THE EFFECT OF DIGITAL FINANCE ADOPTION, THE ROLE OF MICROFINANCE INSTITUTIONS AND FINANCIAL LITERACY ON MICROENTERPRISE TECHNOLOGICAL INNOVATION WITH TRANSACTION COSTS AS A MODERATOR

Aulia Sofia Meilinda[1]
Universitas Mataram, Mataram, Indonesia
auliasofia09@gmail.com

Embun Suryani[2]
Universitas Mataram, Mataram, Indonesia

I Nyoman Nugraha AP[3]
Universitas Mataram, Mataram, Indonesia

Abstract

This study aims to analyze the effect of digital finance adoption, the role of microfinance institutions, and financial literacy on technological innovation in micro businesses with transaction costs as a moderating variable. The study used a quantitative approach with purposive accidental sampling method on 150 respondents of micro business actors in the western southeast Nusa Tenggara region and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results showed that digital finance adoption and financial literacy have a significant positive effect on micro business technological innovation, while the role of microfinance institutions showed a positive but insignificant effect. Moderation tests revealed that transaction costs have no effect on the adoption of digital finance, microfinance institutions and financial literacy on technological innovation.

Keywords: Digital Finance Adoption, Microfinance Institutions,Financial Literacy, Technological Innovation, Transaction Costs, Microenterprises

INTRODUCTION

Micro enterprises play a strategic role in the Indonesian economy, contributing significantly to GDP, job creation, and poverty alleviation. However, micro enterprises still face serious challenges such as limited access to financing, low financial literacy, and suboptimal adoption of digital technology, which often hampers their competitiveness and ability to innovate. Technological innovation is seen as a key factor to improve efficiency, productivity, and market expansion, especially in the digital era. In the case of micro enterprises, this includes the use of technology to improve operations, product quality, and management systems. Micro enterprises play an important role in the Indonesian economy, supporting up to 97% of economic activity with 65.4 million business units. By 2022, the contribution of micro enterprises to national GDP will reach 61%. With the rapid development of digitalization, the involvement of micro enterprises in the digital economy has the potential to further increase Indonesia's economic growth.

The digital economy system through the *MSME Go Digital* Program launched by the Indonesian government has delivered impressive results in recent years. The number of micro-enterprises transitioning to digitalization continues to exceed the target and consistently increases until 2023. This positive trend continues into 2023 with more micro enterprises entering the digital ecosystem and exceeding the target. In 2022, Indonesia's digital economy revenue reached US$77 billion, a 22% increase compared to 2021. The e-commerce sector is the largest contributor to digital economy revenue. According to the *Indonesian E-Commerce Association* (idEa), the number of ***e-commerce*** sellers or micro businesses that have gone digital will reach 21.8 million by 2022. However, this increase is not accompanied by a positive trend in all regions due to Indonesia's unique geography, which poses a challenge to the provision of reliable internet connections for micro businesses scattered across the country. As a result, there are barriers to digital adoption, especially for micro enterprises in less developed parts of Indonesia. In addition to creating new jobs, the *UMKM Go Digital* program also increases operational cost efficiency so that funds can be diverted to increase productivity.

the other hand, microfinance institutions (MFIs) play a role in providing financing, mentoring, and training to strengthen the capacity of micro enterprises. However, the effectiveness of MFIs is often affected by the sustainability of their operations, as well as the extent to which they are able to innovate and adapt to technological developments. Microfinance institutions were established in an effort to encourage community empowerment, especially for lower-middle-income people. In 2022 there were 242 companies, an increase of 6.61 percent from the previous year. Total loans granted in 2022 grew by 13.09 percent from IDR 836.18 billion to IDR 945.63 billion compared to 2021. Loans provided by conventional MFIs reached 696.92 billion rupiah, accounting for 76.14 percent of total assets. Meanwhile, financing provided by Sharia MFIs amounted to 248.71 billion rupiah.

However, the effectiveness of this role is still variable, especially if it is not matched with adequate financial literacy. Financial literacy has proven to be an important foundation in business management, decision-making, and business readiness to adopt technology. Based on data from OJK, financial literacy in Indonesia has been increasing in the last three years, but data from the World Bank (2022) shows that only 30% of micro businesses in Indonesia have a good understanding of basic financial concepts such as loan interest,

investment risk, and diversification. A 2023 Financial Services Authority (OJK) survey shows that the financial literacy level of micro enterprises is lower than the national average, at only 39%**,** especially in rural areas. This is because most micro businesses manage their finances manually without the use of software, which is based on a lack of basic accounting knowledge and the absence of a structured recording system, especially for micro businesses. This is not in line with the rise of digital financial services in Indonesia.

Transaction cost is also a crucial factor that can strengthen or weaken the influence of digital finance, MFIs, and financial literacy on technological innovation. High transaction costs often hinder the utilization of financial services, while low costs can encourage the adoption of innovations.

This research takes an object in West Nusa Tenggara (NTB) Province with the consideration that NTB is a province with the largest number of micro businesses in eastern Indonesia, and has a high level of financial literacy but has not been in line with financial inclusion. This condition shows an interesting gap to be studied further. Thus, this study aims to analyze the effect of digital finance adoption, the role of microfinance institutions, and financial literacy on microenterprise technological innovation with transaction costs as a moderating variable.

REVIEW OF LITERATURE

Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) developed by Ajzen (1991) is a development of the Theory of Reasoned Action (TRA) which emphasizes that behavior is not only determined by intention, but also the factors that influence it. TPB explains that behavioral intentions are influenced by three main aspects, namely attitudes towards behavior**,** subjective norms, and perceived behavioral control**.** Attitudes reflect an individual's positive or negative assessment of an action, subjective norms relate to social pressure from the environment, while perceived behavioral control relates to an individual's belief in the ability to control factors that influence their actions. These three factors together determine the strength of intention, which in turn affects the likelihood of a person to behave.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was introduced by Fred Davis in 1989 to understand the factors that influence the adoption of technology by individuals or organizations. This model focuses on how a person's perception of *perceived ease of use* and *perceived usefulness* of technology affects their attitude and intention to use the technology (Fecira & Abdullah, 2020.). *The Technology Acceptance Model (TAM)* is one of the most widely used theories to study technology acceptance, both in the context of business, education, and the general public. According to Hervilia et al., (2022) the main indicators in the *Technology Acceptance Model (TAM)* include several interrelated elements, namely *perceived usefulness***,** *perceived ease of use***,** *attitude towards use***,** *behavioral intention to use***,** and *actual system use***.** Each indicator has a significant role in explaining how technology is accepted and used by individuals or organizations (Hervilia et al., 2022).

