The Impact of Financing Digitalization on MSME Operational Effectiveness: The Mediating Role of Innovation, Digital Infrastructure, and Fintech

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ABSTRACT

This study aims to examine the influence of financing digitalization on the operational effectiveness of Micro, Small, and Medium Enterprises (MSMEs), mediated by product innovation, digital infrastructure, and financial technology in Medan City. Utilizing a quantitative descriptive approach, the research employed Structural Equation Modeling (SEM) with SMART PLS 3.0 to analyze data from 100 MSMEs selected through simple random sampling from a population of 38.343 units in Medan City in 2023. Data were gathered through questionnaires, observations, and secondary sources, ensuring strong validity and reliability. The findings reveal that financing digitalization significantly improves MSME operational effectiveness both directly (T=6.233, p<0.001) and indirectly through product innovation (T=4.112, p=0.003), digital infrastructure (T=3.347, p=0.001), and financial technology (T=5.534, p=0.002). These mediating variables contribute to enhanced efficiency by simplifying transaction processes, strengthening infrastructure reliability, and automating financing operations. The study highlights the critical importance of adopting digital financing solutions within MSMEs to remain competitive. It also emphasizes the role of policymakers in facilitating this transformation by investing in digital infrastructure and implementing comprehensive digital literacy programs to foster a sustainable and inclusive digital economy.

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***Keywords**: Digital Infrastructure, Financing Digitalization, Financial Technology, MSME Operational Effectiveness, Product Innovation*

ABSTRAK

Penelitian ini bertujuan untuk menguji pengaruh digitalisasi pembiayaan terhadap efektivitas operasional Usaha Mikro, Kecil, dan Menengah (UMKM), yang dimediasi oleh inovasi produk, infrastruktur digital, dan teknologi keuangan di Kota Medan. Dengan memanfaatkan pendekatan deskriptif kuantitatif, penelitian ini menggunakan Structural Equation Modeling (SEM) dengan SMART PLS 3.0 untuk menganalisis data dari 100 UMKM yang dipilih melalui simple random sampling dari populasi 38.343 unit di Kota Medan pada tahun 2023. Data dikumpulkan melalui kuesioner, observasi, dan sumber sekunder, memastikan validitas dan reliabilitas yang kuat. Temuan penelitian mengungkapkan bahwa digitalisasi pembiayaan secara signifikan meningkatkan efektivitas operasional UMKM baik secara langsung (T=6,233, p<0,001) maupun secara tidak langsung melalui inovasi produk (T=4,112, p=0,003), infrastruktur digital (T=3,347, p=0,001), dan teknologi keuangan (T=5,534, p=0,002). Variabel-variabel mediasi ini berkontribusi pada peningkatan efisiensi dengan menyederhanakan proses transaksi, memperkuat keandalan infrastruktur, dan mengotomatiskan operasi pembiayaan. Studi ini menyoroti pentingnya penerapan solusi pembiayaan digital dalam UMKM agar tetap kompetitif. Studi ini juga menekankan peran pembuat kebijakan dalam memfasilitasi transformasi ini dengan berinvestasi dalam infrastruktur digital dan menerapkan program literasi digital yang komprehensif untuk mendorong ekonomi digital yang berkelanjutan dan inklusif.

***Kata kunci**: Infrastruktur Digital, Digitalisasi Pembiayaan, Teknologi Keuangan, Efektivitas Operasional UMKM, Inovasi Produk*

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INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) form the backbone of Indonesia's economy, accounting for over 99% of all business entities and playing a crucial role in job creation, poverty alleviation, and inclusive economic development. As of 2023, Indonesia had approximately 66 million MSMEs, each typically operating with assets around 50 million Rupiah and an annual turnover of roughly 300 million Rupiah. These enterprises significantly contribute to employment opportunities and economic dynamism by supporting business growth and household income (Oyewole et al., 2024). Despite their critical role, MSMEs continue to encounter persistent structural challenges, particularly in accessing formal financing, adopting digital technologies, and optimizing operational processes—factors essential for survival and competitiveness in today's digital economy.

