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Green Finance Accessibility and Sustainable Economic Development: The Roles of Financial Literacy, Green Investment Capability, and Institutional Support

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Abstract: Access to green financing remains a challenge for micro, small, and medium enterprises (MSMEs), particularly in developing environmentally friendly investments and supporting sustainable economic development. This study aims to analyze the influence of financial literacy and institutional support on green financing accessibility, green investment capability, and sustainable economic development, including the mediating role of these two variables. The study used a quantitative approach with an explanatory cross-sectional survey design. Data were collected through purposive sampling from 300 MSME owners or managers and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4. All eight tested direct paths were positive and statistically significant. Financial literacy and institutional support were positively associated with green financing accessibility and green investment capability. Institutional support, green financing accessibility, and green investment capability also demonstrated significant positive associations with sustainable economic development. Furthermore, the mediation analysis identified significant indirect associations through green financing accessibility and green investment capability. This study broadens understanding of the interrelationships between financial literacy, institutional support, green financing, and green investment in supporting the economic sustainability of MSMEs. Practically, these findings emphasize the importance of improving financial literacy, facilitating access to green financing, and strengthening environmentally friendly investment capabilities.

Keywords: Financial Literacy; Institutional Support; Green Financing Accessibility; Green Investment Capability; Sustainable Economic Development

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INTRODUCTION

Sustainable economic development is increasingly important in addressing the challenges of economic growth, resource constraints, and increasing pressures on the environment. Economic development is no longer solely measured by increases in production, income, or business expansion, but must also consider the efficiency of resource use and the ability to sustain

economic activity in the long term (Cong et al., 2026). In this context, a green economy is a relevant approach because it encourages productive activities that generate economic benefits while reducing the waste of energy, raw materials, and natural resources. Micro, small, and medium enterprises (MSMEs) play a strategic role in this process because they play a role in job creation, equitable distribution of economic activity, and business development across various sectors (Putri et al., 2025). However, limited financial resources, technology, knowledge, and management capacity can hinder the ability of MSMEs to adopt more sustainable business practices. Therefore, sustainable economic development at the MSME level requires an approach that considers not only access to financial resources but also the ability of business actors to utilize those resources productively and responsibly towards the environment (Schrank & Kijkasiwat, 2024).

One instrument with the potential to support the transition of MSMEs toward sustainable business activities is green finance. Green finance can help businesses provide financial resources for investments that support energy efficiency, the use of more environmentally friendly technologies, waste reduction, and more effective use of raw materials. For MSMEs, such investments can be a means to improve operational efficiency while strengthening the sustainability of business activities. However, the need for green finance is not always matched by the ability to obtain and utilize it (Mugisha & Ahenkan, 2026). MSMEs may face limited capital, uncertainty about investment benefits, difficulty meeting financing requirements, and limited information about available financial products. These conditions indicate that the existence of green financing products alone is not enough to drive changes in business practices. Their effectiveness also depends on the extent to which business actors can access financing sources that are appropriate to their needs and business characteristics and use them to support sustainable economic activities (Woode, 2024).

In this study, Green Finance Accessibility is understood as the level of ease for MSMEs in obtaining information, understanding requirements, accessing application procedures, and accessing financing services aimed at environmentally friendly business activities. This concept needs to be distinguished from financing realization because ease of access to services does not automatically mean that a business has received a loan or obtained investment funds (A. Khan et al., 2026). Accessibility encompasses several interrelated aspects, namely the availability of information, clarity of administrative requirements, opportunities to apply for financing, affordability, and the availability of financial institutions accessible to businesses. For MSMEs, barriers in any of these aspects can reduce the opportunity to utilize green financing, even if the business has relevant investment needs (Adomako et al., 2016). Thus, the accessibility of green financing is a crucial factor that needs to be analyzed to understand how financial resources can support sustainable business activities. However, the level of accessibility is also potentially influenced by the internal characteristics of business actors and the available institutional support environment.

One internal factor thought to play a role in this process is financial literacy. Financial literacy relates to a business owner's ability to understand financial concepts, assess financing costs and obligations, compare funding alternatives, recognize investment risks, and plan for long-term financial needs (Mabula & Dong, 2018). For MSME owners, this capability can help them make more informed decisions when considering financing for environmentally friendly investments. Business owners with a better conceptual understanding of finance are better equipped to assess the suitability of financing products to their repayment capacity and investment needs. Financial literacy is also relevant to Green Investment Capability, as green investment decisions require the ability to estimate initial costs, evaluate economic benefits,

develop financing plans, and consider long-term benefits (Graña-Alvarez et al., 2024). Thus, financial literacy has the potential to be linked to both green financing accessibility and green investment capability. However, this relationship needs to be empirically tested, as sound financial literacy does not necessarily eliminate external barriers, such as limited financing products or financial institution requirements.

In addition to internal factors, institutional support is an external factor that can influence MSMEs' opportunities to develop green economic activities. This support can come from financial institutions, the government, business associations, supporting institutions, and other organizations involved in MSME development. This support includes providing information on green financing opportunities, assistance in meeting administrative requirements, training in sustainable business development, technical assistance, and facilitating access to financial services. Institutional support has the potential to reduce the information gap and help business actors understand financing processes that may have previously been difficult to access (Paterson et al., 2022). Furthermore, training and mentoring can help MSMEs identify investment needs and develop the ability to manage investments that support resource efficiency. Institutional support also has the potential to provide direct benefits to business sustainability through increased knowledge, access to support networks, and strengthened management capacity (Ngoasong et al., 2026). Therefore, the influence of institutional support needs to be considered not only in relation to the accessibility of green finance, but also to investment capabilities and sustainable economic outcomes at the business level.

Access to green financing, whether supported by financial literacy or institutional facilitation, does not necessarily automatically result in productive investments. Utilizing financial resources for environmentally friendly activities requires Green Investment Capability, namely the ability of business actors to identify investment opportunities that can improve resource efficiency, evaluate costs and benefits, develop financial plans, select appropriate technology or equipment, and monitor investment returns. This capability is crucial because green investments often involve initial outlays that need to be weighed against long-term economic benefits. Without the ability to evaluate investment feasibility, available financing runs the risk of not being optimally utilized or not producing the expected operational improvements (Khanra et al., 2022). Conversely, adequate investment capabilities can help businesses direct financial resources toward more productive and efficient activities. Within the Resource-Based View framework, these capabilities can be understood as internal abilities that help businesses utilize resources to generate value (Chin et al., 2026). Therefore, Green Investment Capability is positioned as a potential mechanism linking access to green finance with sustainable economic outcomes, as well as a variable that may explain the relationship between internal and external factors and business sustainability.

In this study, Sustainable Economic Development is operationalized at the MSME level as a sustainable economic outcome reflected in the efficiency of resource use, reduction of material and energy waste, the ability to maintain productive activities, the economic benefits of more efficient production processes, and business development with attention to environmental sustainability. This operationalization positions sustainability as part of business management and development, rather than as a direct measure of regional or national economic growth. Sustainable economic outcomes can be related to a business's ability to control resource use, reduce unproductive costs, and maintain economic activity in the long term. From a sustainable development perspective, these outcomes reflect efforts to link economic goals with more responsible resource management (Wang et al., 2022). In the context of MSMEs, accessibility to

green financing has the potential to provide resources to support production process improvements, while green investment capabilities help ensure that these resources are directed toward relevant investments. Institutional support can also contribute through facilitation, training, and mentoring. However, the link between these factors and sustainable economic outcomes cannot be assumed automatically and requires examination of both direct and indirect mechanisms (M. A. Khan et al., 2022).

Conceptually, the relationships between constructs in this study can be explained through four complementary perspectives. The Resource-Based View emphasizes the importance of internal resources and capabilities, thus financial literacy and green investment capabilities are seen as relevant to the ability of MSMEs to manage economic opportunities. Institutional Theory provides a basis for understanding how institutional support and the institutional environment can relate to access to financing and business development. Meanwhile, the Financial Capability Perspective explains the importance of financial knowledge and capabilities in understanding financing options and making appropriate investment decisions. The Sustainable Development Perspective provides a basis for assessing business outcomes not only based on short-term economic benefits, but also through resource efficiency and the sustainability of productive activities (Fu et al., 2024). Based on the integration of these perspectives, this study proposes that Financial Literacy and Institutional Support have the potential to be related to Green Finance Accessibility and Green Investment Capability. Furthermore, Green Finance Accessibility is expected to be related to Green Investment Capability and Sustainable Economic Development, while Green Investment Capability is expected to be related to Sustainable Economic Development. Institutional support is also tested for its direct influence on sustainable economic outcomes. This relationship structure allows the study to distinguish direct influences from those that operate through one or more intermediary variables.

