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# Digital Empowerment Through Artificial Intelligence And Financial Literacy: Evidence From Women Owned MSMEs In Makassar, Indonesia

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***Abstract:****This study examines the role of artificial intelligence (AI) and digital financial literacy in sustaining women-owned micro, small, and medium enterprises (MSMEs) in Makassar City, Indonesia. Using a mixed-methods approach with an explanatory sequential design, this research combines qualitative exploration with quantitative testing through Structural Equation Modeling–Partial Least Squares (SEM-PLS) with a purposive sample of 150 respondents drawn from 3,060 women-owned MSMEs registered with the MSME Incubator in Makassar. The Digital Empowerment model proposed in this study refers to an integrated framework in which AI and digital financial literacy work complementarily to strengthen business decision-making, financial behavior, and fintech adoption among women-owned MSMEs. The results show that AI has a positive and significant direct effect on MSME sustainability, as does financial literacy. Financial behavior and financial technology were found to significantly mediate the relationship between financial literacy and MSME sustainability — confirming both indirect pathways. However, neither financial behavior nor financial technology significantly mediated the AI–sustainability relationship, indicating that AI's impact remains direct at this stage of adoption. These findings carry important practical implications: local governments and MSME incubators should develop integrated digital financial literacy training programs that incorporate AI-based decision-support tools. This study makes a novel theoretical contribution by proposing an operational Digital Empowerment model contextualized for women-owned MSMEs in Eastern Indonesia, filling a gap in the empirical literature on AI adoption and MSME sustainability in developing countries.*
***Keywords:*** *Digital Empowerment, Artificial Intelligence, Financial Literacy, Women-Owned MSMEs*

## INTRODUCTION

Makassar City, as a center of economic growth in Eastern Indonesia, has great potential for the development of sustainable Micro, Small, and Medium Enterprises (MSMEs), particularly those managed by women. Nationally, 64.5 percent of MSMEs in Indonesia are managed by women, and 3,060 women-owned MSMEs are members of the MSME Incubator in Makassar City (Ministry of MSMEs of the Republic of Indonesia, 2025; Makassar City MSME Incubator, 2025).

This condition demonstrates the strategic role of women in the local economy, while also demanding adaptive strengthening strategies for the development of digital-based businesses.

Financial literacy and inclusion among female MSMEs remain relatively low (Ramli et al., 2025). The main problem lies not only in the limited adoption of digital technology but also in the lack of practical models capable of converting digital financial data into a basis for business decision-making. Suboptimal financial record-keeping hinders decision-making and business development (Sjahruddin et al., 2024). Although some MSMEs have adopted digital financial record-keeping and cashless payment systems, the resulting financial information has not been effectively utilized for pricing, cash flow management, inventory planning, and marketing strategies (Hayati et al., 2023; Caroline & Murtiningsih, 2024).

Related to this, the use of Artificial Intelligence (AI) by women-owned MSMEs in Makassar City is still very limited due to low digital literacy and the perception that AI is a complex and expensive technology (Fajri et al., 2024; Prasetyo & Andrilla, 2025; Oldemeyer et al., 2025). However, AI has been proven to improve the operational and economic performance of MSMEs through process efficiency, cost reduction, increased profitability, and long-term growth (Soomro et al., 2025; Khan et al., 2025; Magableh et al., 2024). Without adequate digital financial literacy support, AI utilization tends to be partial and unsustainable (Asandimitra et al., 2024). To date, there is no operational model that integrates AI and digital financial literacy to promote the sustainability of women-owned MSMEs in Makassar City. Therefore, this study formulates a Digital Empowerment model for women's MSMEs that integrates the use of AI and digital financial literacy to support the sustainability of women's MSMEs in Makassar City.

This study uses an exploratory approach to map and test a contextual Digital Empowerment model for women's MSMEs based on AI and digital financial literacy. AI in this study is not positioned as the development of systems, applications, or computational algorithms, but rather as an analytical approach based on rule-based decision support that utilizes women's MSMEs' digital financial data to generate interpretations of business conditions and simple business decision categories such as cash flow management and pricing. Changes in financial behavior and the use of financial technology are analyzed as part of the implementation of solutions to support business sustainability.

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This research employed a mixed methods approach with an explanatory sequential design. The qualitative approach served as the initial stage for understanding the context, while the quantitative approach served as a follow-up to examine the relationships between variables related to the sustainability of women's MSMEs.