One of the most enduring barriers to MSME growth is limited access to financing. Traditional financial institutions, including commercial banks, often impose rigid collateral and documentation requirements, which many MSMEs cannot fulfill due to informality, lack of credit history, or weak financial reporting (Nurmadewi & Mahendrawathi, 2020). This lack of access restricts MSMEs' ability to expand, invest in technology, and improve service delivery. Adequate financing is vital for increasing production capacity, maintaining business continuity, and ensuring long-term sustainability. As emphasized by Purwanto et al. (2022), MSMEs with better financing access are more capable of improving their operational systems and income-generating capacity. In response to these limitations, digital financial innovations such as fintech lending, peer-to-peer (P2P) platforms, digital wallets, and mobile-based financing have emerged as alternative funding mechanisms (Antoni, 2023). These technologies offer more accessible, faster, and flexible financing solutions compared to conventional banking systems. However, their potential impact remains underutilized due to challenges including low digital literacy, lack of trust in digital systems, and insufficient supporting infrastructure among MSMEs. In many cases, entrepreneurs are unfamiliar with digital financial tools or lack the technical knowledge to utilize them effectively, limiting the broader adoption of these services.

The digitalization of MSME operational systems also presents both opportunities and challenges. Digital transformation—such as the implementation of online sales platforms, digital inventory tracking, and customer relationship management tools—can significantly improve operational speed, process efficiency, and customer satisfaction. According to Astuti et al. (2023), MSMEs that successfully digitize their processes are better positioned to grow into larger, more competitive enterprises. Nonetheless, a significant number of Indonesian MSMEs still lag in this transition due to a lack of resources, digital skills, and access to adequate infrastructure (Dewi & Mahendrawathi, 2019). This technological gap undermines their productivity, limits market access, and results in operational inefficiencies and potential revenue losses. While a number of studies have explored the individual effects of either financing access or digital technology adoption on MSMEs, relatively few have examined how digital financing impacts operational effectiveness through mediating variables. For instance, Purwanto et al. (2022) emphasize the direct relationship between financing and performance but do not account for the mediating roles of product innovation or digital infrastructure. Similarly, Hermawan et al. (2022) highlight artificial intelligence (AI) in credit evaluation but neglect its broader implications for business operations. Mohamad et al. (2022) address digital financing transparency but fall short in linking it to tangible performance outcomes. These gaps underscore the need for a more comprehensive and integrated framework.

Therefore, this study investigates the influence of financing digitalization on MSME operational effectiveness in Indonesia, with a specific focus on the mediating roles of product innovation, digital infrastructure, and financial technology. Innovations such as AI-driven credit scoring, buy-now-pay-later (BNPL) services, and mobile-based payment systems offer promising pathways to enhance financial access and operational

performance. However, their effectiveness largely depends on MSMEs' digital readiness and the availability of enabling infrastructure (Nurmadewi & Mahendrawathi, 2020). By addressing existing research gaps, this study aims to deliver practical insights for MSME owners, financial technology providers, and policymakers to foster MSME growth and resilience in the digital economy.

LITERATURE REVIEW & HYPOTHESIS DEVELOPMENT

Financing Digitalization on Product Innovation and Financial Technology

Financing digitalization enhances MSME operational effectiveness by streamlining financial processes and improving access to capital. Fanggidae et al. (2023) noted that digital platforms, such as fintech lending and digital wallets, simplify loan processes, enabling MSMEs to allocate resources efficiently and meet market demands. Aji & Priyono (2021) highlighted that real-time payment systems foster customer trust and business reliability, critical for operational efficiency in Indonesia's dynamic market. Digital financing reduces transaction costs and fraud risks, supporting sustainable growth. Sihombing (2024) emphasized that digital financing systems improve operational capacity by providing accessible capital, enhancing MSMEs' ability to scale operations. Thus, the following hypothesis is proposed:

H1: Financing digitalization positively affects MSME operational effectiveness.