Previous studies have examined financial literacy, financing access, and green business capabilities, whereas this study considers their relationships jointly with institutional support and MSME-level sustainable economic outcomes (Graña-Alvarez et al., 2024; Khanra et al., 2022; Widyastuti et al., 2023). First, a more focused understanding of green financing accessibility at the MSME level is needed, particularly when accessibility is distinguished from actual financing receipt and linked to sustainable economic outcomes. Second, the relationship between financial literacy and access to green financing and green investment capability needs to be examined simultaneously to understand the role of financial capacity in business decision-making. Third, green investment capability needs to be positioned as a potential mechanism explaining how access to financing relates to resource efficiency and the sustainability of economic activities. Fourth, the role of institutional support needs to be analyzed by considering its contribution to financing accessibility, investment capability development, and business outcomes. Fifth, the relationships between these factors require testing in an integrated model that encompasses direct, mediating, and chain mediation effects. These gaps are not intended to imply that each relationship has not been studied, but rather indicate the need to examine the extent to which these relationships have been comprehensively explained in the context of MSMEs and the measurement of sustainable economic outcomes at the business level.

The scientific novelty of this study lies in its integrated examination of the mechanisms through which financial capabilities and institutional support are associated with sustainable economic outcomes among micro, small, and medium enterprises (MSMEs). Rather than treating green financing accessibility and green investment capability as independent determinants of business sustainability, this study positions both constructs as interconnected mediating

mechanisms within a unified structural model. Specifically, the proposed framework distinguishes the direct contributions of financial literacy and institutional support from the indirect pathways operating through green financing accessibility and green investment capability, including their sequential mediation effects. A further conceptual contribution is the distinction between perceived accessibility to green financing and MSMEs' reported capability to identify, plan, implement, and monitor environmentally responsible investments, without equating either construct with actual financing receipt or verified investment outcomes. Moreover, sustainable economic development is operationalized at the enterprise level through resource efficiency, waste reduction, continuity of productive activities, and economic benefits associated with sustainable business practices. By empirically examining these relationships using Partial Least Squares Structural Equation Modeling (PLS-SEM), this study contributes a more detailed explanation of how internal financial capabilities and external institutional conditions are associated with sustainable economic outcomes through interconnected financing and investment mechanisms. These findings extend the analytical understanding of green finance by identifying specific direct and indirect pathways that may inform the development of more integrated financial and institutional support strategies for MSMEs.

In line with the conceptual framework, this study aims to analyze the influence of Financial Literacy on Green Finance Accessibility and Green Investment Capability, as well as the influence of Institutional Support on Green Finance Accessibility, Green Investment Capability, and Sustainable Economic Development. This study also aims to examine the influence of Green Finance Accessibility on Green Investment Capability and Sustainable Economic Development, as well as the influence of Green Investment Capability on Sustainable Economic Development. In addition, the study examines three mediation mechanisms, namely the role of Green Investment Capability in the relationship between Green Finance Accessibility and Sustainable Economic Development, the role of Green Finance Accessibility in the relationship between Institutional Support and Sustainable Economic Development, and the sequential mediation of green financing accessibility and green investment capability in the relationships of institutional support and financial literacy with sustainable economic development. All of these relationships are formulated into 12 hypotheses and will be tested using a quantitative approach with a cross-sectional explanatory survey design and Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis. Through this approach, the research is expected to explain the direct and indirect links between financial literacy, institutional support, green financing accessibility, green investment capabilities, and sustainable economic outcomes at the MSME level.

METHOD

This study uses a quantitative approach with an explanatory cross-sectional survey design to analyze the relationship between financial literacy, institutional support, green finance accessibility, green investment capability, and sustainable economic development at the business level. Data were collected using a structured questionnaire based on the conceptual definitions and indicators of each research variable. This approach allows for testing of direct and indirect relationships between variables, including the mediating role of green finance accessibility and green investment capability in explaining the link between financial factors, institutional support, and business sustainability outcomes. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4. The choice of this method is based on the research objective to test a model of relationships between constructs involving multiple structural paths and mediating mechanisms. Due to the cross-sectional nature of the study design,

the relationships found will be interpreted as statistical relationships based on data from a single collection period, rather than as definitive evidence of temporal causality.

The study population comprised owners or managers of micro, small, and medium enterprises (MSMEs) engaged in productive activities who had experience, knowledge, or concrete investment plans aimed at improving resource efficiency or reducing environmental impacts. The research context included MSMEs in the manufacturing, agribusiness, food production, production-based creative industries, waste management, and productive energy use sectors, as well as businesses implementing or planning to use energy-efficient technologies. The survey was conducted among eligible MSMEs operating in the productive sectors covered by the study, with data collected during a single survey period to assess their financing conditions, green investment capabilities, and sustainable economic development outcomes. The sample was selected using a purposive sampling technique based on criteria relevant to the research objectives. Respondents must be at least 18 years old, be MSME owners or managers, be involved in business financial decision-making, have at least one year of business management experience, understand business financing or investment needs, and have experience, knowledge, or concrete plans regarding environmentally friendly business activities. Willingness to participate was also a requirement. The initial target of the study was 300 respondents, while the final sample size was determined based on statistical adequacy, statistical power considerations, and feasibility of access to the target population. Following eligibility screening, the final analytical sample comprised 300 MSME owners or managers, with one respondent representing each business.

The research unit of analysis was MSMEs, with one primary respondent representing each business. Owners or managers directly involved in financial decisions were selected because they were deemed to possess relevant knowledge regarding financing conditions, investment needs, resource management, and business development direction. The primary data source came from a structured questionnaire completed by respondents based on their business conditions and experience. Where available and with the necessary permits, supporting information regarding financing experience, green investment, annual turnover, energy costs, raw material use, and business productivity can be used to strengthen the interpretation of the survey results. The operationalization of the variables includes five constructs with six indicators each. Financial literacy (X1) measures financial knowledge and capabilities relevant to managing business financing and investment through indicators X1.1–X1.6. Institutional support (X2) measures perceived support from financial institutions, the government, and supporting institutions through indicators X2.1–X2.6. Green financing accessibility (M1) measures the availability of information, clarity of requirements, application opportunities, ease of procedures, affordability, and access to green financing services through indicators M1.1–M1.6. Green investment capability (M2) measures the ability to identify opportunities, evaluate costs and benefits, plan, select technology, implement, and monitor green investments through indicators M2.1–M2.6. Meanwhile, sustainable economic development at the business level (Y) is measured using indicators Y.1–Y.6, which include resource efficiency, reduction of material and energy waste, sustainability of productive activities, economic benefits from efficiency, and business development that takes sustainability into account.

Perception indicators were measured using a five-point Likert scale, with categories 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. Specifically, measuring financial literacy requires distinguishing respondents' perceptions of their financial capabilities from objective financial knowledge. In this study, financial literacy was assessed using six self-reported indicators measured on a five-point Likert scale to capture respondents'

perceived financial knowledge and capabilities. Instrument development was carried out through establishing indicators based on relevant literature, expert assessment of conceptual suitability and wording clarity, and pilot testing to evaluate question understandability and instrument feasibility. Revisions were made if items were found to be ambiguous or inappropriate for the MSME context. Before data collection, eligibility criteria and respondent recruitment procedures were established to identify MSME owners or managers who met the study requirements. Respondents were provided with information regarding the purpose of the study, the voluntary nature of participation, and the use of data. Confidentiality and anonymity of respondents were maintained in accordance with procedures actually implemented in the study. After data collection, responses were checked for completeness, identification of responses that did not meet the criteria, checking for values outside the measurement range, and data cleaning prior to statistical analysis.