Stakeholder Theory

Stakeholder Theory popularized by Freeman (1984) asserts that the success of an organization is not only determined by the owners of capital, but also influenced by various interested parties or stakeholders, such as consumers, suppliers, government, society, and

financial institutions. In the context of microenterprises, business sustainability is highly dependent on support and interaction with these stakeholders. Microfinance institutions (MFIs) are one of the important stakeholders, as they not only provide capital, but also encourage the adoption of digital technology through modern financial services. With the support of MFIs, MSMEs can reduce transaction costs and create mutually beneficial relationships in accordance with the principles of Stakeholder Theory.

Agency Cost Theory

Agency Cost Theory introduced by Jensen and Meckling (1976) explains the relationship between principals (capital owners) and agents (business managers) who often have different interests. This difference raises the problem of information asymmetry, because the agent knows more about business conditions than the principal. This situation can lead to moral hazard and adverse selection, resulting in additional costs called agency costs. Agency cost is part of transaction costs, especially monitoring costs incurred by the owner of capital to ensure that the agent carries out the contract according to the rules. If agency costs are too high, microenterprise resources are absorbed in monitoring and administration, hindering productivity and innovation. However, if agency costs are reduced through digital transparency and good financial literacy, MSMEs can more freely allocate resources for product, process and technology innovation.

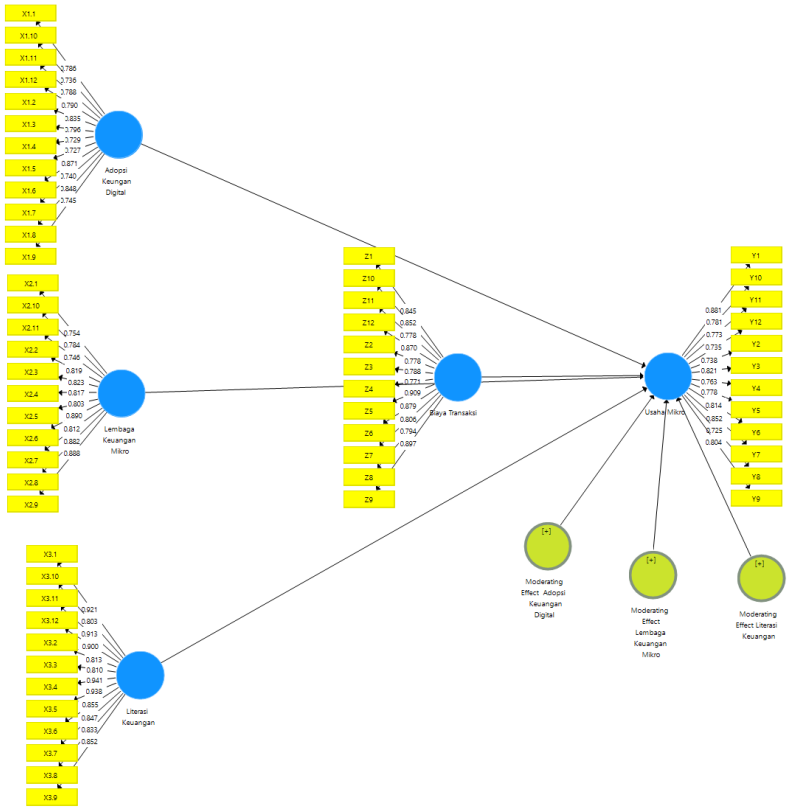
RESEARCH METHOD

This study uses a quantitative approach with the aim of analyzing the relationship between variables and testing the moderating effect of transaction costs in relation to technological innovation of micro businesses. The sampling method used purposive accidental sampling with a total of 150 respondents from MSMEs spread across West Nusa Tenggara. Respondents were selected based on the criteria of active involvement in business activities and utilization of financial services, both digital and conventional. The research instrument was a questionnaire prepared on a Likert scale, covering the variables of digital finance adoption, the role of microfinance institutions, financial literacy, technological innovation, and transaction costs. The collected data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM)**.** This technique was chosen because it is able to test the relationship between latent variables simultaneously and assess the strength of direct and indirect effects, including the role of transaction costs as a moderating variable.

RESULTS AND DISCUSSION

Convergent validity

According to Hair et al., (2014) states that *Convergent validity* assesses the extent to which two measures of the same concept are correlated. Hair et al., (2014) explain that the value of Convergent validity can be seen from the *Loading Factor* value where a good rule of thumb is that the standard loading estimate should be 0.5 or higher, but the ideal value is 0.7 or higher.



Based on the processing results using SmartPLS 3.0, it can be seen in the table above, where the outer model value or the correlation between constructs and variables shows that overall it meets the standard outer loading value greater than 0.7 so that it is declared valid.

Discriminant Validity

After testing the validity using the outer loading value, then testing the discriminant validity using the *average variance extracted* (AVE) value. the following are the results of the discriminant test :

Variable	Average Variance Extracted (AVE)
Micro Business Technology Innovation (Y)	0,624
Digitak Finance Adoption (X1)	0,615
Microfinance Institution (X2)	0,674
Financial Literacy (X3)	0,757
Transaction Cost (Z)	0,692

This test is carried out to see how much difference there is between variables. The value seen in this test is the average variance extracted (AVE) value. Overall, all variables are obtained as estimated results where the value is> 0.50 so that it can be declared valid.