Digital financing fosters product innovation by enabling MSMEs to adopt creative financial solutions, such as digital wallets and AI-driven lending platforms. Bahl et al. (2023) emphasized that these innovations bypass traditional banking barriers, enhancing financial inclusion. Kurniawan & Iskandar (2023) noted that AI-based credit scoring accelerates funding access, allowing MSMEs to innovate in financial management, which supports operational scalability and competitiveness. Hasanah et al. (2024) highlighted that ERP-based systems foster innovative financial solutions, improving MSMEs' market adaptability. Based on the above discussion, the following hypothesis is formulated:

H2: Financing digitalization positively affects product innovation in MSME financing digitalization.

Financing digitalization drives investments in digital infrastructure, such as reliable internet and secure platforms, essential for seamless financial transactions. Mangifera & Mawardi (2022) argued that robust infrastructure supports efficient capital access, enhancing MSME operational performance. Nurmadewi & Mahendrawathi (2020) pointed out that infrastructure gaps, particularly in rural areas, hinder adoption, necessitating policy interventions to ensure equitable access. Mediaty et al. (2025) noted that robust digital infrastructure supports accounting information systems, enhancing MSMEs' financial management. Thus, the following hypothesis is proposed:

H3: Financing digitalization positively affects MSME digital infrastructure.

Digital financing promotes the adoption of fintech tools, such as mobile payment apps and AI-driven credit systems, which streamline financial management. Wibowo et al. (2023) highlighted that fintech enhances capital access, supporting MSME growth. Nurmadewi & Mahendrawathi (2020) noted that limited digital literacy and infrastructure challenges impede fintech adoption, requiring training and technological investments to maximize benefits. Rahayu et al. (2023) emphasized that fintech adoption fosters financial inclusion, enabling MSMEs to compete in the formal economy. Based on the above discussion, the following hypothesis is formulated:

H4: Financing digitalization positively affects MSME financial technology.

Product Innovation, Digital Infrastructure, and Financial Technology

Product innovation in financing digitalization, such as digital wallets, peer-to-peer lending, and AI-driven credit platforms, enhances MSME operational effectiveness by simplifying financial transactions and improving capital access. Bahl et al. (2023) emphasized that innovative financial products enable MSMEs to bypass traditional banking barriers, streamlining processes and reducing operational costs. Pramudana et al. (2023) noted that AI-driven approval systems provide timely funding, allowing MSMEs to meet market demands efficiently, such as restocking inventory or expanding services. These innovations enhance customer satisfaction by enabling faster payment processing, fostering business reliability and scalability (Aji & Priyono, 2021). However, Nurmadewi & Mahendrawathi (2020) highlighted that limited digital literacy among MSME owners can hinder adoption, necessitating training programs to maximize benefits. Consequently, the following hypothesis is put forward:

H5: Product innovation in MSME financing digitalization positively affects MSME operational effectiveness.

Robust digital infrastructure, including reliable internet and secure platforms, is critical for MSMEs to leverage digital financing effectively, directly enhancing operational efficiency. Mangifera & Mawardi (2022) argued that stable infrastructure supports seamless financial transactions, reducing delays and improving productivity. Annisa & Mahendrawathi (2019) emphasized that secure systems build trust, encouraging MSMEs to adopt digital tools that streamline operations, such as real-time inventory management. Infrastructure gaps, particularly in rural Indonesia, limit adoption, as noted by Dewi & Mahendrawathi (2019), who stressed the need for government investment in broadband expansion to ensure equitable access. Improved infrastructure enables MSMEs to compete in digital markets, enhancing service delivery and customer trust (Syaifullah et al., 2021). Thus, the following hypothesis is proposed:

H6: Digital infrastructure positively affects MSME operational effectiveness.