Data analysis was conducted in four stages. The first stage was data screening and descriptive statistics, including checking for missing data, invalid responses, answer consistency, respondent characteristic distribution, and the mean and standard deviation values of indicators or constructs. The second stage was measurement model evaluation. For reflective constructs, the evaluation included outer loadings, Cronbach's Alpha, Composite Reliability, Average Variance Extracted (AVE), and Heterotrait-Monotrait Ratio (HTMT) to assess reliability, convergent, and discriminant validity. If a construct is determined to be formative based on its theory and conceptual definition, the evaluation was tailored to the characteristics of formative measurement, including indicator collinearity, significance and relevance of outer weights, content validity, and convergent validity using appropriate procedures. Therefore, the type of measurement model for each construct should be determined based on theoretical foundations, rather than by assuming that all constructs are reflective. The third stage is the evaluation of the structural model by examining the Variance Inflation Factor (VIF), path coefficients, R^2 and adjusted R^2 values, f^2 effect sizes, and the model's predictive ability using PLSpredict if appropriate to the analysis objectives. Potential control variables considered include firm age, firm size, business sector, annual revenue, owner education, previous financing experience, and previous green investment experience. Control variables are included only if they are theoretically relevant and have been specified in the analysis design.

The fourth stage is hypothesis testing and mediation analysis using a bootstrapping procedure with 5,000 resamples, a 5% significance level, and a 95% confidence interval. The testing covers eight direct influence paths, namely H1 to H8, and four indirect paths, namely H9 to H12, according to the research conceptual framework. The indirect influence analysis is conducted by examining specific indirect effects, while direct effects and total effects are used to understand the relationship patterns between constructs more comprehensively. Decisions regarding hypotheses are based on the direction and magnitude of the path coefficients, t-statistics, p-values, and confidence intervals obtained from the data processing results. The mediation effect is assessed based on the results of the indirect influence test, not only on the significance of individual paths. The statistical results, including path coefficients, t-statistics, and significance levels, were reported based on the SmartPLS output. This procedure is expected to produce a systematic evaluation of the measurement quality, strength of structural relationships, predictive ability, and mediation mechanisms in explaining the relationship between financial literacy, institutional support, green financing accessibility, green investment capability, and sustainable economic development at the MSME level.

RESULTS AND DISCUSSION

Research Results

1) Respondent Characteristics and Data Screening

The initial examination of the research data included the completeness of observations, the uniqueness of respondent identities, the appropriateness of indicator value ranges, and the consistency of the data structure. The research file contained 300 observations with 45 columns, consisting of respondent identities and characteristics, business profiles, 30 measurement indicators for the five research constructs, and the average score for each construct. The examination results showed no missing values in any column, no duplicate respondent IDs were found, and all indicators fell within the 1–5 range according to the measurement scale used. Therefore, all 300 observations met the initial data completeness and value range checks and could proceed to the next stage of analysis. However, this check does not, by itself, ensure the validity of the responses, detect all possible anomalous responses, or prove the validity and reliability of the instrument. Further evaluation is still needed through examination of response patterns and testing of the measurement and structural models using SmartPLS 4.

Table 1. Respondent Characteristics and MSME Profile

Characteristics	Category	Frequency (n)	Percentage (%)
Gender	Male	178	59.3
	Female	117	39.0
	Choose not to answer	5	1.7
Age	18–25 years	30	10.0
	26–35 years	75	25.0
	36–45 years	90	30.0
	46–55 years	78	26.0
	Over 55 years old	27	9.0
Owner's education	High School/Vocational School	117	39.0
	Diploma	26	8.7
	S1	136	45.3
	S2 or above	21	7.0
Business sector	Processing industry	68	22.7
	Food production	68	22.7
	Agribusiness	49	16.3
	Production-based creative industry	45	15.0
	Businesses with productive energy use	25	8.3
	Energy saving technology	24	8.0
	Waste treatment	21	7.0
Business age	1–3 years	84	28.0
	4–6 years	79	26.3
	7–10 years	77	25.7
	Over 10 years	60	20.0
Business size	Micro	166	55.3
	Small	103	34.3
	Medium	31	10.3
Annual income	Under Rp. 300 million	171	57.0
	Rp. 300 million–Rp. 2.5 billion	90	30.0
	Above Rp2.5 billion–Rp50 billion	39	13.0
Previous financing experience	Yes	178	59.3
	No	122	40.7
Previous green investment experience	Yes	144	48.0
	No	156	52.0

Respondent characteristics show that males dominated the sample with 178 respondents (59.3%), while females comprised 117 respondents (39.0%). In terms of age, the 36–45 age group was the largest, with 90 respondents (30.0%), followed by the 46–55 age group with 78

respondents (26.0%), and the 26–35 age group with 75 respondents (25.0%). This composition indicates that the majority of respondents were in the productive adult age group. Based on the owner's education, respondents with a bachelor's degree were the largest group, with 136 respondents (45.3%), followed by high school/vocational school graduates with 117 respondents (39.0%). These variations in educational background provide context for understanding differences in financial knowledge and investment decision-making approaches among MSME owners or managers.

In terms of business characteristics, the food processing and production sectors each comprised 68 businesses (22.7%), followed by agribusiness with 49 businesses (16.3%), and production-based creative industries with 45 businesses (15.0%). Based on business age, the 1–3 year group was the largest category with 84 businesses (28.0%), while 60 businesses (20.0%) had been operating for more than 10 years. In terms of business size, the micro category dominated the sample with 166 businesses (55.3%), followed by small businesses with 103 businesses (34.3%) and medium businesses with 31 businesses (10.3%). In addition, 171 businesses (57.0%) reported annual revenues below Rp300 million. This profile indicates that the sample encompasses MSMEs with diverse scales, operational experience, activity sectors, and income levels.

Green financing and investment experience also provides insight into respondents' financial context. A total of 178 respondents (59.3%) reported having previous financing experience, while 122 respondents (40.7%) had no such experience. Meanwhile, 144 respondents (48.0%) reported green investment experience, compared to 156 respondents (52.0%) who did not. These differences in experience are relevant for assessing green financing accessibility and green investment capability, as respondents may have varying levels of exposure to financing processes and investment practices oriented toward resource efficiency. However, these descriptive characteristics do not yet demonstrate statistical relationships or effects between variables. Further testing is needed to determine how financial literacy, institutional support, green financing accessibility, and green investment capability relate to sustainable economic development at the business level.

2) Descriptive Statistics

Table 2. Descriptive Statistics of Research Variables

Variables	Code	Mean	Standard deviation	Minimum	Maximum
Financial Literacy	X1	3.065	1.066	1.000	5.000
Institutional Support	X2	3.073	1.090	1.000	5.000
Green Financing Accessibility	M1	3.064	1.050	1.000	5.000
Green Investment Capability	M2	2.998	1.021	1.000	5.000
Sustainable Economic Development	Y	2.971	1.046	1.000	5.000

Descriptive statistics show that institutional support had the highest mean score of 3.073, followed by financial literacy at 3.065 and green financing accessibility at 3.064. These scores indicate that respondents' perceptions of the three variables were around the midpoint of the five-point Likert scale. Meanwhile, green investment capability had a mean score of 2.998, while sustainable economic development had an average score of 2.971. Both scores were also around the midpoint of the scale, indicating that respondents' assessments of green investment capability and the achievement of sustainable economic development in MSMEs did not show a strong tendency toward high ratings.

The standard deviation values for all variables ranged from 1.021 to 1.090, indicating variation in responses among respondents. Institutional support had the highest standard deviation at 1.090, while green investment capability had the lowest at 1.021. Furthermore, all

variables had a minimum value of 1 and a maximum of 5, indicating that respondents used the full range of answer options. These descriptive findings provide an initial overview of the characteristics of the research data before evaluating the measurement model and testing the relationships between variables using PLS-SEM.