Reliability Test

Reliability testing is carried out to determine whether the variables used in this study are reliable or not. Reliability testing uses *Cronbach's Alpha* and *composite reliability* values. The following are the results of reliability testing.

Variable	Cronbach 's Alpha	Composite Reliability	Rule of Thumb	Model Evaluation
Micro Business Technology Innovation (Y)	0,945	0,952	> 0.70	Reliable
Digital Finance Adoption (X1)	0,943	0,950		Reliable
Microfinance Institutions (X2)	0,953	0,958		Reliable
Financial Literacy (X3)	0,971	0,974		Reliable
Transaction Cost (Z)	0,959	0,964		

Based on the table above, it can be concluded that the constructs for all variables meet the criteria or *are reliable*. This is indicated by the *Cronbach's Alpha* and *composite reliability* values obtained from the SmartPLS estimation results. The resulting value is> 0.70 as recommended criteria.

Model Fit Evaluation

In Partial Least Squares Structural Equation Modeling (PLS-SEM) based structural model analysis, two important indicators used to evaluate model quality are the R-Square (R^2) value and the Q-Square (Q^2) value. These two values have different but complementary functions in explaining how well the model can describe and predict the variables studied.

	R- Square	Adjusted R-Square
Y	0,468	0,442

The R-Square (R^2) value for the micro business technology innovation variable (Y) is 0.468 and the Adjusted R-Square value is 0.442. This value indicates that 46.8% of the variation in technological innovation by micro enterprises can be explained by the variables of digital finance adoption, the role of microfinance institutions, financial literacy, and the interaction of transaction costs as moderating variables. Meanwhile, the slightly lower Adjusted R^2 value corrects the effect of the number of independent variables on the overall strength of the model, and still indicates that the model has a fairly strong explanatory power.

Hypothesis Test Results

In hypothesis testing, this study uses several criteria that must be met, namely the *original sample* value, *t-statistic* value and *probability* value through *Bootstrapping* in PLS. The *t-statistic* value and *P-values of* each hypothesis in this study are shown in the following table:

Hypothesis	Influence Between Variables	Original Sample	t- Statistics	P Values	Description
H1	Digital Finance Adoption -> Micro business	0.270	3.256	0.001	Positive Significant
H2	Microfinance Institution -> Microenterprise technological innovation	0.017	0.228	0.819	Positive Not Significant
H3	Financial Literacy -> Micro business technology innovation	0.206	2.583	0.010	Positive Significant
H4	Moderation of Digital Finance Adoption -> Micro business technology innovation	0.001	0.016	0.987	Not Significant
H5	Moderation of MFI -> Micro business technology innovation	0.106	1.660	0.097	Not Significant
H6	Moderation of Financial Literacy -> Micro business technology innovation	0.054	1.038	0.300	Not Significant

The Effect of Digital Finance Adoption on Micro Business Technology Innovation

Based on the results of hypothesis testing, the effect of Digital Finance Adoption on Microbusiness Technology Innovation shows significant results. The original sample value of 0.270, t-statistic value of 3.26, and p-value of 0.001 indicate that this effect is positive and significant.

This finding is in line with the Theory of Technology Acceptance Model (TAM) developed by Davis (1989), which explains that the adoption of a technology is strongly influenced by two main perceptions, namely perceived usefulness and perceived ease of use. In the case of micro businesses, when business actors feel that digital financial systems such as e-wallets, mobile banking, and online payment applications are able to provide convenience and benefits in their business processes, they are more encouraged to adopt these technologies. This adoption not only increases transaction efficiency, but also triggers innovation in service systems, financial recording, even in product development and marketing strategies.

Practically, these results imply that the adoption of digital financial services, such as mobile banking, e-wallets, and QRIS-based payment systems, make it easier for micro enterprises to conduct financial transactions, access capital, and maintain efficient financial records. These conveniences create room for micro enterprises to transform towards a more technology-driven business model.

This finding is in line with Rahayu (2021) which states that micro businesses that utilize digital banking and online lending services tend to have a greater ability to adopt digital innovations (Rahayu, 2021). Research from Ayuningtyas (2024) also mentions

technological factors finding that perceived ease of use of SaaS applications and payment systems are the main drivers of technology adoption intentions by micro businesses (Ayuningtyas et al., 2024).

The Influence of Microfinance Institutions on Microenterprise Technology Innovation

Based on the data displayed in the hypothesis testing table, the effect of Microfinance Institutions on Microenterprise Technology Innovation is positive and insignificant. This can be seen from the original sample value of 0.017, t-statistic of only 0.228, and p-value of 0.819, far above the 0.05 significance limit. This means that the presence or activities of Microfinance Institutions (MFIs) do not have a significant influence on the tendency of micro enterprises to adopt or innovate technology. In other words, the presence of MFIs has not been able to become the main driving factor for technological development in microenterprise business activities.

If linked to Stakeholder Theory, this condition can be understood because microfinance institutions as one of the stakeholders emphasize their role on business stability, capital sustainability, and risk management. The support provided tends to be directed towards operational aspects such as working capital needs and improving managerial skills, rather than long-term and high-risk investments in technological innovation. Thus, despite good service and access to financing, the contribution of microfinance institutions to technological innovation remains limited.

Although most of the highly rated indicators are related to ease of access to financing and financial services, such as ease of requirements, speed of approval, and financing assistance. This means that the main contribution of MFIs is still focused on providing capital and financial services, not on directly encouraging the development or application of new technology in MSME businesses. In addition, the focus of training provided by MFIs is more on business and financial management, not on the aspect of technology adoption or application. As a result, the increase in competency obtained by MSMEs does not directly encourage technological innovation. Furthermore, digital products by MFIs are more aimed at supporting efficiency rather than innovation, meaning that they are still limited to facilitating financial transactions, not yet encouraging MSMEs to innovate technology-based products, processes, or business models. This emphasizes that MFIs only play a role as a provider of financial facilities, so that even though their services are good, it does not necessarily have direct implications for increasing technological innovation. In addition, in this study, variables such as technology training programs from the government, partnerships with technology companies, or market competition pressure may have a stronger influence on microenterprises' technological innovation than MFI support. In other words, although MFIs play a role in strengthening capital and efficiency, the impetus to innovate technologically is triggered more by interventions specifically directed at technological development. This finding is supported by several previous studies. For example, Hermawan (2025) found that the effect of fintech and financial literacy on microenterprise performance is realized not directly, but through increased financial inclusion as a fully mediating variable (Hermawan et al., 2025). Meanwhile, Ramdhan (2019) added that to encourage innovation, financial support from MFIs must be accompanied by non-financial encouragement such as digital literacy and training in the use of applications (Ramdhan, 2019).