Previous research has shown that financial literacy, financial behavior, and financial technology play a crucial role in improving the performance and sustainability of MSMEs, including women-owned MSMEs, by improving the quality of decision-making and business management (Asandimitra et al., 2024; Aripin & Zuhriyah, 2025; Widagdo & Sa'diyah, 2023). While financial technology has been shown to improve transaction efficiency and financial management in MSMEs, its impact on sustainability is generally indirect and highly dependent on the financial behavior of business actors (Sudrajat et al., 2024; Kurniasari et al., 2023; Martin et al., 2025; Nugraheni et al., 2025). The literature on MSME digital transformation has further developed into the use of digital technologies such as digital financial recording, cashless payments, and online marketing (Anatan & Nur, 2023; Damayanti et al., 2025). However, this digitalization is still predominantly administrative in nature and has not been directed to support data-based business decision-making (Kallmuenzer et al., 2025; Calderon-Monge & Ribeiro-Soriano, 2024).

AI studies in the context of MSMEs are currently dominated by conceptual approaches and literature reviews that emphasize AI's potential to improve the efficiency and quality of decision-making (Sudrajat et al., 2024; Ozili, 2021; Asrini et al., 2025). However, existing studies present several critical gaps: (1) most AI adoption models have been developed for large enterprises or male-owned businesses and fail to account for the unique constraints of women-owned MSMEs, such as lower digital literacy, limited access to capital, and social-cultural barriers (Fajri et al., 2024; Oldemeyer et al., 2025); (2) the integration of AI with digital financial literacy within a unified empowerment framework has not been empirically tested, particularly in the developing-country context of Eastern Indonesia; and (3) the mediating roles of financial behavior and financial technology in the AI–sustainability nexus remain empirically underexplored. Unlike previous research, this study positions AI not merely as a digitalization tool but as a mechanism for processing and interpreting business data to generate more systematic decision-making

recommendations. The theoretical foundation of this study integrates the Technology Acceptance Model (TAM) and Social Cognitive Theory (SCT) to explain how AI adoption and financial literacy jointly shape financial behavior, fintech utilization, and ultimately MSME sustainability. By positioning financial behavior and financial technology as supporting mechanisms within the Digital Empowerment model, this study offers a novel, operational, and contextual contribution to the MSME sustainability literature in Makassar City and Eastern Indonesia.

## METHOD

This research uses mixed methods with an explanatory sequential design, where the qualitative approach serves as the initial stage for deepening the context, while the quantitative approach serves as the next stage for testing the relationships between variables. The research stages include:

a. Identification of problems

The initial stage is to map the main issues faced by women-owned MSMEs, particularly those related to digitalization, digital financial literacy, AI utilization, and business sustainability.

b. Literature study and instrument development

This stage functions through literature searches and secondary data to develop a conceptual research framework that maps the relationship between AI, digital financial literacy, financial behavior, financial technology, and the sustainability of women's MSMEs.

c. Development of a conceptual framework for Digital Empowerment

The stage of formulating the relationship between variables (AI, digital financial literacy, financial behavior, financial technology, and the sustainability of women's MSMEs) along with the initial operational definition as the basis for compiling indicators.

d. Preparation of instruments and sample determination.

The research instrument was developed as a five-point Likert-scale questionnaire (1 = strongly disagree to 5 = strongly agree) based on the results of a preliminary study and validated through expert assessment and pilot testing involving 30 respondents. Measurement indicators for each construct were adapted from validated scales in prior literature (see Table 1 for details). The study population comprised 3,060 women-owned

MSMEs registered with the MSME Incubator in Makassar City. Using purposive sampling based on the criterion of active digital financial service usage, a final sample of 150 respondents was obtained, representing a response rate of approximately 78%. This sample size meets the minimum adequacy requirement for SEM-PLS analysis as recommended by Hair et al. (2017), which suggests a minimum of 10 times the maximum number of structural paths directed at any construct. SEM-PLS was selected over CB-SEM because the proposed model is exploratory in nature, the data distribution is non-normal, and the primary objective is prediction rather than theory confirmation (Hair et al., 2017). All participants provided informed consent prior to participation, and data collection procedures were conducted in accordance with the ethical standards of Universitas Negeri Makassar.