3) Evaluation of Measurement Model

Table 3. Outer Loadings Test Results

Variables	Indicator	Outer Loading	Assessment criteria	Decision
Green Finance Accessibility (M1)	M1.1	0.872	≥ 0.70	Valid
	M1.2	0.761	≥ 0.70	Valid
	M1.3	0.851	≥ 0.70	Valid
	M1.4	0.832	≥ 0.70	Valid
	M1.5	0.860	≥ 0.70	Valid
	M1.6	0.862	≥ 0.70	Valid
Green Investment Capability (M2)	M2.1	0.784	≥ 0.70	Valid
	M2.2	0.873	≥ 0.70	Valid
	M2.3	0.764	≥ 0.70	Valid
	M2.4	0.835	≥ 0.70	Valid
	M2.5	0.846	≥ 0.70	Valid
	M2.6	0.843	≥ 0.70	Valid
Financial Literacy (X1)	X1.1	0.869	≥ 0.70	Valid
	X1.2	0.890	≥ 0.70	Valid
	X1.3	0.858	≥ 0.70	Valid
	X1.4	0.837	≥ 0.70	Valid
	X1.5	0.831	≥ 0.70	Valid
	X1.6	0.791	≥ 0.70	Valid
Institutional Support (X2)	X2.1	0.832	≥ 0.70	Valid
	X2.2	0.800	≥ 0.70	Valid
	X2.3	0.852	≥ 0.70	Valid
	X2.4	0.862	≥ 0.70	Valid
	X2.5	0.861	≥ 0.70	Valid
	X2.6	0.820	≥ 0.70	Valid
Sustainable Economic Development (Y)	Y.1	0.851	≥ 0.70	Valid
	Y.2	0.792	≥ 0.70	Valid
	Y.3	0.853	≥ 0.70	Valid
	Y.4	0.824	≥ 0.70	Valid
	Y.5	0.856	≥ 0.70	Valid
	Y.6	0.811	≥ 0.70	Valid

The results of the outer loadings test show that all 30 indicators in the five research constructs have values between 0.761 and 0.890. All of these values have met the minimum criterion of 0.70, so each indicator is declared valid based on the indicator validity criteria in the reflective measurement model. The highest outer loading value is found in indicator X1.2 at 0.890, indicating that this indicator has the strongest relationship with the financial literacy construct. Meanwhile, the lowest value is found in indicator M2.3 at 0.764, but the value is still above the recommended threshold.

In the green finance accessibility construct (M1), all indicators have outer loading values between 0.761 and 0.872. The green investment capability construct (M2) has a value between 0.764 and 0.873, while financial literacy (X1) shows a value between 0.791 and 0.890. Furthermore, the institutional support indicator (X2) has a value between 0.800 and 0.862, while sustainable economic development (Y) is in the range of 0.792 to 0.856. This range of values shows that all indicators in each construct have an adequate contribution in representing the measured variables.

Overall, these results support the feasibility of retaining all indicators in further analysis without elimination based on outer loading criteria. However, the validity of the measurement

model needs to be further evaluated using the Average Variance Extracted (AVE) value to ensure convergent validity is met. Furthermore, Cronbach's Alpha, rho_A, and Composite Reliability tests are needed to assess the internal consistency of each construct. Therefore, conclusions regarding the quality of the measurement model will be based on a comprehensive evaluation of the indicators, convergent validity, and construct reliability.

Table 4. Results of Construct Reliability and Convergent Validity Testing

Construct	Cronbach's Alpha	rho_A	Composite Reliability (rho_C)	AVE	Information
Green Finance Accessibility (M1)	0.917	0.922	0.935	0.706	Reliable and valid
Green Investment Capability (M2)	0.906	0.909	0.927	0.680	Reliable and valid
Financial Literacy (X1)	0.921	0.923	0.938	0.717	Reliable and valid
Institutional Support (X2)	0.915	0.919	0.934	0.702	Reliable and valid
Sustainable Economic Development (Y)	0.911	0.912	0.931	0.692	Reliable and valid

The test results show that all constructs have Cronbach's Alpha values between 0.906 and 0.921, rho_A values between 0.909 and 0.923, and Composite Reliability values between 0.927 and 0.938. All of these values are above the threshold of 0.70, thus indicating that each construct has good internal consistency and composite reliability. The highest Composite Reliability value is found in the financial literacy construct (X1), which is 0.938, while the lowest value is found in the green investment capability construct (M2), which is 0.927. Nevertheless, all constructs still meet the required reliability criteria.

From the convergent validity aspect, all constructs have an AVE value above 0.50. Financial literacy (X1) obtained the highest AVE value of 0.717, followed by green financing accessibility (M1) at 0.706, institutional support (X2) at 0.702, sustainable economic development (Y) at 0.692, and green investment capability (M2) at 0.680. These results indicate that each construct is able to explain more than 50% of the variance of its indicators. Thus, all constructs meet the criteria for reliability and convergent validity, so they can proceed to discriminant validity testing and structural model evaluation.

Table 5. Results of Discriminant Validity Test (HTMT)

Construct	M1	M2	X1	X2	Y
Green Finance Accessibility (M1)	—	—	—	—	—
Green Investment Capability (M2)	0.604	—	—	—	—
Financial Literacy (X1)	0.416	0.412	—	—	—
Institutional Support (X2)	0.452	0.465	0.245	—	—
Sustainable Economic Development (Y)	0.512	0.574	0.248	0.417	—

The results of the discriminant validity test using HTMT showed that all inter-variable values ranged from 0.245 to 0.604. The highest value was found in the relationship between green financing accessibility (M1) and green investment capability (M2), which was 0.604. Meanwhile, the lowest value was found in the relationship between financial literacy (X1) and institutional support (X2), which was 0.245. All of these values were below the threshold of 0.85 and 0.90, thus meeting the discriminant validity criteria.

These findings indicate that each construct has sufficient empirical distinction and can be distinguished from the others. Although green finance accessibility and green investment capability have the highest HTMT values, they are still below the recommended threshold. Therefore, there is no indication of discriminant validity issues based on the HTMT test results.

Overall, the test results support the feasibility of the measurement model in terms of discriminant validity. Therefore, the analysis can proceed to the structural model evaluation stage, including testing for collinearity using the Variance Inflation Factor (VIF), coefficient of

determination (R^2), effect size (f^2), predictive relevance (Q^2), and testing the path coefficients and research hypotheses.

4) Structural Model Evaluation

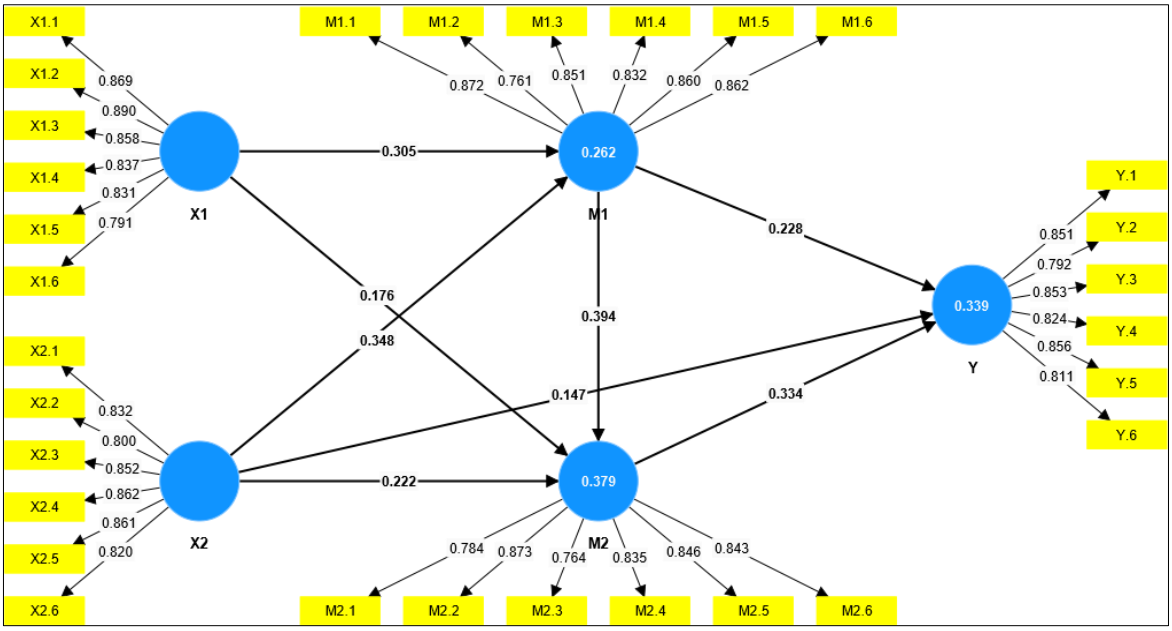


Figure 1. PLS-SEM Structural Model

The PLS-SEM structural model image shows the relationship between financial literacy (X1), institutional support (X2), green financing accessibility (M1), green investment capability (M2), and sustainable economic development (Y). The coefficient of determination shows that financial literacy and institutional support are able to explain 26.2% of the variation in green financing accessibility (R^2 = 0.262), while the model explains 37.9% of the variation in green investment capability (R^2 = 0.379) and 33.9% of the variation in sustainable economic development (R^2 = 0.339). The value on the path between variables describes the magnitude of the relationship estimated in the model, while the number on the indicator shows the outer loading value of each construct. In general, the model provides an overview of the relationship between financial literacy and institutional support factors with access to green financing, green investment capability, and sustainable economic development in MSMEs.

