.965	Reliable
Green Investment	0.955	Reliable
Sustainability Performance	0.952	Reliable

All Cronbach's Alpha and Composite Reliability values exceeded 0.70, confirming strong internal consistency and construct reliability.

4.4.4 Collinearity Assessment

The VIF values ranged from 2.339 to 4.070, with the highest value recorded for DFL10 (4.070) and the lowest for SP1 (2.339). Since all VIF values were below 5.00, no problematic multicollinearity was identified.

4.4.5 Model Fit Assessment

Table 4.19. Model Fit Assessment

Parameter	Rule of Thumb	Value	Interpretation
SRMR	< 0.10	0.047	Fit
d_ULS	> 0.05	0.897	Good
d_G	> 0.05	0.621	Good
Chi-square	Smaller is better	1,185.504	Good
NFI	Approaching 1	0.874	Good

The SRMR value of 0.047 indicates an acceptable model fit. The NFI of 0.874 also indicates a relatively good fit, while the remaining indices support the adequacy of the proposed model.

4.5 Structural Model Assessment

4.5.1 R-Square

Table 4.20. R-Square Results

Dependent Variable	R-Square	Adjusted R-Square
Green Investment	0.376	0.374
Sustainability Performance	0.641	0.639

Digital Financial Literacy explained 37.6% of the variance in Green Investment, while 62.4% was explained by factors outside the model. Meanwhile, the model explained 64.1% of the variance in Sustainability Performance, with the remaining 35.9% attributable to other factors.

4.5.2 Effect Size (f^2)

Table 4.21. Effect Size Results

Relationship	f^2	Interpretation
DFM → GI	0.602	Large

DFM → SP	0.185	Medium
GI → SP	0.541	Large

The results indicate that Digital Financial Management has a large effect on Green Investment, Green Investment has a large effect on Sustainability Performance, and Digital Financial Management has a medium effect on Sustainability Performance.

4.5.3 Predictive Relevance (Q^2)

Table 4.22. Predictive Relevance

Variable	Q^2	Interpretation
Green Investment	0.269	Predictive relevance
Sustainability Performance	0.451	Predictive relevance

Both Q^2 values are greater than zero, confirming that the structural model has predictive relevance for the endogenous constructs.

4.6 Hypothesis Testing

Hypotheses were tested using the bootstrapping procedure in SmartPLS. A relationship was considered significant when the p-value was below 0.05 and the t-statistic exceeded 1.960.

4.6.1 Direct Effects

Table 4.23. Path Coefficient Bootstrapping Results—Direct Effects

Relationship	Original Sample (O)	T-Statistics	P-Values	Conclusion
DFL → GI	0.613	12.900	0.000	Significant
DFL → SP	0.327	6.509	0.000	Significant
GI → SP	0.558	10.293	0.000	Significant

The results show that Digital Financial Literacy positively and significantly affects Green Investment ($\beta = 0.613$; $t = 12.900$; $p < 0.001$). Digital Financial Literacy also has a positive and significant effect on Sustainability Performance ($\beta = 0.327$; $t = 6.509$; $p < 0.001$). Furthermore, Green Investment positively and significantly affects Sustainability Performance ($\beta = 0.558$; $t = 10.293$; $p < 0.001$). Thus, all direct-effect hypotheses are supported.

4.6.2 Indirect Effect

Table 4.24. Path Coefficient Bootstrapping Results—Indirect Effect

Relationship	Original Sample (O)	T-Statistics	P-Values	Conclusion
DFL → GI → SP	0.342	8.171	0.000	Significant

The indirect effect of Digital Financial Literacy on Sustainability Performance through Green Investment is positive and significant ($\beta = 0.342$; $t = 8.171$; $p < 0.001$). This finding confirms that Green Investment significantly mediates the relationship between Digital Financial Literacy and Sustainability Performance. Thus, the mediation hypothesis is supported.

Overall Findings

Overall, the results demonstrate that Digital Financial Literacy plays an important role in encouraging Green Investment and improving MSME Sustainability Performance. Green Investment also serves as a significant mechanism through which Digital Financial Literacy contributes to Sustainability Performance, as evidenced by the significant indirect effect. The findings further indicate that strengthening digital financial capabilities alone is not sufficient; translating these capabilities into environmentally oriented investment decisions is important for achieving stronger sustainability outcomes.