e. Qualitative Data Analysis

A qualitative approach was used as the initial analysis to strengthen the research context through semi-structured interviews and focus group discussions with women's MSMEs and relevant stakeholders. This phase aimed to clarify practices, perceptions, and variable indicators to reflect the conditions of women's MSMEs in Makassar City.

f. Quantitative Data Analysis

The explanatory quantitative phase was conducted through a survey of women-owned MSMEs in Makassar City and data analysis using Structural Equation Modeling–Partial Least Squares (SEM-PLS) to test the relationships between research variables. The analysis results were used to construct an empirical model of women's digital empowerment of MSMEs.

g. Model integration and finalization

The final stage was carried out by integrating qualitative and quantitative findings to develop a final model of Digital Empowerment of women's MSMEs, as well as formulating initial recommendations and policy implications at the regional level to support the sustainability of women's MSMEs in Makassar City.

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## RESULTS AND DISCUSSION

The measurement model in this study uses the Partial Least Square (PLS) method, and data analysis was conducted using SmartPLS 3 software on artificial intelligence, financial literacy, financial behavior, and financial technology regarding the sustainability interest of MSMEs in Makassar City. The indicators used must be valid and reliable. The following is a path diagram of the outer model and inner capital design in this study.

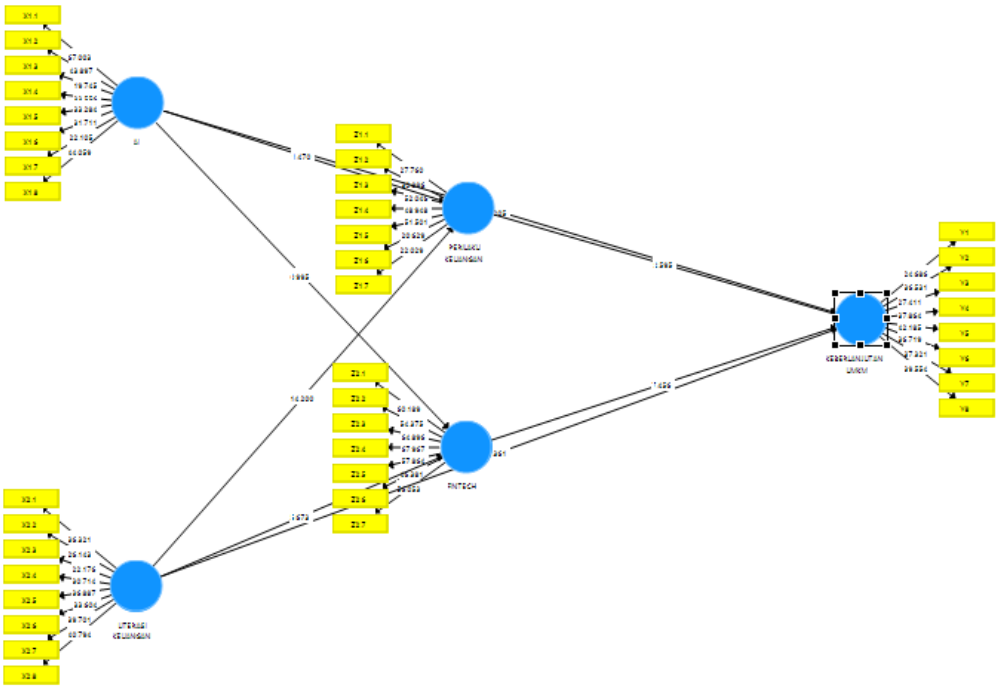

***Figure 1.*** *Data Analysis Results*
*Source: Processed data (2026)*

1. Outer Model Test

The data analysis technique using SmartPLS in assessing outer capital is by looking at the validity and reliability tests which consist of convergent validity, discriminant validity, composite reliability (Cronbach alpha) (Ghozali & Latan, 2020).

a. Validity Test

Validity testing is a test used to demonstrate the extent to which a measuring instrument is capable of producing what it is intended to measure. Validity testing using SmartPLS can be done

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by examining the outer loading of each construct. An indicator is considered valid if it has an outer loading greater than 0.70 and an AVE value greater than 0.50.