Table 6. Collinearity Test Results (Inner VIF)

Relationship between variables	VIF	Criteria	Information
M1 → M2	1.356	VIF < 5.00	There is no indication of collinearity
M1 → Y	1.531	VIF < 5.00	There is no indication of collinearity
M2 → Y	1.545	VIF < 5.00	There is no indication of collinearity
X1 → M1	1.055	VIF < 5.00	There is no indication of collinearity
X1 → M2	1.181	VIF < 5.00	There is no indication of collinearity
X2 → M1	1.055	VIF < 5.00	There is no indication of collinearity
X2 → M2	1.219	VIF < 5.00	There is no indication of collinearity
X2 → Y	1.297	VIF < 5.00	There is no indication of collinearity

The results of the collinearity test show that all VIF values are in the range of 1.055 to 1.545. The highest VIF value is found in the relationship between green investment capability (M2) and sustainable economic development (Y), which is 1.545, while the lowest values are found in the relationship between financial literacy (X1) and green financing accessibility (M1) and institutional support (X2) and green financing accessibility (M1), which are each 1.055.

All VIF values were below the threshold of 5.00, with none reaching 3.00. This finding indicates that the structural model exhibits no indication of collinearity that could interfere with the estimation of relationships between variables. Therefore, the predictor variables in the model can be used for further structural analysis without any indication of serious multicollinearity. The next step is to evaluate the model's ability to explain endogenous variables through the coefficient of determination (R^2).

Table 7. Results of the Coefficient of Determination (R^2) Test

Endogenous Variables	R-square (R^2)	Adjusted R-square	Interpretation Criteria	Information
Green Finance Accessibility (M1)	0.262	0.257	0.25 = weak; 0.50 = moderate; 0.75 = strong	Weak
Green Investment Capability (M2)	0.379	0.373	0.25 = weak; 0.50 = moderate; 0.75 = strong	Weak
Sustainable Economic Development (Y)	0.339	0.332	0.25 = weak; 0.50 = moderate; 0.75 = strong	Weak

The results of the coefficient of determination test indicate that the green financing accessibility variable (M1) has an R^2 value of 0.262 and an adjusted R-square of 0.257. Financial literacy and institutional support together accounted for 26.2% of the observed variance in green financing accessibility, while 73.8% of the variance remained unexplained by the predictors included in this model. This value indicates that the model's ability to explain green financing accessibility is in the weak category, although it has exceeded the reference limit of 0.25.

For the green investment capability variable (M2), the R^2 value of 0.379 with an adjusted R-square of 0.373 indicates that the predictor variables in the model are able to explain 37.9% of the variation in green investment capability. Meanwhile, the sustainable economic development variable (Y) obtained an R^2 value of 0.339 and an adjusted R-square of 0.332. These results indicate that the model is able to explain 33.9% of the variation in sustainable economic development in MSMEs. Based on the interpretation guidelines used, both variables are also in the weak category, but have higher explanatory power than the model for M1.

Overall, the R^2 values for the three endogenous variables ranged from 0.262 to 0.379. The relatively small difference between the R^2 and adjusted R-square values indicates that adjusting the number of predictors did not significantly change the model's explanatory power. This finding provides insight into the model's explanatory power, but does not yet demonstrate the significance of the relationships between variables or its predictive power outside the sample. Therefore, further evaluation should consider the effect size (f^2) and predictive relevance (Q^2) before drawing further conclusions about the quality of the structural model.

Table 8. Effect Size Test Results (f^2)

Relationship between variables	f^2	Interpretation Criteria	Information
M1 → M2	0.184	0.15–0.34	Moderate
M1 → Y	0.051	0.02–0.14	Small
M2 → Y	0.109	0.02–0.14	Small
X1 → M1	0.120	0.02–0.14	Small
X1 → M2	0.042	0.02–0.14	Small
X2 → M1	0.155	0.15–0.34	Moderate
X2 → M2	0.065	0.02–0.14	Small
X2 → Y	0.025	0.02–0.14	Small

The results of the effect size test indicate that the relationship between green finance accessibility (M1) and green investment capability (M2) has an f^2 value of 0.184, thus falling into the moderate effect category. Institutional support (X2) on green finance accessibility (M1) also shows a moderate effect, with an f^2 value of 0.155. These f^2 estimates indicate moderate

incremental explanatory contributions for the two relationships (0.184 and 0.155), while their statistical significance is evaluated separately through bootstrapping.

Meanwhile, the other six relationships showed small effects. The relationship between financial literacy (X1) and green financing accessibility (M1) had an f^2 value of 0.120, while the relationship between green investment capability (M2) and sustainable economic development (Y) was 0.109. The relationship between institutional support (X2) and green investment capability (M2) obtained a value of 0.065, green financing accessibility (M1) and sustainable economic development (Y) was 0.051, financial literacy (X1) and green investment capability (M2) was 0.042, and institutional support (X2) and sustainable economic development (Y) was 0.025.

Overall, the results indicate that the relative contributions of predictors in the model vary, with two relationships having medium effects and six relationships having small effects. No relationships reached the large effect category. However, the f^2 effect size does not indicate whether a relationship is statistically significant or whether the research hypothesis is accepted. This assessment should be based on bootstrapping results, while the model's predictive relevance needs to be further evaluated using the Q^2 value or the PLS-Predict procedure.

Table 9. Predictive Relevance Test Results (Q^2)

Construct	SSO	SSE	Q^2	Information
Green Finance Accessibility (M1)	1,800.000	1,474.205	0.181	Predictive relevance exists
Green Investment Capability (M2)	1,800.000	1,344.595	0.253	Predictive relevance exists
Financial Literacy (X1)	1,800.000	1,800.000	0.000	Not applicable (exogenous construct)
Institutional Support (X2)	1,800.000	1,800.000	0.000	Not applicable (exogenous construct)
Sustainable Economic Development (Y)	1,800.000	1,385.742	0.230	Predictive relevance exists

The results of the construct cross-validation redundancy test show that green finance accessibility (M1) has a Q^2 value of 0.181, green investment capability (M2) of 0.253, and sustainable economic development (Y) of 0.230. All three endogenous constructs have Q^2 values above 0, thus indicating predictive relevance in the model. The highest Q^2 value is found in green investment capability (M2), which is 0.253, followed by sustainable economic development (Y) of 0.230 and green finance accessibility (M1) of 0.181.

In contrast, financial literacy (X1) and institutional support (X2) each have a Q^2 value of 0.000. These values do not indicate predictive relevance as endogenous constructs in this test. This condition is consistent with the position of both variables as exogenous constructs in the model, which are not predicted by other constructs. Therefore, the primary interpretation of predictive relevance focuses on M1, M2, and Y.

Overall, these results indicate that the model has predictive relevance for the three endogenous constructs tested. However, the Q^2 value of construct cross-validation redundancy does not in itself prove that the model has high out-of-sample predictive ability. To assess out-of-sample predictive ability more comprehensively, these test results can be supplemented with PLS-Predict analysis.