Effect of Financial Literacy on Micro Business Technology Innovation

Based on the results of hypothesis testing in Table 14, financial literacy has a significant positive effect on microenterprise technological innovation with an original sample value of 0.206, t-statistic of 2.583, and p-value of 0.010. A p-value smaller than 0.05 indicates that the relationship is statistically significant. This indicates that the higher the financial literacy of micro businesses, the greater their tendency to adopt or develop innovations in the use of technology. Good financial literacy enables businesses to understand the benefits of investing in technology and to manage the financial risks that may arise from such innovations.

According to the Theory of Planned Behavior (Ajzen, 1991), a person's behavior is influenced by three main factors. Financial literacy strengthens micro merchants' positive attitude towards financial management and innovation. When micro merchants have a good knowledge of finance, they tend to be more confident in making investment decisions, including the use of new technologies.

This finding is in line with previous research by Potrich, Vieira, & Kirch (2015) which states that financial literacy contributes positively to rational economic behavior, including in terms of business innovation. In addition, a study by Rahmandhani and Nugroho (2020) also revealed that Mikro Enterprises with higher levels of financial literacy are better prepared to face the challenges of the digital era through the use of technology. Financial literacy strengthens the confidence of micro-entrepreneurs in making technology- based decisions, thereby accelerating the adoption and implementation of digital innovations.

Thus, the results of this study reinforce the importance of financial literacy programs for micro enterprises as a strategy to encourage technological innovation. Financial training and education can be a strategic long-term investment for the government and microenterprise support institutions to help them thrive in the changing digital economy. Without adequate financial literacy, micro businesses will be hesitant to innovate due to risk uncertainty and limited resources.

The Relationship of Transaction Costs Moderating the Effect of Digital Finance Adoption on Microenterprise Technology Innovation

Based on the data on the moderation variable of transaction costs represented by the Moderation of Digital Financial Adoption on Technological Innovation of micro businesses shows positive and insignificant results, with an original sample value of 0.001, t-statistic 0.016, and p-value of 0.987. The p-value indicates that the presence of moderating variables in the form of transaction costs neither strengthens nor weakens the effect of digital finance adoption on microenterprise technological innovation. This means that the direct effect of digital finance adoption on micro business technology innovation does not depend on low or high transaction costs.

This is because the use of digital services by micro enterprises is mostly directed towards the efficiency of financial transactions (such as online payments or fund transfers), rather than the development of innovative product technologies or production processes. In other words, the adoption of digital finance only affects the administrative side, rather than directly driving technological innovation. Another result shows that micro merchants may not consider the cost of digital transactions when deciding to adopt technological innovations. This could be because the impetus for digital financial technology adoption is more strongly influenced by ease of access, speed of service, and operational efficiency rather than an

explicit calculation of the costs incurred. In other words, micro enterprises see the long-term benefits of financial digitization as greater than the costs involved in the transaction process. If associated with agency cost theory, the high effectiveness of transaction costs actually reduces the potential agency costs that usually arise due to information asymmetry, monitoring needs, or conflicts of interest between principals and agents. Digital technology makes information more transparent and accessible so that differences in interests can be minimized. This means that transaction costs that previously had the potential to be a barrier to innovation have now been suppressed by the function of digital technology itself, so that its existence no longer acts as a moderating variable in encouraging technological innovation in micro businesses.

Gustin et al. (2021) Although transaction costs can be an additional burden, in the context of microenterprise digitization in Indonesia, these costs are relatively small, even only ranging from 0.3-0.7% per small transaction. Many micro-enterprises actually feel that the efficiency and security benefits of digital transactions are more significant than the burden of these costs. Thus, transaction costs do not have enough impact to inhibit or strengthen the effect of digital adoption on technological innovation (Gustin et al., 2021).

Overall, the findings provide insights that strategies to strengthen microenterprises' technological innovation through digital finance adoption should not focus too much on reducing transaction costs. Instead, efforts should be directed towards improving digital literacy, trust in the digital financial system, and other supporting infrastructure. While transaction costs remain important in practical terms, in the empirical framework of this study, they are not shown to strengthen or weaken the influence between financial digitalization and technological innovation by micro enterprises.

Transaction Costs Moderate the Effect of Microfinance Institutions on Microenterprise Technology Innovation

Based on the results of hypothesis testing H5 in the table, moderation of transaction costs on the effect of Microfinance Institutions (MFIs) on microenterprise technological innovation shows positive and insignificant results, with an original sample of 0.106, t-statistic of 1.660, and p-value of 0.097. The p-value is greater than 0.05, which means that statistically, transaction costs are unable to strengthen or weaken the relationship between the role of MFIs and technological innovation of micro enterprises. This indicates that the presence of MFIs alone is not enough to encourage technological innovation, regardless of high or low transaction costs.

This finding indicates that although MFIs function as financing providers for micro enterprises, their impact on technological innovation does not depend much on the transaction cost factor. This could be due to the fact that the financing schemes offered by MFIs are relatively homogenous and not fully digitalized or transaction cost efficient. In other words, whether transaction costs are high or low, the role of MFIs on micro enterprises' decision to innovate technologically does not change significantly. In addition, microfinance institutions play more of a role in providing access to capital, mentoring, and institutional support, while the decision to undertake technological innovation is more influenced by internal business factors, such as adaptability, digital skills, and market needs.