1) Convergent Validity Test

According to Hair et al., (2017)Convergent validity is the extent to which a measure positively correlates with alternative measures of the same construct. Convergent validity is tested using the average variance (AV) value. The outer loading value must be greater than 0.70, and the AVE value must be greater than 0.50, indicating that the indicators for each variable are valid.

| Variables | Indicator | | Results |
|---|---|---|---|
| **Artificial Intelligence** | X1.1 | 0.875 | Valid |
| | X1.2 | 0.844 | Valid |
| | X1.3 | 0.704 | Valid |
| | X1.4 | 0.757 | Valid |
| | X1.5 | 0.757 | Valid |
| | X1.6 | 0.752 | Valid |
| | X1.7 | 0.716 | Valid |
| | X1.8 | 0.827 | Valid |
| **Financial Literacy** | X2.1 | 0.800 | Valid |
| | X2.2 | 0.766 | Valid |
| | X2.3 | 0.735 | Valid |
| | X2.4 | 0.750 | Valid |
| | X2.5 | 0.794 | Valid |
| | X2.6 | 0.774 | Valid |
| | X2.7 | 0.800 | Valid |
| | X2.8 | 0.802 | Valid |
| **Financial Behavior** | Z1.1 | 0.746 | Valid |
| | Z1.2 | 0.761 | Valid |
| | Z1.3 | 0.848 | Valid |
| | Z1.4 | 0.843 | Valid |
| | Z1.5 | 0.845 | Valid |
| | Z1.6 | 0.715 | Valid |
| | Z1.7 | 0.706 | Valid |
| **Financial Technology** | Z2.1 | 0.868 | Valid |
| | Z2.2 | 0.865 | Valid |
| | Z2.3 | 0.875 | Valid |
| | Z2.4 | 0.879 | Valid |
| | Z2.5 | 0.874 | Valid |
| | Z2.6 | 0.850 | Valid |
| | Z2.7 | 0.867 | Valid |
| **Sustainability of MSMEs** | Y1 | 0.745 | Valid |

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| | | | |
|---|---|---|---|
| | Y2 | 0.745 | Valid |
| | Y3 | 0.736 | Valid |
| | Y4 | 0.780 | Valid |
| | Y5 | 0.821 | Valid |
| | Y6 | 0.793 | Valid |
| | Y7 | 0.804 | Valid |
| | Y8 | 0.815 | Valid |

***Table 1.*** *Outer Loading Test Results*
*Source: Processed data*

Based on Table 1 above, it can be seen that all indicators in this study have outer loading values greater than 0.70, indicating that the indicators for each variable meet convergent validity requirements, and each construct is highly correlated. Therefore, data testing or analysis can proceed to the next stage.

2) AVE Test (Average Variance Extracted)

In the test measurement, if the AVE value for each indicator is greater than 0.50, then the value can be considered valid. The following are the results of the AVE values in this study.

| Variables | Average Variance Extracted (AVE) | Results |
|---|---|---|
| **X1** | 0.610 | Valid |
| **X2** | 0.754 | Valid |
| **Z1** | 0.609 | Valid |
| **Z2** | 0.605 | Valid |
| **Y** | 0.613 | Valid |

***Table 2.*** *Results of the Average Variance Extracted Test*
*Source: Processed data (2026)*

Based on Table 2, the AVE values obtained confirm good convergent validity, as all values exceed the 0.50 threshold. This indicates that more than 50% of the indicator variance for each construct is explained by the relevant latent variable. In addition, discriminant validity was assessed using the Heterotrait-Monotrait (HTMT) ratio criterion. All HTMT values were below the conservative threshold of 0.85, confirming adequate discriminant validity across all constructs. Furthermore, the predictive relevance of the model was evaluated using the $Q^2$ (Stone-Geisser) statistic obtained via blindfolding procedures. All endogenous constructs yielded $Q^2$ values above zero (Financial Behavior = 0.381; Financial Technology = 0.201; MSME Sustainability = 0.427), confirming that the model has satisfactory predictive relevance.

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b. Reliability Test

Reliability testing is used to measure the trustworthiness of the questionnaire. In this study, reliability testing was performed by examining composite reliability and Cronbach's alpha values. An indicator is considered reliable if both the composite reliability and Cronbach's alpha values are greater than 0.70.

| Variables | Composite Reliability | Cronbach Alpha | Information |
|---|---|---|---|
| Artificial Intelligence (X1) | 0.926 | 0.908 | Reliable |
| Financial Literacy (X2) | 0.925 | 0.907 | Reliable |
| Financial Behavior (Z1) | 0.917 | 0.893 | Reliable |
| Financial Technology (Z2) | 0.955 | 0.946 | Reliable |
| Sustainability of MSMEs (Y) | 0.926 | 0.946 | Reliable |

***Table 3.*** *Reliability Test Results*
*Source: Processed data (2026)*

Based on Table 3 above, it can be seen that all composite reliability values for each variable have met the reliability criteria because all variables show values greater than 0.70. Likewise, the Cronbach Alpha value is greater than 0.70, meaning that the questionnaire used in this study is declared feasible because all concepts from each measurement of each variable are reliable.