Table 10. PLS-Predict Test Results at Indicator Level

Indicator	Q^2predict	PLS-SEM RMSE	PLS-SEM MAE	LM RMSE	LM MAE	RMSE Comparison
M1.1	0.223	1.105	0.922	1.138	0.943	PLS-SEM is lower
M1.2	0.138	1.183	0.966	1.199	0.972	PLS-SEM is lower
M1.3	0.158	1.169	0.976	1.202	1.009	PLS-SEM is lower
M1.4	0.155	1.098	0.913	1.123	0.920	PLS-SEM is lower
M1.5	0.180	1.159	0.956	1.195	0.985	PLS-SEM is lower
M1.6	0.189	1.113	0.937	1.142	0.962	PLS-SEM is lower

M2.1	0.095	1.167	0.969	1.195	1.000	PLS-SEM is lower
M2.2	0.183	1.143	0.948	1.168	0.970	PLS-SEM is lower
M2.3	0.153	1.132	0.941	1.146	0.955	PLS-SEM is lower
M2.4	0.206	1.102	0.921	1.123	0.930	PLS-SEM is lower
M2.5	0.218	1.092	0.911	1.120	0.921	PLS-SEM is lower
M2.6	0.167	1.134	0.942	1.169	0.966	PLS-SEM is lower
Y.1	0.097	1.225	1.031	1.238	1.034	PLS-SEM is lower
Y.2	0.082	1.195	0.999	1.212	1.016	PLS-SEM is lower
Y.3	0.131	1.144	0.954	1.158	0.963	PLS-SEM is lower
Y.4	0.102	1.227	1.040	1.251	1.046	PLS-SEM is lower
Y.5	0.128	1.197	0.995	1.202	0.989	PLS-SEM RMSE is lower; MAE is higher
Y.6	0.117	1.145	0.950	1.158	0.959	PLS-SEM is lower

The PLS-Predict test results show that all 18 indicators have positive Q^2predict values, ranging from 0.082 to 0.223. The highest value is found in indicator M1.1 at 0.223, while the lowest value is found in indicator Y.2 at 0.082. These results indicate that the model has predictive relevance for all evaluated indicators.

Comparison of RMSE values shows that the PLS-SEM model produces lower prediction errors than the linear model (LM) for all indicators. The PLS-SEM RMSE values range from 1.092 to 1.227, while the LM RMSE ranges from 1.120 to 1.251. For indicator Y.5, although the PLS-SEM RMSE is lower than the LM, the PLS-SEM MAE value of 0.995 is slightly higher than the LM MAE of 0.989. For the other 17 indicators, the PLS-SEM MAE value is lower than the LM.

Across the 18 assessed indicators, PLS-SEM yielded lower RMSE values than the linear-model benchmark; however, its MAE was higher for Y.5 (0.995 versus 0.989), so the comparative assessment depends on the error metric used. However, because the indicator-level evaluation reveals comparative patterns that need to be considered holistically, conclusions regarding the model's predictive ability should be made after reviewing the comparative distributions of RMSE and MAE according to the PLS-Predict interpretation procedure. These findings complement the previous Q^2 results and provide additional support for the evaluation of the research model's predictive ability.

5) Hypothesis Testing

Table 11. Results of Direct Effects Test

Hypothesis	Relationship between variables	Coefficient (β)	T-statistic	P-value	Decision
H1	X1 → M1	0.305	6.036	< 0.001	Supported
H2	X1 → M2	0.176	3.421	0.001	Supported
H3	X2 → M1	0.348	7.124	< 0.001	Supported
H4	X2 → M2	0.222	4.733	< 0.001	Supported
H5	X2 → Y	0.147	2.796	0.005	Supported
H6	M1 → M2	0.394	8.291	< 0.001	Supported
H7	M1 → Y	0.228	4.052	< 0.001	Supported
H8	M2 → Y	0.334	6.101	< 0.001	Supported

The results of bootstrapping tests using SmartPLS 4 indicate that all eight direct influence paths in the research model have positive and statistically significant coefficients. All t-statistic values exceed the critical value of 1.96, while all p-values are below 0.05. Thus, H1 to H8 are supported by the empirical test results. Financial literacy has a positive and significant effect on green finance accessibility ($\beta = 0.305$; $t = 6.036$; $p < 0.001$), thus supporting H1. Financial literacy also has a positive effect on green investment capability ($\beta = 0.176$; $t = 3.421$; $p = 0.001$), thus supporting H2. These findings indicate that financial literacy is related to MSMEs' access to green financing and their ability to develop sustainability-oriented investments.

Institutional support has a positive and significant effect on green financing accessibility ($\beta = 0.348$; $t = 7.124$; $p < 0.001$) and green investment capability ($\beta = 0.222$; $t = 4.733$; $p < 0.001$).

Therefore, H3 and H4 are supported. Institutional support also shows a positive and significant effect on sustainable economic development (β = 0.147; t = 2.796; p = 0.005), thus H5 is supported. These results indicate that institutional support is related to financing access, green investment capability, and sustainable economic development in MSMEs. Furthermore, green financing accessibility has a positive and significant effect on green investment capability (β = 0.394; t = 8.291; p < 0.001), thus H6 is supported. Green financing accessibility also has a positive effect on sustainable economic development (β = 0.228; t = 4.052; p < 0.001), thus H7 is supported. Meanwhile, green investment capability shows a positive and significant effect on sustainable economic development (β = 0.334; t = 6.101; p < 0.001), thus H8 is supported.

Overall, the test results support all proposed direct effect hypotheses. Among the three direct pathways to sustainable economic development, green investment capability has the largest path coefficient (β = 0.334), followed by green finance accessibility (β = 0.228) and institutional support (β = 0.147). This comparison indicates that green investment capability has the largest relative estimated direct effect on sustainable economic development in the model.

6) Mediation Analysis

Table 12. Results of Indirect Effect Testing (Specific Indirect Effects)

Hypothesis	Indirect influence pathway	Coefficient (β)	T-statistic	P-value	Decision
H9	M1 → M2 → Y	0.132	4.696	< 0.001	Supported
H10	X2 → M1 → Y	0.079	3.528	< 0.001	Supported
H11	X2 → M1 → M2 → Y	0.046	3.956	< 0.001	Supported
H12	X1 → M1 → M2 → Y	0.040	3.628	< 0.001	Supported

The results of the specific indirect effects test indicate that all mediation hypotheses H9–H12 are empirically supported. All indirect effect coefficients are positive, with a T-statistic greater than 1.96 and a p-value less than 0.05. The results of the H9 test indicate that green finance accessibility has an indirect effect on sustainable economic development through green investment capability, with a coefficient of 0.132 (T = 4.696; p < 0.001). This finding indicates that green investment capability is a significant intermediary pathway in the relationship between green finance accessibility and sustainable economic development. Thus, H9 is supported.

In H10, institutional support has an indirect effect on sustainable economic development through green finance accessibility, with a coefficient of 0.079 (T = 3.528; p < 0.001). This result indicates that green finance accessibility is one of the mechanisms linking institutional support to sustainable economic development. Therefore, H10 is supported. Furthermore, testing H11 indicates that institutional support has an indirect effect on sustainable economic development through two sequential mediators, namely green finance accessibility and green investment capability. The serial path coefficient is 0.046 (T = 3.956; p < 0.001). These results support the sequential role of these two mediators in the relationship between institutional support and sustainable economic development. Thus, H11 is supported.

The results of H12 also showed a positive and significant serial indirect effect of financial literacy on sustainable economic development through green financing accessibility and green investment capability, with a coefficient of 0.040 (T = 3.628; p < 0.001). This finding suggests that the relationship between financial literacy and sustainable economic development also occurs through green financing access, which is then related to green investment capability. Therefore, H12 is supported. Overall, the test results support all four indirect effect hypotheses. Among the tested paths, H9 has the largest indirect effect coefficient (β = 0.132), while H12 has the smallest (β = 0.040). The difference in these coefficients indicates the magnitude of the estimated effect on

each path, not necessarily proving that the differences between the effects are statistically significant.

Discussion

The research results show that financial literacy is positively and significantly related to the accessibility of green financing for MSMEs. This finding indicates that understanding financial management, business planning, financing costs, and financial risks can help MSMEs identify and utilize financing sources that support environmentally friendly business activities. Business owners with better financial literacy tend to be better prepared to assess the suitability of financing products to their business needs, understand financial institution requirements, and prepare the financial information needed for financing applications (Widyastuti et al., 2023). This explanation aligns with the Financial Capability perspective, which places financial knowledge as the foundation for decision-making and utilization of financial services. In the context of green financing, financial literacy becomes increasingly relevant because business actors need to understand not only the costs and benefits of financing, but also the characteristics of sustainability-oriented investments. However, financial knowledge does not always guarantee access to financing if MSMEs still face limited collateral, complex administrative procedures, or a lack of suitable financing products (Masdupi et al., 2024). Therefore, improving financial literacy requires simplifying procedures and providing easy-to-understand green financing information.