If associated with agency cost theory, transaction costs should arise due to conflicts of interest, information asymmetry, and monitoring costs between principals and agents. However, under these conditions, agency costs can be reduced through information

transparency and transaction efficiency facilitated by digital technology. Microfinance institutions that function as intermediaries also do not face significant obstacles in supporting innovation, as information and transaction processes are more open.

Previous research supports this result as stated by Ledgerwood (2013), MFIs generally focus on traditional microfinance, and have not integrated many digital systems or advanced technologies that can directly encourage innovation. This is in line with research by Tambunan (2019) which states that MFIs play more of a role in the financial sustainability aspect of micro businesses, not in encouraging technological transformation. Therefore, although transaction cost is an important factor in terms of digital financial services, its influence is still weak in the relationship between MFIs and microenterprise technological innovation.

The Transaction Cost Relationship Moderates the Effect of Financial Literacy on Micro Business Technology Innovation

Based on the results of testing hypothesis H6 in the study, it was found that the moderating variable of transaction costs had no significant effect in moderating the relationship between financial literacy and technological innovation of micro businesses. This is indicated by the *original sample* value of 0.054, *t-statistic* 0.1038, and *p-value* 0.300 which is far above the 0.05 significance limit. This means that the level of transaction costs neither strengthens nor weakens the effect of financial literacy on micro business technological innovation.

Theoretically, financial literacy is expected to improve micro merchants' ability to access and utilize technology, including through transaction cost efficiency. However, this finding indicates that even if micro merchants have a good understanding of finance, changes in the level of transaction costs have little impact on their decision to innovate. Most likely, other factors such as access to technology, digital readiness, and business ecosystem support play a greater role in driving technological innovation.

If linked to agency cost theory, transaction costs should arise due to information search costs, negotiation costs, and monitoring costs between the financial service provider (principal) and the business (agent). However, because good financial literacy enables businesses to manage information, make rational decisions, and reduce potential errors and uncertainties, agency costs become smaller. Financial literacy can be considered as a tool to reduce transaction costs as micro merchants with high financial literacy are usually more efficient in choosing sources of funds, better informed on how to manage risks, and understand contractual implications, so in theory, they can avoid costly or inefficient transactions. However, if transaction costs beyond the control of micro merchants such as bank transfer fees, financial service commissions, digital platform fees, are still high, then the positive effect of financial literacy does not become stronger, which may explain why there is no significant moderating effect in this relationship.

Previous research conducted by Lusardi and Mitchell (2014) explained that financial literacy contributes significantly to financial decision making, but its impact on technological innovation requires support from affordable infrastructure and operational costs (Mitchell, 2014). In line with that, research by Sari and Nugroho (2020) found that even though financial literacy is high, if transaction costs are still high or unstable, micro businesses tend to be reluctant to innovate digitally because they feel they do not directly benefit from the cost efficiency (Sari and Nugroho, 2020).

CONCLUSION

This study concludes that digital finance adoption has a positive and significant effect on microenterprise technological innovation, in line with the *Technology Acceptance Model (TAM)* which emphasizes the role of technological convenience and usefulness. The role of microfinance institutions shows a positive but insignificant influence, as their main focus is more on business continuity and capital security rather than direct encouragement of innovation, as explained in *Stakeholder Theory*. Meanwhile, financial literacy proved to have a positive and significant effect, supporting the *Theory of Planned Behavior (TPB)* that individual attitudes, norms and control drive the decision to innovate. Meanwhile, transaction costs have a positive but insignificant effect on the main variable. This shows that although cost efficiency can support financial adoption and business management, its role is still limited to supporting factors and not the main determinant in driving technological innovation in MSMEs.

REFERENCES

Aditya, Mf., Ansori, M., & Fauzan Mubarok, A. (2025). Peran Lembaga Keuangan Mikro Syariah dalam Meningkatkan Perekonomian Masyarakat di Desa Tahunan. *EKOMA : Jurnal Ekonomi*, *4*(2).

Affan, M. W. (2022). Analisis Penggunaan E-Commerce: Faktor Yang Mempengaruhi dan Dampaknya Bagi UMKM. *Jurnal Akademi Akuntansi*, *5*(3), 392–403. https://doi.org/10.22219/jaa.v5i3.22013

Ainun Nufus, Natasya Natasya, Mas Munfasiroh, & Rasidah Novita Sari. (2024). Strategi Inovasi Produk Keuangan Syariah untuk Meningkatkan Inklusi Finansial. *SANTRI : Jurnal Ekonomi Dan Keuangan Islam*, *2*(6), 104–116. https://doi.org/10.61132/santri.v2i6.1016

Ananda Meylani Puteri, Intan Inanda, Rifaldy Bagas Prasetio, & Rudi Sanjaya. (2024). Pengaruh Literasi Keuangan dan Literasi Digital terhadap Preferensi Bank Digital di Kalangan Mahasiswa. *Jurnal Publikasi Ilmu Manajemen*, *Vol 2 No 4*, 16–25. https://doi.org/https://doi.org/10.55606/jupiman.v3i3.4467

Anggi Mirdiyantika. (2023). Pengaruh literasii keuangan, Inklusi keuangan dan Financial Technology terhadap peningkatan Kinerja Umkm Di Kecamatan Bulakamba. *JRIME : JURNAL RISET MANAJEMEN DAN EKONOMI*, *Vol. 1, No. 2*, 30.

Anggraeni, D., & Herlinawati, E. (2019). Analisis Model Pembiayaan Umkm Melalui Peran Lembaga Keuangan Mikro. In *Journal Image* | (Vol. 8, Issue 1).

Anggraini, A., Wulandari, D., & Edward Utama, R. (2023). *Strategi Inovasi Teknologi Terhadap Daya Saing Umkm Oleh*. *2*. https://doi.org/10.8734/mnmae.v1i2.359

Anggun Lestari, D., Dewi Purnamasari, E., & Setiawan, B. (2020). *Pengaruh Payment Gateway terhadap Kinerja Keuangan UMKM* (Vol. 1, Issue 1).