Financial technology (fintech), such as mobile payment apps and AI-based credit scoring, automates financial processes, reducing costs and delays, thus enhancing MSME operational effectiveness. Wibowo et al. (2023) highlighted that fintech tools improve capital access, enabling MSMEs to address operational needs promptly, such as equipment upgrades. Ayustia et al. (2023) noted that user-friendly fintech platforms foster trust and high transaction volumes, supporting scalability. However, Dewi & Mahendrawathi (2019) pointed out that limited digital literacy and infrastructure challenges in rural areas hinder fintech adoption. Fintech enhances transparency, reducing fraud risks and improving cash flow management (Handayani & Mahendrawathi, 2019). These hypotheses align with Rosyidiana & Narsa (2024), who emphasized that digital innovations improve financial performance by streamlining transactions and fostering competitiveness in Indonesia's digital economy. Thus, the following hypothesis is proposed:

H7: MSME financial technology positively affects MSME operational effectiveness.

Mediating Effects

Product innovation, such as digital wallets and fintech lending, facilitates efficient capital access, enhancing operational efficiency (Bahl et al., 2023). Kurniawan & Iskandar (2023) noted that innovative financial products simplify transactions, enabling MSMEs to respond to market demands swiftly. Taleb et al. (2023) emphasized that innovation capability mediates the relationship between entrepreneurial resources and business performance, enhancing MSMEs' operational effectiveness. These innovations foster

financial inclusion and streamline processes, supporting scalability. Consequently, the following hypothesis is put forward:

H8: Financing digitalization positively affects MSME operational, mediated by product innovation.

Robust infrastructure, including reliable internet and secure platforms, supports seamless financial transactions, amplifying the benefits of digital financing (Mangifera & Mawardi, 2022). Wajdi et al. (2023) emphasized that infrastructure reduces transaction delays, improving operational performance. Mediaty et al. (2025) highlighted that digital infrastructure enhances accounting information systems, supporting efficient financial management in MSMEs. This strengthens operational scalability and competitiveness. Thus, the following hypothesis is proposed:

H9: Financing digitalization positively affects MSME operational effectiveness, mediated by digital infrastructure.

Fintech tools, such as AI-driven credit scoring, streamline financing processes, enhancing operational scalability (Wibowo et al., 2023). Nurmadewi & Mahendrawathi (2020) highlighted that fintech automates loan approvals, reducing costs and delays, directly supporting MSME growth. However, Dewi & Mahendrawathi (2019) noted that infrastructure gaps and limited digital literacy hinder the mediating effects, particularly in rural areas. Aji & Priyono (2021) argued that these mediators create a synergistic effect, enhancing MSMEs' ability to manage resources and compete in the digital economy. For instance, digital infrastructure supports real-time transaction processing, while fintech ensures transparent financial management, reducing fraud risks (Handayani & Mahendrawathi, 2019). Winarsih et al. (2020) emphasized that fintech, combined with financial literacy, strengthens MSME sustainability by improving operational efficiency. Based on the above discussion, the following hypothesis is formulated:
H10: Financing digitalization positively affects MSME operational effectiveness, mediated by financial technology.

Conceptual Framework

The conceptual framework outlines the relationships between financing digitalization, mediating variables (product innovation, digital infrastructure, financial technology), and MSME operational effectiveness. Financing digitalization serves as the exogenous variable, directly influencing operational effectiveness and indirectly through the mediating variables. Product innovation, such as digital wallets, enhances access to financing, improving MSMEs' operational efficiency (Bahl et al., 2023). Digital infrastructure, including reliable internet and secure platforms, supports seamless financial transactions, boosting operational performance (Mangifera & Mawardi, 2022). Financial technology, like AI-driven credit systems, streamlines financing processes, enhancing MSMEs' ability to manage operations effectively (Wibowo et al., 2023).