The positive relationship between financial literacy and green investment capabilities suggests that financial literacy can support MSMEs' ability to plan, evaluate, and implement environmentally-oriented investments. Green investments often require relatively large initial costs, while the benefits can emerge gradually through energy savings, waste reduction, increased production efficiency, or strengthened business competitiveness. In such situations, financial literacy helps business actors estimate cash flow, calculate capital requirements, assess risks, and compare investment alternatives based on both short-term and long-term benefits (Padi et al., 2026). The Resource-Based View (RBV) perspective explains that knowledge and decision-making skills are internal resources that can support the development of organizational capabilities. In the context of MSMEs, financial literacy needs to be translated into practical skills for developing green budgets, identifying viable investments, managing risks, and evaluating investment returns (Goyal et al., 2025). Thus, improving financial literacy should not only be oriented towards conceptual knowledge, but also towards the ability to apply it in real investment decisions.

Institutional support has a positive and significant relationship with the accessibility of green financing. These findings suggest that the availability of supporting policies, financing information, mentoring, and facilitation of relationships with financial institutions can help MSMEs overcome barriers to obtaining financing for environmentally friendly activities. From an Institutional Theory perspective, organizational activities are influenced by rules, norms, incentives, and institutional structures that shape opportunities and constraints in the business environment. For MSMEs, institutional support is crucial because limited internal resources often make the financing application process difficult to carry out independently. Assistance in preparing proposals, providing information on requirements, and facilitating communication with financial institutions can help reduce the information gap between business actors and financing providers (Fachrurazi et al., 2023). Therefore, the effectiveness of institutional support needs to be assessed based on the program's ability to facilitate real access, not just the existence of regulations or the number of programs implemented. Coordination between the government,

financial institutions, support organizations, and MSME development institutions is crucial to ensure that available support is truly utilized (Ekayani et al., 2024).

The positive relationship between institutional support and green investment capability demonstrates that the ability of MSMEs to develop sustainable investments depends not only on internal resources but also on the quality of their supporting environment. Information on environmentally friendly technologies, investment training, technical consulting, business mentoring, and incentive programs can help MSMEs understand investment alternatives that align with their business capacities and needs. Such support can also reduce uncertainty when businesses consider technologies or production processes that have never been used before (Kurniawan et al., 2023). From an Institutional Theory perspective, the institutional environment can create conditions that encourage organizations to adopt more sustainable practices. Meanwhile, RBV helps explain how external support can strengthen the internal capabilities needed to manage investments. Both perspectives suggest that green investment policies need to combine financial and non-financial support. Capital assistance without technical assistance can make it difficult for MSMEs to choose the right investment, while training without access to financial resources can limit the implementation of acquired knowledge (Ullah et al., 2023). Therefore, a green investment capability development program should include business needs assessment, introduction of appropriate technology, budget planning, implementation assistance, and evaluation of investment results. This integrated approach can help MSMEs develop more targeted investment capabilities that are relevant to sustainability goals.

Institutional support also has a positive and significant relationship with sustainable economic development. These findings indicate that the institutional environment can help create conditions that support business development while encouraging attention to resource efficiency, environmental responsibility, and economic resilience. Support in the form of business development programs, financing facilitation, mentoring, and incentives can help MSMEs increase operational capacity and consider more responsible business practices. From a Sustainable Development perspective, economic development is assessed not only by revenue growth but also by the sustainability of economic activities, their impact on the environment, and the resulting social benefits (Peris et al., 2026). Therefore, institutional contributions need to be viewed in terms of their ability to drive changes in business practices and strengthen long-term sustainability. Programs that focus solely on distributing aid without evaluating its use and outcomes risk failing to generate substantial change. Conversely, support tailored to the needs of the business sector and the capacities of MSMEs has the potential to create a more conducive environment for sustainable development. This implication positions the government and related institutions not merely as policy providers but also as ecosystem facilitators connecting resources, competencies, and market opportunities. Thus, institutional support can be a crucial part of a development strategy that integrates economic and environmental interests.

Accessibility to green financing has a positive and significant relationship with green investment capability. This finding suggests that the availability of appropriate financing sources can help MSMEs develop the ability to plan and implement investments that support environmental sustainability. Limited capital is a potential barrier for MSMEs in adopting energy-efficient equipment, cleaner production technologies, or improved waste management systems. Perceived access to green financing may widen the investment alternatives MSMEs consider, although such accessibility does not establish that financing was received or that a proposed investment was implemented (Zhang et al., 2021). From an RBV perspective, access to financing is an external resource that can support the development and strengthening of internal

capabilities. However, access to capital does not automatically guarantee investment quality. Businesses still need the ability to determine priorities, assess feasibility, allocate funds, monitor implementation, and evaluate results. Therefore, green financing needs to be integrated with investment competency development to ensure productive use of the funds obtained. Financial institutions can support this process through investment feasibility consultations, information on financing products, and assistance with fund use. Meanwhile, MSME development programs can help businesses identify investments that align with their operational scale, cash flow conditions, and business environment needs. This integration is crucial so that financing does not stop at providing capital but contributes to the sustainable development of green investment capabilities (Sinha et al., 2021).

The positive relationship between green financing accessibility and sustainable economic development suggests that financing can be instrumental in supporting the transformation of MSME economic activities. Appropriate financing can help businesses upgrade equipment, improve energy and raw material efficiency, reduce waste, and strengthen the ability to sustain business operations. These findings demonstrate that green financing needs to be positioned within the context of changing business practices, not simply as additional capital. However, financing accessibility cannot be treated as a guarantee of achieving sustainable economic development. Its impact depends on the intended use of the funds, the suitability of the investment to the business's needs, management capabilities, and the sustainability of the resulting benefits (Achmad & Wiratmadja, 2025). Therefore, evaluation of financing programs should consider not only the amount of funds disbursed, but also their use for productive investments, operational efficiency, and improved environmental practices. This approach can help ensure that green financing contributes to more resilient and responsible economic development.

Green investment capability has a positive and significant relationship with sustainable economic development. This finding underscores the importance of MSMEs' ability to translate investment opportunities into operational actions that generate economic and environmental benefits. This capability encompasses opportunity identification, financial and technical feasibility assessment, technology selection, resource allocation, risk management, and evaluation of investment impacts on business activities. MSMEs with this capability are better equipped to integrate environmental considerations into business decisions without compromising financial viability (Xiong & Wang, 2026). From the RBV perspective, green investment capability can be understood as an organization's ability to combine knowledge, resources, and decision-making processes to create value. Meanwhile, the sustainable development perspective emphasizes that investment success must be considered in terms of long-term benefits, including resource efficiency, reduced environmental impact, and business resilience. Therefore, developing green investment capabilities is not simply achieved through the introduction of environmentally friendly technologies; it must also encompass the ability to develop financial plans, calculate maintenance costs, measure benefits, and anticipate implementation risks. A comprehensive assessment can help MSMEs choose investments that are appropriate to their business conditions and avoid decisions based solely on trends or short-term incentives (Hasbi, 2025). Thus, green investment capabilities act as a bridge between financing opportunities and the implementation of sustainable business practices.

The results of the mediation test indicate that green investment capability is an important mechanism in the relationship between green financing accessibility and sustainable economic development. This indirect pathway demonstrates that the benefits of financing lie not only in the

availability of capital, but also in the ability of MSMEs to convert these resources into investments that align with business needs and environmental goals. Easily accessible financing can open up investment opportunities, but its benefits for sustainable development depend on the quality of investment planning and implementation. From the RBV perspective, financing provides resources that can be used to strengthen organizational capabilities, while the sustainable development perspective explains the importance of directing these capabilities toward valuable outcomes in the long term (Ramadani et al., 2025). This mediation finding confirms that green financing strategies need to include post-financing support, such as assistance in selecting investments, developing plans for fund use, monitoring implementation, and evaluating outcomes. Therefore, financing success is measured not only by the MSME's ability to obtain funding but also by its ability to utilize those funds effectively (Pramana et al., 2026). Because this study used cross-sectional data, these indirect paths should be interpreted as statistically significant association mechanisms supported by the model, rather than as definitive evidence of a causal sequence over time.