Anisyah, E. N., Pinem, D., & Hidayati, S. (2021). Pengaruh literasi keuangan, inklusi keuangan dan financial technology terhadap perilaku keuangan pelaku UMKM di Kecamatan Sekupang. *Management and Business Review*, *5*(2), 310–324. https://doi.org/10.21067/mbr.v5i2.6083

Anna Nur Faidah, & Aisyah. (2024). Pengaruh Kreativitas, Inovasi Produk Dan Kompetesi Wirausaha Terhadap Keberhasilan Usaha (Studi Pada Industri UMKM Kain Sasiragan

Di Kota Banjarmasin). *Jurnal Ekonomi Dan Bisnis Digital*, *Vol. 02 No. 02*, 1235–1247. https://jurnal.ittc.web.id/index.php/jebd/index

Anwar, K., & Elistia, E. (2024). YUME : Journal of Management Faktor-Faktor Yang Mempengaruhi Fintech Adoption Pada Generasi Milenial. In *YUME : Journal of Management* (Vol. 7, Issue 2).

Audrey, K., Sinaga, S., Irene, J., & Christanti, R. (2025). digital adoption and financial performance: evidence from indonesian smes in food and beverage *SECTOR*. https://return.publikasikupublisher.com/index.php/return/index

Ayuningtyas, A., Suhandiah, S., Sudarmaningtyas, P., & Lebdaningrum, K. (2024). Analisis Faktor Teknologi dan Organisasi dalam Adopsi Aplikasi Penjualan dan Pembayaran oleh UMKM. *Jurnal Eksplora Informatika*, *13*(2), 234–244. https://doi.org/10.30864/eksplora.v13i2.1091

Chen, S., & Guo, Q. (2024). *Fintech and MSEs Innovation: an Empirical Analysis*. http://arxiv.org/abs/2407.17293

Christie, S., Dewi, M., Hadiana, D., Corsini, A., & Nurgraha, W. (2024). Pengaruh Branderpreneurship Mindset Terhadap Intensi Pelaku UMKM Dalam Menggunakan Teknologi E-Commerce. In *General: Multidisciplinary Research Journal* (Vol. 1, Issue 2). https://money-id.com/index.php/money/index

Dahrani, D., Saragih, F., & Ritonga, P. (2022). Model Pengelolaan Keuangan Berbasis Literasi Keuangan dan Inklusi Keuangan : Studi pada UMKM di Kota Binjai. *Owner*, *6*(2), 1509–1518. https://doi.org/10.33395/owner.v6i2.778

Demetrius, F. (2025). *Pengaruh Literasi Keuangan Dan Teknologi Keuangan Terhadap Kinerja Umkm*. *07*(01), 325–333.

Dwinanto Priyo Susetyo, & Deri Firmansyah. (2023). Literasi Ekonomi, Literasi Keuangan, Literasi Digital dan Perilaku Keuangan di Era Ekonomi Digital. *Economics and Digital Business Review*, *Volume 4*(Issue 1 (2023)).

Elsa Bella Lilisonya, C., Dewi Rismawati, S., & Abdurrahman Wahid Pekalongan, U. K. (2023). *Dampak Positif Keuangan Digital Pada Pertumbuhan Ekonomi Islam*.

Ester Veronika, Innaya Izti, Chika Yunita, Nabila Pebriyani, & Dzannuba Dirgantara. (2024). Peran UMKM di Kota Depok dalam Pembangunan Ekonomi Berkelanjutan dan Kesejahteraan Masyarakat pada Provinsi Jawa Barat. *Wawasan : Jurnal Ilmu Manajemen, Ekonomi Dan Kewirausahaan*, *3*(1), 01–17. https://doi.org/10.58192/wawasan.v3i1.2669

Faiz, F., Le, V., & Masli, E. K. (2024). Determinants of digital technology adoption in innovative SMEs. *Journal of Innovation and Knowledge*, *9*(4). https://doi.org/10.1016/j.jik.2024.100610

Fecira, D., & Mohd Khairal Abdullah, T. (n.d.). *Analisis Penerimaan E-Learning Menggunakan Technology Acceptance Model (TAM)*.

Ghozali, I. (2015). *Partial Least Squares : Konsep, Teknik dan Aplikasi Menggunakan program SmartPLS 3.0*. Badan PenerbitUniversitas Diponegoro.

Gustin, F. A., Dinurri'anah, U., & Shohiha, A. (2021). antara inovasi teknologi pembayaran transaksi bisnis tradisional : (studi kasus ukm di yogyakarta). *At-Thullab : Jurnal Mahasiswa Studi Islam*, *2*(2), 444–454. https://doi.org/10.20885/tullab.vol2.iss2.art5

Hamid, R. S., & Anwar, S. M. (2019). *Structural Equation Modeling (SEM) Berbasis Varian : Konsep Dasar dan Aplikasi dengan Pemrograman SmartPLS 3.2.8 dalam Riset Bisnis*. PT Inkubator Penulis Indonesia.

Hermawan, I., Ramadhan, Muh. S., & Sumarni, S. (2025). Peran Mediasi Inklusi Keuangan: Analisis Teknologi Keuangan dan Literasi Keuangan Terhadap Kinerja Usaha Mikro, Kecil dan Menengah. *Atestasi : Jurnal Ilmiah Akuntansi*, *8*(2), 369–381. https://doi.org/10.57178/atestasi.v8i2.1634

Hervilia, H., Singasatia, D., & M. Agus Sunandar. (2022). Analisis Faktor Yang Mempengaruhi Penerimaan Teknologi Pada Pengguna Aplikasi Shopee Menggunakan Technology Acceptance Model (TAM). *INSOLOGI: Jurnal Sains Dan Teknologi*, *1*(4), 401–410. https://doi.org/10.55123/insologi.v1i4.750

Judijanto, L., Destiana, R., Sudarmanto, E., Ayu, I., Suprapti, P., & Harsono, I. (2024). Analisis Pengaruh Adopsi Teknologi Finansial, Kepercayaan Nasabah, dan Regulasi Terhadap Penggunaan Layanan Keuangan Digital. In *Jurnal Akuntansi dan Keuangan West Science* (Vol. 3, Issue 01).