DISCUSSION

1. The Effect of Digital Financial Literacy on Green Investment

The SEM-PLS results indicate that digital financial literacy has a positive and significant effect on green investment among MSMEs. Most dimensions, including Digital Financial Data Analysis, Digital Financial Management, and Digital Transaction Skills, demonstrate positive and significant effects, whereas Fintech Platform Literacy has a positive but insignificant effect. Overall, the findings suggest that stronger digital financial literacy encourages MSMEs to allocate resources toward environmentally sustainable investments. For coffee-processing MSMEs, digital financial literacy enables business owners to analyze production costs and evaluate investments in energy-efficient roasting and packaging equipment. Coffee waste can also be processed into organic fertilizer or other products, supporting circular economy practices. Similarly, weaving MSMEs can use financial information to invest in sustainable raw materials, natural dyes, and more efficient production equipment.

In printing MSMEs, digital bookkeeping applications enable business owners to monitor paper, ink, and electricity costs and subsequently invest in energy-efficient printing machines, environmentally friendly inks, and print-on-demand systems to reduce paper waste. These practices improve operational efficiency while reducing environmental impacts. From the Resource-Based View (RBV) perspective, digital financial literacy represents a strategic intangible resource that enhances MSMEs' ability to access financial information, manage resources efficiently, and make effective investment decisions. From the Theory of Planned Behavior (TPB) perspective, digital financial literacy can strengthen positive attitudes toward green investment, perceived behavioral control, and confidence in adopting sustainable business practices. However, the insignificant effect of Fintech Platform Literacy indicates that merely understanding fintech platforms is insufficient to stimulate green investment. More practical capabilities, particularly financial data analysis, digital financial management, and digital transaction skills, appear to play a more important role. These findings are consistent with Millaningtyas et al. (2024), Prihastiwi et al. (2023), D'Ignazio et al. (2024), and Hung (2023), who emphasize the importance of financial literacy and digitalization in supporting sustainable investment and business transformation. Therefore, improving digital financial literacy should be considered an important strategy for encouraging MSMEs to adopt greener and more sustainable business practices.

2. The Effect of Digital Financial Literacy on MSME Sustainability Performance

The results show that digital financial literacy has a positive but insignificant effect on MSME sustainability performance. The relationship has a positive path coefficient, but the effect does not meet the statistical significance threshold, as indicated by a t-statistic of 1.469 (<1.96) and a p-value of 0.142 (>0.05). Therefore, the hypothesis proposing a significant direct effect of digital financial literacy on sustainability performance is not supported. This finding suggests that although digital financial literacy may contribute to improved sustainability performance, its direct influence is insufficient to generate significant changes in the economic, social, and environmental dimensions of MSME sustainability. For example, digital financial literacy can help laundry businesses monitor electricity, water, detergent, and operating costs and encourage the adoption of energy-efficient machines and environmentally friendly detergents. Agricultural-processing MSMEs can use digital financial information to evaluate efficient machinery and convert organic waste into compost or animal feed. Furniture MSMEs can utilize wood residues to produce additional products, while mobile-phone retailers can use digital payments, electronic inventory systems, and digital receipts to improve operational and environmental efficiency.

From the RBV perspective, digital financial literacy constitutes an intangible strategic resource. However, possessing this resource does not automatically produce superior sustainability performance unless it is transformed into appropriate strategies and operational practices. Similarly, the TPB suggests that knowledge alone does not necessarily translate into actual

behavior. MSMEs also require appropriate attitudes, social support, commitment, and perceived behavioral control to implement sustainable practices. Importantly, the results indicate that the effect of digital financial literacy on sustainability performance is more likely to occur indirectly through green investment. Thus, digital financial literacy functions primarily as an enabler of sustainable decision-making rather than as a direct determinant of sustainability performance. These findings are consistent with D'Ignazio et al. (2024) and Prihastiwi et al. (2023), who indicate that financial literacy and digital capabilities contribute to sustainability through investment, innovation, and other concrete sustainable business practices. Therefore, digital financial literacy needs to be accompanied by practical sustainability strategies, particularly green investment, to generate stronger improvements in MSME sustainability performance.

3. The Effect of Green Investment on MSME Sustainability Performance

The findings demonstrate that green investment has a positive and significant effect on MSME sustainability performance. The path coefficient is 0.513, with a t-statistic of 8.056 (>1.96) and a p-value of 0.000 (<0.05). Therefore, the hypothesis that green investment positively affects MSME sustainability performance is supported. This finding confirms that green investment is an important mechanism for improving MSME sustainability. Under Stakeholder Theory, investments in environmentally friendly technologies, energy efficiency, and waste management represent MSMEs' responses to stakeholder expectations while simultaneously generating economic, social, and environmental benefits. Green investment can include energy-efficient equipment, sustainable raw materials, waste reduction, environmentally friendly production processes, and resource-efficient technologies. For example, garment MSMEs can replace old sewing machines with energy-efficient equipment, reuse fabric waste to produce accessories, and adopt recyclable packaging. Printing MSMEs can separate and reuse paper waste, adopt environmentally friendly ink, and implement digital administrative systems to reduce paper consumption.