Figure 1 visually depicts these relationships, illustrating financing digitalization as the central driver, with arrows indicating direct effects on operational effectiveness and indirect effects through the mediators. The framework integrates insights from prior studies, emphasizing the role of digital innovations in overcoming MSMEs' financing and operational challenges (Nurmadewi & Mahendrawathi, 2020). It highlights how robust infrastructure and fintech adoption amplify the benefits of financing digitalization, addressing barriers like limited digital literacy (Dewi & Mahendrawathi, 2019). This study uses this framework to test the hypothesized relationships, providing a comprehensive model for understanding MSME growth in Indonesia's digital economy (Aji & Priyono, 2021).

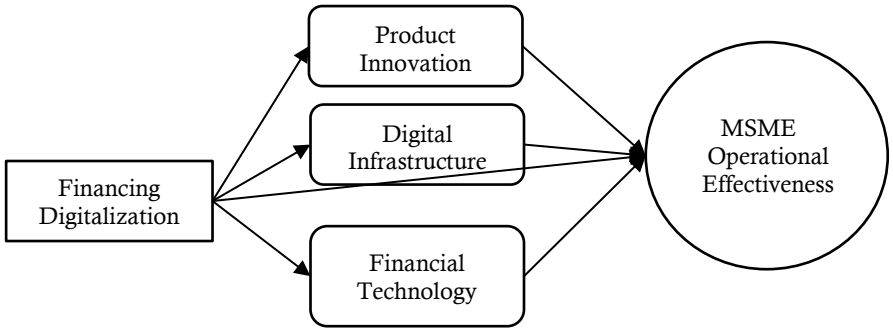

Figure 1. Conceptual Framework

RESEARCH METHOD

This research employed a quantitative descriptive method with data analysis conducted using the Structural Equation Modeling (SEM) technique. According to Zeng et al. (2021), SEM is a statistical approach used to describe the interrelationships among construct variables through a series of structural equations. The study population consisted of approximately 38.343 units of Micro, Small, and Medium Enterprises (MSMEs) in Medan City, Indonesia in 2023 (Hidayat et al., 2024). A simple random sampling technique was used to select the sample. Simple random sampling is a method in which each sample unit has an equal probability of being selected, and the selection is made without any systematic pattern, thus allowing for an unbiased representation of the population.

The appropriate sample size was determined using the Slovin formula, which is commonly applied in large populations to obtain a manageable sample size while maintaining acceptable accuracy. To determine the sample size, Slovin's formula is used:

$$n = \frac{N}{1 + Ne^2}$$

Where:
n = sample size
N = population size = 38,343
e = margin of error (typically 0.10 for 10%)

$$n = \frac{38,343}{1 + 38,343(0.10)^2}$$

$$n = \frac{38,343}{1 + 38,343(0.01)}$$

$$n = \frac{38,343}{1 + 383.43}$$

$$n = \frac{38,343}{384.43}$$

$$n \approx 99.74 \approx 100 \text{ MSMEs}$$

Total of 100 MSMEs in Indonesia were selected as the sample for the year 2023.

Data were collected through structured questionnaires and analyzed using SMART PLS 3.0, a software tool specifically designed for Partial Least Squares-SEM. This tool is suitable for analyzing complex models involving latent variables. The data analysis process was divided into two main stages. The first stage involved evaluating the measurement model to test for validity and reliability. This included assessing convergent validity through outer loadings (> 0.7) and Average Variance Extracted (AVE > 0.5),

discriminant validity using the Fornell-Larcker criterion, and composite reliability (> 0.6). The second stage involved testing the structural model to evaluate the path coefficients and examine the proposed hypotheses.

To assess the statistical significance of relationships between variables, a bootstrapping technique with 5,000 resamples was applied. This method enhances the robustness and generalizability of the results. Overall, this methodological approach ensures accurate, valid, and reliable findings, thereby addressing the research questions and objectives effectively.