Judijanto, L., Sandy, S., Yanti, D. R., Kristanti, D., Hakim, M. Z., Jakarta, I., Stie,), & Bulan, J. (2023). pengembangan usaha kecil menengah (ukm) berbasis inovasi teknologi untuk mendorong pertumbuhan ekonomi lokal. *Communnity Development Journal*, *4*(6), 12500–12507.

Juwita, O., Firdonsyah, A., Ali, M., Puji Widodo, A., & Rizal Isnanto, R. (2022). Studi Literatur Platform Digital Sebagai Sarana Dalam Mengembangkan UMKM. In *Informatics Journal* (Vol. 7, Issue 1).

Latifiana, D. (2017). *Studi Literasi Keuangan Pengelola Usaha Kecil Menengah (UKM)*.

Layli, M., Firmansyah, F., Wibowo, F. W., Setiorini, K. R., Nurjannah, N., & Indriyani, T. (2024). Diseminasi Literasi Keuangan Sebagai Transisi Peningkatan Potensi Umkm Menghadapi Inklusi Keuangan. *JMM (Jurnal Masyarakat Mandiri)*, *8*(1), 1503. https://doi.org/10.31764/jmm.v8i1.20776

Marcela. (2024). Pengaruh Literasi Keuangan Terhadap Pengelolaan Keuangan Umkm Kuliner Di Kota Palembang. *K&K_JURNAL MANAJEMEN*, *VOL 3 NO 1*, 83–604.

Muhammad Adil. (2023). Analisis Keputusan Berinvestasi Di Umkm Melalui Securities Crowdfunding: Pendekatan Theory Of Planned Behavior. *Contemporary Studies in Economic, Finance and Banking*, *2*(3), 467–480. https://doi.org/10.21776/csefb.2023.02.3.10

Mustehsan, M., & Munir, S. (2023). *Assessing The Influence Of Financial Inclusion And Digital Finance On Smes Performance: The Moderating Role Of Technological Adaptation*. https://www.researchgate.net/publication/375171097

Nofranita, W., Nurul Ulya, & Fitri Yulianis. (2024). Pengaruh Literasi Keuangan dan Teknologi Keuangan Terhadap Perilaku Keuangan UMKM. *Jurnal Akademi Akuntansi Indonesia Padang*, *4*(1), 80–95. https://doi.org/10.31933/xmwq6905

Nova, V., Banggai, P., Luwuk Banggai, I., Hamzah, H., Luwuk Banggai, A., & Unsong, I. F. (2024). Merancang Strategi Cerdas Bisnis Inovatif Di Tengah Revolusi Digital Yang Terus Berkembang. In *Meraja Journal* (Vol. 7, Issue 3).

Purmiyati, A., Setyawan, A., Ayu Pramesti, G., & Ayu Nastiti, G. (2022). Manfaat Penggunaan Teknologi Pada UMKM dalam Penguatan Ekonomi Jawa Timur Selama Pandemi Covid-19 Tuwanku Aria Auliandri. In *Gebrina Ayu Pramesti*.

Putri, P. L., & Widadi, B. (2024). Peran Inovasi dalam Pengembangan Model Bisnis UMKM di Era Digital. *Maeswara : Jurnal Riset Ilmu Manajemen Dan Kewirausahaan*, *2*(4), 180–189. https://doi.org/10.61132/maeswara.v2i4.1113

Putri Ramadhanti, S., Dharmawan Buchdadi, A., & Fawaiq, M. (2023). *Determinan Adopsi Dompet Digital: Perceived Ease Of Use, Trust, dan Perceived Usefulness* (Vol. 4, Issue 1).

Rafika Putri, & Qahfi Romula Siregar. (2022). Pengaruh Pengetahuan Keuangan, Sikap Keuangan Dan Literasi Keuangan Terhadap Perilaku Manajemen Keuangan Pada Pelaku Umkm Ayam Penyet Di Desa Laut Dendang. *Jurnal AKMAMI (Akutansi, Manajemen, Ekonomi,)*, *Vol 3 No 3*, 580–592. https://jurnal.ceredindonesia.or.id/index.php/akmami

Rahadi, D. R., & Farid, M. (2021). Analisis Variabel Moderating. In P. Adi & M. Muslih (Eds.), *Paper Knowledge . Toward a Media History of Documents* (Monograf A, Vol. 7, Issue 2). CV. Lentera Ilmu Mandiri.

Rahmadi, A. R. (2024). Pengaruh Inovasi Terhadap Daya Saing Usaha Mikro Dengan Kompetensi Pegawai Usaha Mikro Sebagai Mediasi. *Jurnal Manajemen Terapan Dan Keuangan (Mankeu)*, *13*(01).

Rahmah, A. T., & Fasa, M. I. (2024). PT. Media Akademik Publisher. *JMA)*, *2*(10), 3031–5220. https://doi.org/10.62281

Renny Oktafia. (2017). *Percepatan Pertumbuhan Usaha Mikro, Kecil Dan Menengah (Umkm) Melalui Perkuatan Lembaga Keuangan Mikro Syariah (Lkms) Di Jawa Timur*.

Rinaldi Bursan. (2025). The Influence of Digital Technology on MSME Performance through Innovation, Financial Access, and Trust. *Harmony Management: International Journal of Management Science and Business*, *2*(2), 116–125. https://doi.org/10.70062/harmonymanagement.v2i2.240

Rizky Isfany, Muhammad Fuad, & Dias Setianingsih. (2024). Analisis Hubungan Sikap Keuangan, Literasi Keuangan, Pengetahuan Keuangan Dan Kepribadian Keuangan Terhadap Pengelolaan Keuangan Pada Bumdes Di Kota Langsa. *Tax and Business Journal*, *Vol 5 No 1*, 132–142.