2. Inner Model Test

| | **R Square** |
|---|---|
| **Financial Behavior** | 0.648 |
| **Financial Technology** | 0.359 |
| **Sustainability of MSMEs** | 0.720 |

***Table 4.*** *R Square Test Results*
*Source: Processed data (2026)*

Based on Table 4 above, it can be seen that the R Square result for financial behavior is 0.648, in this case 64.8% can be explained by artificial intelligence and financial literacy. And for financial technology R Square is 0.359, so 35.9% can only be explained by artificial intelligence and financial literacy. For MSME sustainability, it is 0.720, so 72% can be explained by artificial intelligence and digital financial literacy variables and 28% is explained by other variables outside the study.

| | **Financial Behavior (Z1)** | **Financial Technology (Z2)** | **Sustainability of MSMEs (Y)** |
|---|---|---|---|
| **Artificial Intelligence (X1)** | 0.008 | 0.004 | 0.018 |
| **Financial Literacy (X2)** | 0.615 | 0.114 | 0.041 |
| **Financial Behavior (Z1)** | | | 0.028 |

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| | | | |
|---|---|---|---|
| **Financial Technology (Y)** | | | 0.272 |

***Table 5.*** *F Square Test Results*
*Source: Processed data (2026)*

Based on Table 5 above, it can be concluded that:

a. *Artificial Intelligence*on the sustainability of MSMEs obtained an F Square value of 0.018 so it can be concluded that the resulting effect is low.
b. Digital financial literacy on the sustainability of MSMEs obtained an F Square value of 0.041 so it can be concluded that the resulting effect is low.
c. Financial behavior towards the sustainability of MSMEs obtained an F square value of 0.028 so it can be concluded that the resulting effect is low.
d. *Financial technology*digital on long-term investment requests obtained an F square value of 0.272 so it can be concluded that the resulting effect is high.
e. *Artificial Intelligence*on financial behavior obtained an F Square value of 0.008 so it was concluded that the resulting effect was low.
f. Digital financial literacy on financial behavior obtained an F Square value of 0.615 so it can be concluded that the resulting effect is high.
g. *Artificial Intelligence*on financial technology obtained an F Square value of 0.004 so it can be concluded that the resulting effect is low.
h. Digital financial literacy towards financial technology obtained an F Square value of 0.114 so it can be concluded that the resulting effect is high.

| | Original Sample | P-Value |
|---|---|---|
| *Artificial Intelligence* Sustainability of MSMEs→ | 0.136 | 0.028 |
| Sustainable Financial Literacy for MSMEs→ | 0.260 | 0.001 |

***Table 6.*** *Partial Test Results*
*Source: Processed data (2026)*

Based on Table 6, the direct effect bootstrapping results (5,000 resamples) including path coefficients and 95% confidence intervals can be concluded that:

a. The artificial intelligence variable (X1) on the sustainability of MSMEs (Y) obtained a p-value of 0.028, meaning its significance is less than 0.05 (0.028 < 0.05). The original sample value was 0.136, so it can be concluded that artificial intelligence has a positive and significant influence on the sustainability of MSMEs.

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b. The financial literacy variable (X2) on the sustainability of MSMEs (Y) obtained a p-value of 0.001, meaning its significance is less than 0.05 (0.001 < 0.05). The original sample value was 0.351, so it can be concluded that financial literacy has a positive and significant influence on the sustainability of MSMEs.

| | Original Sample | P-Value |
|---|---|---|
| *Artificial Intelligence* Sustainable Financial Behavior of MSMEs→→ | -0.018 | 0.248 |
| Financial Literacy, Financial Behavior, Sustainability of MSMEs→→ | 0.154 | 0.012 |
| *Artificial Intelligence* Financial Technology for MSME Sustainability→ | 0.037 | 0.318 |
| Financial Literacy, Financial Technology, and MSME Sustainability→ | 0.207 | 0,000 |