The results of the mediation test also indicate that accessibility to green finance is a mechanism linking institutional support to sustainable economic development. This finding indicates that institutional support can contribute to sustainability by helping MSMEs overcome barriers to obtaining financial resources. Providing information, facilitating relationships with financial institutions, assisting with applications, and simplifying procedures can help translate institutional support into more tangible financing opportunities (Singh et al., 2024). From an institutional theory perspective, the quality of the institutional environment influences an organization's opportunities to obtain resources and respond to the demands of the business environment. Therefore, the existence of supporting policies is insufficient if business actors still have difficulty accessing programs or understanding their requirements. The government and financial institutions need to ensure that financing information is accessible to MSMEs, procedures are proportional, and requirements are aligned with the characteristics of the targeted businesses. Furthermore, the effectiveness of support needs to be evaluated based on the program's ability to increase access to financing and encourage the productive use of funds (Han & Liu, 2023). The results of this mediation strengthen the argument that financing accessibility is one channel connecting institutional support with sustainability, although the extent of benefits can still be influenced by the management capabilities and conditions of each MSME.

The indirect chain link between institutional support through green financing accessibility and green investment capabilities toward sustainable economic development demonstrates that interconnectedness is a crucial aspect of MSME development. Institutional support can help businesses access financing, financing can provide resources for investment, and investment capabilities can help ensure that those resources are used for activities that support sustainability. This mechanism demonstrates that institutional support is more meaningful when translated into access to resources and implementation capabilities at the business level (Kurniasari et al., 2025). From an institutional theory perspective, institutions provide a support structure that influences organizational opportunities and behavior. Meanwhile, RBV explains that resources need to be combined with the right capabilities to generate value. Therefore, governments, financial institutions, mentoring organizations, and training providers need to build interconnected programs. MSME mentoring, for example, can be linked to financing consultations and green investment training so that business actors are not only aware of the program's existence but also able to access and utilize it (Sintya & Masdupi, 2025). These findings provide a

basis for developing policies that link institutional facilitation, access to finance, and strengthening investment capabilities within a single support chain. However, interpretation of these linkage mechanisms still requires consideration of the cross-sectional design used in the study.

The interconnected link between financial literacy and green financing accessibility and green investment capabilities toward sustainable economic development demonstrates that financial knowledge can contribute through a multi-step mechanism. Financial literacy helps MSMEs understand financing options, estimate capital needs, assess requirements, and recognize investment benefits and risks. This understanding can support their ability to access appropriate financing. When financing is available and managed appropriately, MSMEs have the opportunity to develop green investment capabilities that support business sustainability. This pathway connects the Financial Capability Perspective with the RBV and the sustainable development perspective. Financial literacy serves as knowledge capital; financing accessibility provides external resources, while investment capabilities serve as implementation capabilities that direct these resources toward sustainability goals. An important implication is that financial literacy programs should encompass not only financial recording and management but also understanding green financing products, developing investment plans, analyzing costs and benefits, and evaluating the risks of environmentally friendly investments. This integrated approach can help connect increased financial knowledge with the real needs of MSMEs in developing more sustainable business activities. Thus, the research results provide an explanation that the contribution of financial literacy to sustainable development can involve access to resources and implementation capabilities, not just knowledge as a stand-alone factor.

Theoretically, this study integrates the RBV, Institutional Theory, Financial Capability Perspective, and Sustainable Development Perspective to explain the relationship between MSMEs' internal capabilities, institutional support, access to financial resources, investment capabilities, and sustainable economic development. RBV explains the role of knowledge and investment capabilities as organizational resources, while Institutional Theory emphasizes the importance of the institutional environment in opening opportunities and reducing barriers. The Financial Capability Perspective explains the role of financial literacy in supporting decisions and access to financial services, while the sustainable development perspective provides an orientation towards creating economic value that takes into account environmental responsibility and business sustainability. This integration helps explain that MSME sustainability does not depend solely on a single factor, but rather on the interconnectedness between business actors' capabilities and external supporting conditions. Practically, MSMEs need to improve financial literacy, strengthen investment planning, and systematically evaluate the use of financing. Financial institutions can develop products that are more suited to MSME characteristics, accompanied by easy-to-understand information and adequate mentoring. The government and supporting institutions can integrate training, financing facilitation, technical assistance, and evaluation of investment results. The success of a green economy program should not only be assessed based on the amount of funds disbursed or the number of training participants, but also on changes in business practices, efficiency of resource use, strengthening of investment capabilities, and the sustainability of the benefits generated.

This study has several limitations that should be considered when interpreting the results. First, the cross-sectional survey design measured variables over a single period, so the direct and indirect relationships found cannot yet establish a long-term causal sequence. Second, the use of purposive sampling limits the generalizability of the results to the entire MSME population,

especially if respondents' characteristics differ from those of business groups not represented in the sample. Third, the use of respondent perception data has the potential to introduce measurement bias and common method bias. Future research could combine survey data with financial records, financing information, and verifiable environmental performance indicators to strengthen the validity of the findings. Fourth, differences in business sector, business scale, region, digital maturity, and experience with green financing may produce different patterns of relationships, but have not been fully accommodated in the model. Future research could use a longitudinal design to examine changes in financial literacy, access to financing, investment capability, and business sustainability over time. Further studies could also expand the sample across sectors and regions, compare MSMEs based on business size or green investment readiness, and examine additional factors such as governance quality, technological readiness, green entrepreneurial orientation, and market conditions. This development is expected to provide a more comprehensive understanding of the conditions that strengthen or limit the contribution of green finance to sustainable economic development.

CONCLUSIONS

This study aims to analyze the role of financial literacy and institutional support in increasing green financing accessibility, green investment capability, and sustainable economic development in MSMEs. The results of the structural model testing indicate that all hypothesized direct relationships are empirically supported with positive and significant relationships. Financial literacy has a positive effect on green financing accessibility and green investment capability, while institutional support has a positive effect on both variables and sustainable economic development. In addition, green financing accessibility contributes positively to green investment capability and sustainable economic development, while green investment capability also has a positive effect on sustainable economic development. Within the sampled MSMEs, the findings support an association between sustainable economic development and the modeled relationships involving financial literacy, institutional support, green financing accessibility, and green investment capability, without establishing a causal sequence.

The research also shows that green financing accessibility and green investment capabilities play a crucial role as a mechanism linking financial literacy and institutional support to sustainable economic development. The indirect effect of green financing accessibility on sustainable economic development through green investment capabilities is positive and significant. Similarly, institutional support is related to sustainable economic development through green financing accessibility, both directly through the aforementioned mediation channels and through the interplay between green financing accessibility and green investment capabilities. Financial literacy also demonstrates an indirect effect through the channels of green financing accessibility and green investment capabilities. These findings suggest that improving financial literacy and institutional support needs to be accompanied by expanding access to green financing and strengthening the ability of MSMEs to allocate funds for investment activities that support sustainability.

From a practical perspective, the results of this study have implications for the government, financial institutions, MSME support agencies, and business actors. The government and relevant institutions need to strengthen financial literacy programs that focus not only on conventional financial management but also include an understanding of green financing, financing application requirements, risk assessment, and environmentally friendly investment opportunities. Financial institutions can contribute by providing more easily understood

information on green financing products, proportional application procedures, and mentoring tailored to the characteristics of MSMEs. At the same time, MSMEs need to improve their ability to evaluate investment feasibility, plan fund use, and integrate environmental considerations into business activities. An approach that combines strengthening financial literacy, institutional support, access to financing, and investment capabilities has the potential to create more conducive conditions for sustainable MSME economic development.

Despite its empirical and practical contributions, this study has limitations that warrant consideration. The use of a quantitative survey design with a cross-sectional approach limits the study's ability to establish temporal sequence and definitively conclude causal relationships. Furthermore, the use of questionnaire data may introduce potential bias in respondents' perceptions, while the use of purposive sampling limits the generalizability of the results to all MSMEs. Future research is recommended to employ a longitudinal design or mixed-methods approach to understand the development of green financing access, investment capability, and business sustainability over time. Future studies could also consider additional variables, such as governance quality, technological readiness, green entrepreneurial orientation, and market conditions, and compare results across regions or business sectors. With these developments, understanding of the mechanisms supporting sustainable economic development through green financing and investment in MSMEs could be broadened and deepened.

AUTHOR CONTRIBUTIONS

Sabri: Conceptualization, methodology, supervision, project administration, writing – original draft, and writing – review and editing. **Anne Putri:** Investigation, data collection, formal analysis, data interpretation, and writing – original draft. **Heliyani:** Methodology, validation, formal analysis, data interpretation, and writing – review and editing. **Febriyan Pratama Defaz:** Data curation, software, statistical analysis, visualization, and writing – review and editing. **Riza Novelda:** Investigation, resources, validation, contextual interpretation, and writing – review and editing.

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