RESULTS

The results of the SEM test can be found out through the following Bootstraping diagram in Figure 2. Figure 2 illustrates the bootstrapping results of the Structural Equation Modeling (SEM) analysis, depicting the path coefficients and significance of relationships between financing digitalization, product innovation, digital infrastructure, financial technology, and MSME operational effectiveness.

Zeng et al. (2021) states that convergent validity analysis is a test aimed at finding out the validity of the data of each existing variable. The results of the convergent validity test in this study are shown in Table 1. Table 1 states that the distribution of data in each variable that appears is very valid, because the value of the variable is greater than 0.05.

Moreover, Zeng et al. (2021) states that the AVE test is a test intended to understand how valid the data of existing variables is. The results of the Average Variant Extracted (AVE) test are in Table 2.

Table 1. Convergent Validity test

Variable	Indicator	Outer Loading
Financing Digitization	FP 1	0.873
	FP 2	0.887
	FP 3	0.867
	FP 4	0.855
Operational Effectiveness (Y)	OE 1	0.856
	OE 2	0.866
	OE 3	0.836
	OE 4	0.846
Product Innovation (Z_1)	PI 1	0.810
	PI 2	0.820
	IP 3	0.830
	IP 4	0.850
Digital Infrastructure (Z_2)	DI 1	0.831
	DI 2	0.845
	DI 3	0.882
Financial Technology (Z_3)	FT 1	0.870
	FT 2	0.817
	FT 3	0.822
	FT 4	0.833

Table 2. AVE Test

Variable	AVE
Financing Digitization (X)	0.832
Operational Effectiveness (Y)	0.865
Product Innovation (Z_1)	0.845
Digital infrastructure (Z_2)	0.855
Financial Technology (Z_3)	0.875

According to Table 2, the value of the Average Variant Extracted (AVE) test is greater than 0.5 which can be interpreted that all data results are valid and the validity of the data is in accordance with the expectations of the researcher. Furthermore, according to Zeng et al. (2021) Composite Reliability testing is a data analysis that is carried out to find out and understand how realistic the data is. This can be seen in Table 3.

Table 3. Composite Reliability Test

Variable	Composite Reliability
Financing Digitization (X)	0.883
Operational Effectiveness (Y)	0.820
Product Innovation (Z_1)	0.833
Digital infrastructure (Z_2)	0.872
Financial Technology (Z_3)	0.850

Table 3 states that the composite reliability value is greater than 0.6, where the variable values of all existing variables are reliable and valid. In confirmatory factor analysis (CFA), i.e. structural equation modeling (SEM), discriminant validity analysis is how different construct equations appear. The results of the Discriminant Validity analysis can be seen in Table 4.

Based on Table 4, it can be seen that the existing AVE value is in accordance with the requirements, namely meeting the assumption of Discriminant Validity. As for the path coefficient test, it can be found through Table 5. From Table 5, the R Square value of the MSME operational effectiveness variable can be explained by the variables of financing digitalization, product innovation, digital infrastructure and financial technology of 85.5%, while the remaining 14.5% can be explained by other variables that are not listed in the study.

Table 4. Discriminant Validity Analysis

Variable	Mediation Effect 1	Mediation Effect 2	Mediation Effect 3	Mediation Effect 4	Mediation Effect 5
Financing Digitization (X)	0.767	1.000	0.765	0.767	0.767
Operational Effectiveness (Y)	0.875	0.765	1.000	0.745	0.875
Product Innovation (Z_1)	0.765	0.675	0.875	1.000	0.765
Digital infrastructure (Z_2)	1.000	0.745	0.767	0.675	1.000
Financial Technology (Z_3)	0.745	0.767	0.675	0.875	0.745

Table 5. R Square Test

Variable	R Square
Financing Digitization (X)	0.878
Operational Effectiveness (Y)	0.855
Product Innovation (Z_1)	0.842
Digital infrastructure (Z_2)	0.866
Financial Technology (Z_3)	0.870