***Table 7.*** *Results of Indirect Effects*
*Source: Processed data (2026)*

Based on Table 7 above, it can be concluded that:

a. The financial behavior variable (Z1) was unable to mediate the relationship between the artificial intelligence variable (X1) and the sustainability of MSMEs (Y) because the p-value was 0.248, meaning its significance was greater than 0.05 (0.248 > 0.05). The original sample value was -0.018, so it can be concluded that artificial intelligence does not have a significant effect on the sustainability of MSMEs through financial behavior.

b. The financial behavior variable is able to mediate the relationship between financial literacy (X2) and the sustainability of MSMEs (Y) with a p-value of 0.012, meaning its significance is less than 0.05 (0.012 < 0.05). The original sample value is 0.154, so it can be concluded that financial literacy has a positive and significant influence on the sustainability of MSMEs through financial behavior.

c. The financial technology variable (Z2) was unable to mediate the relationship between the artificial intelligence variable (X1) and the sustainability of MSMEs (Y) because the p-value was 0.318, meaning its significance was greater than 0.05 (0.318 > 0.05). The original sample value was 0.037, so it can be concluded that artificial intelligence does not have a significant effect on the sustainability of MSMEs through financial technology.

d. The financial technology variable is able to mediate the relationship between financial literacy (X2) and the sustainability of MSMEs (Y) with a p-value of 0.000, meaning its significance is less than 0.05 (0.000 < 0.05). The original sample value is 0.207, so it can be concluded that financial literacy has a positive and significant influence on the sustainability of MSMEs through financial technology.

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**The Impact of Artificial Intelligence on the Sustainability of MSMEs**

The results confirm that AI has a positive and significant direct effect on MSME sustainability ($\beta = 0.136$; $p = 0.028$), supporting Hypothesis 1. This finding aligns with the growing body of evidence demonstrating that AI adoption improves business performance through enhanced operational efficiency, cost reduction, market prediction accuracy, and data-driven decision-making (Soomro et al., 2025; Khan et al., 2025; Magableh et al., 2024). AI automation systems enable MSME operators to analyze consumer behavior, set competitive pricing, and forecast market trends more accurately, thereby facilitating faster and more targeted business decisions. Contextually, this finding is particularly meaningful for Makassar City and Eastern Indonesia, where women-owned MSMEs face structural challenges such as limited access to capital, lower digital literacy, and geographic market constraints. AI in this context functions as a practical equalizer — providing smaller enterprises access to analytical capabilities previously reserved for larger corporations. However, the small effect size ($f^2 = 0.018$) suggests that the magnitude of AI's impact is still limited, reflecting the early-stage nature of AI adoption among the study's respondents. Policy-wise, this underscores the need for government-supported AI literacy programs and affordable AI tools tailored for micro-scale women-owned MSMEs.

The implementation of artificial intelligence can support business sustainability by saving time and resources across production, distribution, and customer service. The use of chatbots and virtual assistants allows businesses to respond instantly to customers without adding additional manpower, thus saving costs. This allows MSMEs to focus more on product innovation and long-term business development.

The results of research conducted by Amira & Nasution, (2023)argue that the use of artificial intelligence supports the growth and development of MSMEs because it can improve operational efficiency, expand markets, and increase innovation. However, this use of artificial intelligence must be balanced with attention to ethical and security aspects. Meanwhile, research conducted by Kasmirandi et al. (2025)Artificial intelligence has a significant impact on business resilience, although the presence of artificial intelligence is due to MSMEs having higher levels of education and exposure to digital ecosystems that are more prepared and tend to be quicker to utilize artificial intelligence because the impact of implementing artificial intelligence on businesses can be seen

to increase revenue, operational efficiency and market expansion where MSMEs get greater benefits compared to the informal sector.

**The Impact of Financial Literacy on the Sustainability of MSMEs**

Based on the results of the hypothesis test that has been conducted, the significance value of financial literacy is smaller than 0.05 and for the original sample value is positive, meaning that when financial literacy increases it will result in an increase in the sustainability of MSMEs in the city of Makassar. The results of this study state that with financial literacy can help MSMEs to manage cash flow so that MSMEs can be wiser in managing their finances because it can minimize the risk of bankruptcy caused by MSMEs being unable to manage their finances properly. When having a good financial understanding, it can help MSMEs prepare financial records and reports according to standards if the documents they have are valid, it will make it easier for MSMEs to get access to financing and capital credit from banks when needed.