Roren, Y., Puan, A., Bonamanobing, R., & Alviansha, A. (2025). The Role of Microfinance Institutions in Micro, Small and Medium Enterprises (MSMES): a Case Study of Budi Gadai. In *International Journal of Education* (Vol. 5, Issue 1). http://lpppipublishing.com/index.php/ijessm

Salsabila, Z. (2024). Analysis Of The Role Of Microfinance Institutions In Supporting Community Economic Development Efforts (Msmes) In Indonesia. In *Jurnal Ilmiah Manajemen* (Vol. 246, Issue 3). http://ejournal.pelitaindonesia.ac.id/ojs32/index.php/PROCURATIO/index

Sari, D. W., Pristiyono, P., & Pitriyani, P. (2023). Inklusi Keuangan Digital Melalui Loyalitas Dalam Membangun Finansial Teknologi. *Owner*, *7*(3). https://doi.org/10.33395/owner.v7i3.1557

Sekaran, U. (2015). *Metodologi Penelitian untuk Bisnis (Research Methods for Business)*. Salemba Empat.

Singarimbun, M., & Effendi, S. (2018). *Metode Penelitian Survai*. Pustaka LP3ES.

Sipayung, T. D. (2025). The Impact of Financing Digitalization on MSME Operational Effectiveness: The Mediating Role of Innovation, Digital Infrastructure, and Fintech.

Jurnal Ilmiah Manajemen Kesatuan, *13*(3), 1621–1634. https://doi.org/10.37641/jimkes.v13i3.3258

Siti Huwaena Maulidiah Sidin, Intan Sartika Eris Maghfiroh, & Yusi Tyroni Mursityo. (2024). analisis faktor minat adopsi layanan pembayaran quick response code indonesian standard pada pelaku umkm food & beverage menggunakan kerangka technology acceptance model termodifikasi. *Jurnal Sistem Informasi, Teknologi Informasi, Dan Edukasi Sistem Informasi (JUST-SI)*, *Vol 5*, 13–23.

Sugeng Haryanto. (2011). *Sugeng Haryanto, adalah Dosen Program D3 Keuangan dan Perbankan Universitas Merdeka Malang*.

Sutarsih, E. (2023). *As-Syar'i: Jurnal Bimbingan & Konseling Keluarga Literasi dan Inklusi: Keuangan Syariah Sebagai Fundamental Kesejahteraan UMKM: Edukasi Bisnis Akses Keuangan Syariah untuk UMKM Santri di Yogyakarta*. https://doi.org/10.47476/assyari.v5i3.5628

Tenri Ampa, A., Supatminingsih, T., Dinar, M., & Fajrinah, N. (n.d.). *LP2M-Universitas Negeri Makassar Pengaruh Literasi Digital, Literasi Keuangan dan Inovasi Terhadap Kinerja Usaha Mikro, Kecil, dan Menengah*.

Tri Murti, H., Lakoni, I., Safrianti, S., Manajemen, J., Ekonomi dan Bisnis, F., ProfDr Hazairin, U., & Kota Bengkulu, S. (2023). *Pengaruh Literasi Keuangan Dan Literasi Teknologi Terhadap Adopsi Uang Elektronik Pada Mahasiswadi Kota Bengkulu Melalui Mediasi Attitude Toward Adoption*.

Tubastuvi, N., Nur Ainun, R., Purwidianti, W., & Zamakhsyari, L. (2024). Enhancing MSME: Exploring the Relationship between Financial Literacy, Financial Inclusion, and Capital Access to Improve Performance. *Airlangga Journal of Innovation Management*, *5*(1), 1–16. https://doi.org/10.20473/ajim.v5i1.53990

Ummasyroh, U., Astarina, Y., Riana, D., Muharramah, U., & Africano, F. (2024). Business Development Through The Application Of Financial Technology (Digital Payment) In MSMEs. *Asean International Journal of Business*, *3*(2), 169–181. https://doi.org/10.54099/aijb.v3i2.997

Vera Maria, Linda Nurkhalida, & S. Ulfa. AB. AL. (2024a). Analisis Faktor-Faktor Yang Dapat Mempengaruhi Inovasi Umkm Dalam Meningkatkan Daya Saing Produk Lokal. *MASMAN : Master Manajemen*, *2*(2), 01–07. https://doi.org/10.59603/masman.v2i2.378

Vera Maria, Linda Nurkhalida, & S. Ulfa. AB. AL. (2024b). Analisis Faktor-Faktor Yang Dapat Mempengaruhi Inovasi Umkm Dalam Meningkatkan Daya Saing Produk Lokal. *MASMAN : Master Manajemen*, *2*(2), 01–07. https://doi.org/10.59603/masman.v2i2.378

Wahyu Rumbianingrum, & Candra Wijayangka. (2018). 162-Article Text-696-2-10-20191012. *JURNAL MANAJEMEN DAN BISNIS (ALMANA)*, *VOL. 2 NO. 3*, 156.

Widjayanti, C. E., Adawiyah, W. R., & Sudarto. (2025). Financial literacy innovation is mediated by financial attitudes and lifestyles on financial behavior in MSME players. *Journal of Innovation and Entrepreneurship*, *14*(1). https://doi.org/10.1186/s13731-025-00525-5

Widowati, N., Ekonomi, F., Bisnis, D., Khusaeni, M., Pembangunan, E., & Brawijaya, U. (2022. https://doi.org/10.21776/jdess

Winarto, W. W. A. (2020). Peran Fintech dalam Usaha Mikro Kecil dan Menengah (UMKM). *Jesya (Jurnal Ekonomi & Ekonomi Syariah)*, *3*(1), 61–73. https://doi.org/10.36778/jesya.v3i1.132

Wulan Sari, A., Purwanto, B., & Dasra Viana, E. (2023). *Literasi keuangan dan faktor yang memengaruhi minat pelaku umkm berinvestasi di pasar modal: analisis theory of planned behavior*.

Yogaswari, D. A., Nyoman, N., Diantini, A., Ekonomi, F., & Bisnis, D. (2024). *E-Jurnal Ekonomi Dan Bisnis Universitas Udayana Pengaruh Inovasi Digital Terhadap Kinerja Keuangan Perbankan Di Indonesia*. https://ojs.unud.ac.id/index.php/EEB/index