Furthermore, the results of the hypothesis test can be seen through Table 6. Table 6 presents the results of the hypothesis tests, detailing the influence of financing digitalization and mediating variables on MSME operational effectiveness. It includes ten hypotheses (H1–H10), each with corresponding T-statistics, P-values, and outcomes (Accepted). The table evaluates direct effects (H1–H7) and mediated effects (H8–H10) of financing digitalization through product innovation, digital infrastructure, and financial technology, with all hypotheses showing significant relationships (P-values < 0.05). According to the table 6, it can be concluded that partially the variables of financing digitalization affect the operational effectiveness of MSMEs, payment digitalization product innovations, digital infrastructure and financial technology of MSMEs. Partially, the variables of payment digitalization product innovation, digital infrastructure and MSME financial technology affect the operational effectiveness of MSMEs. Simultaneously, the variables of financing digitalization have an effect on the operational

effectiveness of MSMEs through variables mediated by the variables of payment digitalization product innovation, digital infrastructure and financial technology.

The findings confirm that financing digitalization significantly enhances MSME operational effectiveness, as evidenced by a strong T-statistic (6.233, p<0.001). This indicates a robust direct relationship between financing digitalization and improved operational capacity. Financing digitalization also drives product innovation in MSME financing, with significant effects (T=5.321, p=0.002). The adoption of digital products aligns with operational needs and enhances financial inclusion. Digital infrastructure is significantly influenced by financing digitalization (T=4.234, p=0.001), enabling MSMEs to adopt digital systems more effectively and improving their operational workflows.

Financial technology is positively affected by financing digitalization (T=2.462, p=0.004), indicating the role of fintech in automating financing processes and enhancing accessibility to capital. Product innovation, digital infrastructure, and financial technology each mediate the relationship between financing digitalization and MSME operational effectiveness (H5–H10, all p<0.05). Mediated effects (H8–H10) confirm that these variables significantly amplify the impact of financing digitalization on MSME performance.

Table 6. Hypothesis Test

Hypothesis	Influence	T-Statistics	P-Value	Result
H1	Financing digitalization → operational effectiveness	6.233	0.000	Accepted
H2	Financing digitalization → product innovation	5.321	0.002	Accepted
H3	Financing digitalization → digital infrastructure	4.234	0.001	Accepted
H4	Financing digitalization → financial technology	2.462	0.004	Accepted
H5	Product innovation → operational effectiveness	5.122	0.000	Accepted
H6	Digital infrastructure → operational effectiveness	4.002	0.002	Accepted
H7	Financial technology → operational effectiveness	3.214	0.000	Accepted
H8	Financing digitalization → product innovation → operational effectiveness	4.112	0.003	Accepted
H9	Financing digitalization → digital infrastructure → operational effectiveness	3.347	0.001	Accepted
H10	Financing digitalization → financial technology → operational effectiveness	5.534	0.002	Accepted