The results of this study are in line with research conducted by (Ayu & Dewi, 2021)which states that financial literacy has a positive and significant influence on the sustainability of MSMEs where financial literacy is one of the factors that has a fairly important role in the level of success and sustainability of the economy, one of which is MSMEs because financial literacy is defined as knowledge about how to manage and design finances.

The results of this study are not in line with the research conducted by Irdawati & Nurlia, (2025)which states that financial literacy does not have a significant effect on the sustainability of MSMEs, this is because even though MSME actors have an understanding of the concept of financial literacy, this is not necessarily applied to daily business practices, the stability of MSMEs is also more influenced by external factors such as market conditions, access to capital and government policies compared to the level of financial literacy and there are still many MSMEs that rely on informal financial systems in managing their cash flow such as taking loans from family or communities where this does not require a good level of financial literacy

**The Influence of Artificial Intelligence on MSME Sustainability Through Financial Behavior**

Based on the results of the hypothesis test that has been conducted, the financial behavior variable (Z1) is unable to mediate the relationship between artificial intelligence (X1) and the sustainability of MSMEs (Y) because the p-value is 0.248, meaning its significance is greater than

0.05. The original sample value is -0.018 so it can be concluded that artificial intelligence does not have a significant effect on the sustainability of MSMEs through financial behavior. This finding indicates that although AI is able to increase operational efficiency and support business decision-making, its impact on changes in the financial behavior of MSME actors is not strong enough to indirectly encourage business sustainability.

This aligns with the findings of Widagdo & Sa'diyah (2023), who stated that digital technology and financial knowledge have a more dominant influence on business sustainability than direct changes in financial behavior. The application of AI in MSMEs, which are still in the early stages of adoption, tends to be used as a technical automation tool, rather than as an instrument that actively changes the financial decision-making patterns of business actors (Fajri et al., 2024). This condition is exacerbated by the low digital literacy of female MSMEs in Makassar City, which results in the use of AI not being fully integrated into daily financial management practices (Asandimitra et al., 2024). Sudrajat et al. (2024) also emphasized that the use of AI for financial inclusion and MSME business sustainability is still indirect and requires the support of other factors such as financial literacy and more fundamental behavioral changes for effective mediation.

**The Influence of Financial Literacy on the Sustainability of MSMEs Through Financial Behavior**

Based on the results of the hypothesis test, the financial behavior variable is proven to be able to mediate the relationship between financial literacy (X2) and MSME sustainability (Y) with a p-value smaller than 0.05 and a positive original sample value of 0.154. This means that the higher the financial literacy of MSME actors, the better their financial behavior will be, which ultimately contributes to MSME sustainability significantly.

These findings are consistent with research by Widagdo & Sa'diyah (2023), which demonstrated that financial behavior serves as a bridge between financial knowledge and business sustainability. MSMEs with high financial literacy tend to demonstrate better financial behavior, such as disciplined financial record-keeping, wise cash flow management, and the ability to conduct long-term financial planning that supports business continuity (Asandimitra et al., 2024). Furthermore, Aripin & Zuhriyah (2025) emphasized that women's empowerment through financial

literacy and business management significantly impacts the behavior and performance of women's businesses in Indonesia. Good financial behavior, born from an adequate understanding of financial literacy, enables MSMEs to respond to changes in the business environment more adaptively and strategically, thereby maintaining MSME sustainability in the long term (Nugraheni et al., 2025; Kurniasari et al., 2023).

**The Impact of Artificial Intelligence on the Sustainability of MSMEs Through Financial Technology**

Based on the results of the hypothesis test, the financial technology variable (Z2) was unable to mediate the relationship between the artificial intelligence variable (X1) and the sustainability of MSMEs (Y) because the p value was 0.318 (0.318 > 0.05) with the original sample value of 0.037. Thus, financial technology was not proven to be a significant mediator in the relationship between AI and the sustainability of MSMEs.