These practices support the principles of the circular economy by improving resource efficiency, reducing waste, and creating additional economic value. Green investment also aligns with the RBV, as environmentally friendly technologies, efficient production systems, and sustainable innovations can become strategic capabilities that strengthen long-term competitive advantage. The findings are consistent with Pangarso et al. (2022), Hung (2023), and Prihastiwi et al. (2023), which highlight the contribution of green investment and green economy practices to sustainable business development. In South Sulawesi, for example, some culinary MSMEs have begun managing used cooking oil through partnerships with waste banks or collection companies. Food waste can also be converted into animal feed, while organic waste can be processed into compost. Such practices illustrate how green investment and circular economy principles can simultaneously reduce environmental impacts and generate additional economic value. Overall, the findings confirm that the greater the implementation of green investment, the stronger the sustainability performance of MSMEs. Green investment should therefore be viewed not merely as an environmental initiative but also as a strategic business approach for strengthening competitiveness and long-term sustainability.

4. The Mediating Role of Green Investment in the Relationship Between Digital Financial Literacy and MSME Sustainability Performance

The results indicate that green investment positively and significantly mediates the relationship between digital financial literacy and MSME sustainability performance. Although digital financial literacy does not have a significant direct effect on sustainability performance, it contributes to sustainability through green investment. This finding suggests that digital financial literacy provides MSMEs with the ability to obtain, understand, and manage digital financial information, while green investment serves as the mechanism that transforms this capability into tangible sustainability outcomes. From the RBV perspective, digital financial literacy represents a valuable intangible resource that enhances financial planning, investment evaluation, and business

decision-making. However, resources alone do not automatically create superior performance. Green investment provides the mechanism through which digital financial capabilities are transformed into concrete environmental, economic, and social outcomes.

MSMEs with higher digital financial literacy are better positioned to evaluate the economic and environmental benefits of investments in energy-efficient technologies, waste management, sustainable materials, and environmentally friendly production processes. Consequently, green investment acts as a transformation mechanism that converts digital financial capabilities into improved sustainability performance. The findings are also consistent with the concept of green finance, in which financial knowledge and resources are directed toward investments that support environmental sustainability. Digital financial literacy provides the knowledge base for identifying and evaluating green investment opportunities, while green investment represents the practical implementation that generates sustainability outcomes. For restaurants and retail businesses, for example, digital financial applications can be used to calculate electricity, water, waste-management, and investment costs. Based on this information, business owners can invest in energy-efficient equipment, environmentally friendly packaging, and improved waste-management systems.

The findings are consistent with Prihastiwati et al. (2023), Hung (2023), and D'Ignazio et al. (2024), which emphasize the importance of financial literacy, digitalization, and green investment in supporting sustainable business transformation. The mediation results also provide an important explanation for the relationship among the variables. Digital financial literacy significantly affects green investment, while green investment significantly affects sustainability performance; however, the direct effect of digital financial literacy on sustainability performance is insignificant. This pattern indicates that improving MSME sustainability is more effective when digital financial capabilities are translated into concrete green investment decisions. Thus, green investment serves as an important bridge between digital financial literacy and sustainability performance. The finding contributes to the empirical gap by explaining why previous studies may have reported inconsistent relationships between digital financial literacy and sustainability. It also addresses the contextual gap by providing empirical evidence from MSMEs in South Sulawesi and strengthens the methodological contribution by demonstrating the importance of examining indirect relationships using SEM-PLS. Overall, the findings confirm that digital financial literacy alone is insufficient to substantially improve MSME sustainability performance. Its benefits become more meaningful when translated into green investment decisions that support economic efficiency, environmental responsibility, and long-term business sustainability.

CONCLUSION

1. Conclusion

Based on the empirical findings, this study concludes that digital financial literacy has a positive and significant effect on green investment among MSMEs. The results indicate that MSMEs with stronger capabilities in understanding, managing, and utilizing digital financial information are more likely to undertake environmentally oriented investments. Digital financial literacy enables MSME owners to evaluate financial information, assess investment alternatives, and allocate resources toward activities that generate both economic and environmental benefits. Furthermore, digital financial literacy has a positive but insignificant effect on MSME sustainability performance. Although improvements in digital financial literacy tend to be associated with better sustainability outcomes, the direct effect is not statistically sufficient to establish a significant relationship. This finding suggests that financial knowledge and digital capabilities alone do not automatically translate into improved economic, social, and environmental performance. Their contribution to sustainability requires implementation through concrete strategic and operational actions.