These results are understandable because the adoption of AI among women-owned MSMEs in Makassar City is still at a very early stage, and its use has not been deeply integrated with the fintech ecosystem (Oldemeyer et al., 2025). As Asrini et al. (2025) pointed out, integrating AI with fintech does have the potential to drive financial inclusion, but its success depends heavily on the readiness of digital infrastructure and the capacity of business actors to utilize both technologies synergistically. In the context of women-owned MSMEs, where digital literacy is still low, the use of AI tends to be fragmented and has not been able to directly strengthen the adoption or effectiveness of financial technology use in supporting business sustainability (Sudrajat et al., 2024; Martin et al., 2025). Ozili (2021) also cautioned that while AI and big data have significant potential for financial inclusion, their implementation in the field still faces significant challenges related to the readiness of human resources and a supporting digital ecosystem.

**The Influence of Financial Literacy on the Sustainability of MSMEs Through Financial Technology**

Based on the results of the hypothesis test, the financial technology variable is proven to be able to mediate the relationship between financial literacy (X2) and the sustainability of MSMEs (Y) with a p value of 0.000 (0.000 < 0.05) and a positive original sample value of 0.207. This finding indicates that good financial literacy encourages MSME actors to be more active and

effective in adopting and utilizing financial technology, which ultimately contributes significantly to the sustainability of MSMEs.

These results align with research by Martin et al. (2025), which demonstrated that financial literacy significantly mediates the influence of financial inclusion and fintech adoption on the sustainability of MSMEs. MSMEs with good financial literacy have a deeper understanding of the benefits and risks of using fintech services, enabling them to utilize digital payment services, online loans, and technology-based financial management platforms more optimally (Kurniasari et al., 2023). Damayanti et al. (2025) further corroborate these findings by demonstrating that the readiness for digital financial transformation in MSMEs in Indonesia is significantly influenced by the level of financial and digital literacy of their business owners. Furthermore, Nugraheni et al. (2025) emphasized that the adoption of digital technology supported by adequate financial knowledge has been shown to result in more sustainable MSME performance. Therefore, systematically improving financial literacy will strengthen the capacity of women-owned MSMEs to utilize the fintech ecosystem as a means to increase access to capital, transaction efficiency, and business competitiveness, which will positively impact the long-term sustainability of MSMEs in Makassar City.

## CONCLUSION

This study concludes that both artificial intelligence (AI) and digital financial literacy have positive and significant direct effects on the sustainability of women-owned MSMEs in Makassar City, confirming Hypotheses 1 and 2. The indirect effect analyses further demonstrate that financial behavior and financial technology significantly mediate the relationship between financial literacy and MSME sustainability, while neither mediator is significant in the AI–sustainability pathway. These findings reveal that AI's impact at this stage of adoption operates primarily through direct channels — improving operational efficiency and enabling data-driven decisions — rather than through behavioral or technological intermediaries. Theoretically, this study makes a novel contribution by proposing and empirically validating a Digital Empowerment model that integrates AI utilization and digital financial literacy within a unified framework grounded in the Technology Acceptance Model and Social Cognitive Theory. This model

advances the existing literature by contextualizing digital empowerment for women-owned MSMEs in a developing-country setting, filling a gap in empirical research on AI adoption and MSME sustainability in Eastern Indonesia. From a practical standpoint, the findings underscore the importance of integrated interventions: local governments, MSME incubators, and women's entrepreneurship programs should co-design training curricula that combine AI literacy with digital financial management skills. Furthermore, this study has several limitations that should be acknowledged: the cross-sectional design limits causal inference; the geographic scope is confined to Makassar City; and findings rely on self-reported survey data. Future research is encouraged to adopt longitudinal designs, expand the sample to other regions of Eastern Indonesia, conduct comparative analyses between male- and female-owned MSMEs, and incorporate more advanced measures of AI implementation maturity.

Based on the research findings, several recommendations can be formulated as follows. First, for local governments and stakeholders, it is recommended to develop a digital financial literacy training program integrated with an introduction to the practical use of AI for female MSMEs, particularly in Makassar City and other regions of Eastern Indonesia. Second, MSME mentoring institutions and business incubators need to design empowerment modules that not only introduce digital technology but also encourage changes in the financial behavior of entrepreneurs so they are able to utilize digital financial data as a basis for business decision-making. Third, further research is recommended to expand the sample coverage to other regions in Eastern Indonesia, examine other factors influencing the sustainability of female MSMEs such as access to capital and market conditions, and use a longitudinal design to monitor changes in financial behavior and the impact of AI implementation more comprehensively. Fourth, fintech platform developers and AI service providers are expected to design solutions that are more affordable, easy to use, and relevant to the operational needs of female micro-scale MSMEs in Indonesia.

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