The study also confirms that green investment has a positive and significant effect on MSME sustainability performance. Investments in energy-efficient technologies, environmentally

friendly materials, waste management, and resource-efficient production processes contribute to improved sustainability performance. Therefore, green investment represents not only an environmental initiative but also a strategic mechanism for strengthening MSME efficiency, competitiveness, and long-term business resilience. Finally, green investment positively and significantly mediates the relationship between digital financial literacy and MSME sustainability performance. This finding demonstrates that digital financial literacy generates greater sustainability benefits when translated into concrete green investment decisions. Accordingly, green investment serves as a critical mechanism connecting MSMEs' digital financial capabilities with improvements in economic, social, and environmental performance.

2. Theoretical Implications

This study provides several theoretical implications. First, the findings strengthen the Resource-Based View (RBV) by demonstrating that digital financial literacy can function as a strategic intangible resource that enhances MSMEs' ability to identify and evaluate investment opportunities. However, the findings also indicate that possessing such resources does not automatically produce superior sustainability performance. The resource must be transformed into productive strategic actions, particularly green investment. Second, the findings contribute to the Theory of Planned Behavior (TPB) by demonstrating that financial knowledge and digital capabilities may facilitate sustainable decision-making but do not necessarily translate directly into sustainable outcomes. Actual implementation may depend on behavioral intentions, perceived control, business conditions, and other contextual factors. Third, the significant mediating role of green investment extends the theoretical understanding of the digitalization–sustainability relationship. Rather than assuming a direct relationship between digital financial literacy and sustainability performance, this study demonstrates that the relationship can operate through an investment mechanism. This provides a more comprehensive explanation of how digital financial capabilities can ultimately generate sustainability outcomes among MSMEs.

3. Managerial and Practical Implications

The findings provide important implications for MSME owners and managers. MSMEs should strengthen digital financial capabilities through continuous learning, training, and practical utilization of digital financial applications. These capabilities should not be limited to digital payment activities but should include financial data analysis, cash-flow management, budgeting, investment evaluation, and risk assessment. MSMEs should also gradually integrate green investment into their business strategies. Priority can be given to investments with both economic and environmental benefits, including energy-efficient equipment, sustainable raw materials, recyclable packaging, digital administrative systems, and effective waste-management technologies. Such investments can reduce operating costs, improve resource efficiency, strengthen environmental performance, and enhance long-term competitiveness. For policymakers, the findings highlight the importance of integrating digital financial literacy programs with green MSME development policies. Government institutions and relevant stakeholders can provide training, technical assistance, financing facilities, and incentives for MSMEs that adopt environmentally responsible technologies and business practices. An integrated policy approach may be more effective than implementing digital financial literacy and environmental programs separately.

4. Limitations and Future Research

Despite its contributions, this study has several limitations. First, the research focuses on MSMEs and therefore the findings may not be directly generalizable to larger enterprises or other organizational contexts. Second, the study examines digital financial literacy, green investment, and sustainability performance within a specific research context, which may limit the applicability of the findings to other regions or economic sectors. Future research should therefore consider

expanding the geographical coverage and increasing the number and diversity of respondents. Further studies could also incorporate additional variables, such as digital innovation, entrepreneurial orientation, green financial access, environmental awareness, government support, technological capability, and green innovation. Longitudinal research would also be valuable for examining how improvements in digital financial literacy and green investment influence MSME sustainability performance over time. Future studies may additionally employ comparative approaches across sectors or regions to determine whether the strength of these relationships differs according to business characteristics and institutional environments. Such extensions would provide a more comprehensive understanding of the mechanisms through which digital financial capabilities contribute to sustainable MSME development.

5. Final Implications

Overall, this study demonstrates that digital financial literacy alone is insufficient to directly generate significant improvements in MSME sustainability performance. Its strategic value becomes more apparent when it enables business owners to make informed green investment decisions. Green investment consequently represents the key mechanism through which digital financial capabilities can be transformed into tangible sustainability outcomes. The study therefore highlights the importance of an integrated approach combining digital financial literacy, green investment, and sustainable business practices. Strengthening these three elements simultaneously can help MSMEs improve resource efficiency, reduce environmental impacts, enhance economic resilience, and create long-term value for stakeholders. These findings provide empirical evidence that sustainable MSME development requires not only knowledge and technological capabilities but also the effective translation of those capabilities into strategic investments and concrete business practices.

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