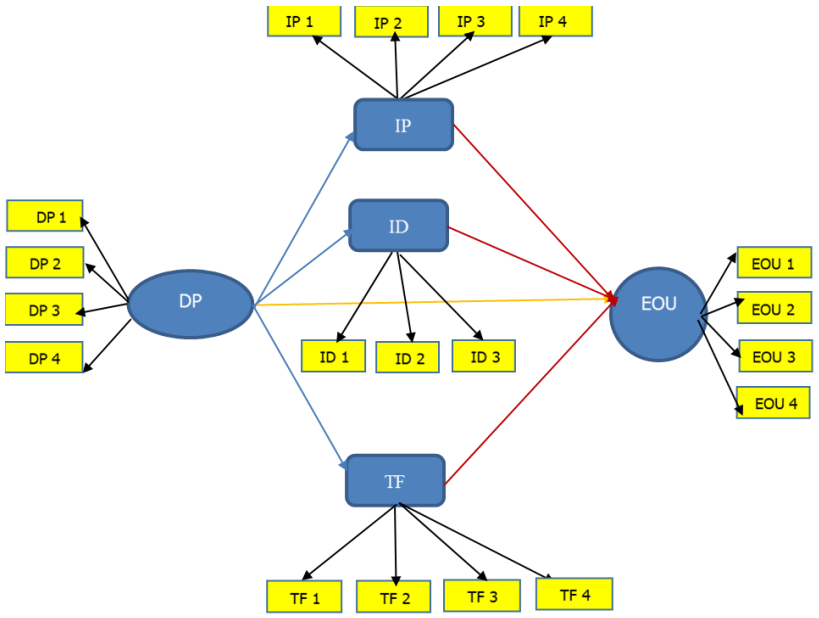

Figure 2. Bootstrapping Diagram

DISCUSSION

These findings support previous studies, such as Sihombing (2024), who argues that digital financing systems improve operational capacity by providing accessible capital. Digital platforms, such as fintech lending, streamline loan processes, enabling MSMEs to meet operational demands efficiently (Mardiana et al., 2020). By reducing reliance on cumbersome bank requirements, financing digitalization fosters transparency and accountability, supporting MSMEs in scaling operations and improving service delivery (Baheti et al., 2024). This result underscores the transformative potential of digital financing in strengthening MSMEs' competitiveness in Indonesia's digital economy.

Yousufzai et al. (2021) emphasize that MSMEs must adopt innovative digital products, like digital wallets, that align with their operational needs. These innovations enhance financial inclusion by connecting MSMEs to diverse funding sources, bypassing traditional barriers (Hasanah et al., 2024). The study's findings suggest that product innovation enables MSMEs to streamline transactions and improve customer satisfaction, reinforcing their market position. This highlights the need for MSMEs to select digital financing tools that complement their financial systems to maximize operational benefits.

The influence of financing digitalization on infrastructure supports the findings of Mediaty et al. (2025), where robust infrastructure, such as reliable internet and secure platforms, enables MSMEs to adopt digital financing effectively (Hakim et al., 2022). This enhances operational efficiency by facilitating seamless financial transactions and reducing delays (Sari & Kusumawati, 2022). The study indicates that improved infrastructure fosters trust among MSMEs, encouraging digital adoption and operational scalability. Addressing infrastructure gaps, particularly in rural areas, is critical to maximizing the benefits of financing digitalization for MSMEs. Fintech solutions, such as AI-driven credit scoring, automate financing processes, enhancing speed and accuracy (Setyawati et al., 2023). This enables MSMEs to access capital promptly, supporting operational needs and growth. The findings highlight fintech's role in creating transparent financial systems, which improve MSMEs' operational effectiveness by reducing fraud risks and operational costs, aligning with Handayani and Mahendrawathi (2019).

Product innovation, digital infrastructure, and financial technology improve operational efficiency by simplifying financial transactions (Taneo et al., 2022; Rosyidiana & Narsa, 2024; Rahayu et al., 2023), supporting faster service delivery (Taleb et al., 2023; Fizzanty & Maulana, 2024), and streamlining capital access (Winarto & Mutmainah, 2020; Wibowo & Aumeboonsuke, 2020). Mediated effects supported by Winarsih et al. (2020), Abidin et al. (2022), and Bahl et al. (2023) confirm that integrating these factors creates a synergistic effect in enhancing MSME performance.

The more effective the operational effectiveness of MSMEs, the more it will create an innovation in financing digitalization, the better the digital infrastructure, and the stronger the financial technology foundation. The findings have significant implications for MSMEs and policymakers in Indonesia. MSME owners should invest in digital literacy training to effectively adopt fintech and innovative financing products. Policymakers should prioritize expanding digital infrastructure, particularly in underserved regions, to support seamless adoption of digital financing. Implementing public-private partnerships to develop affordable fintech solutions can further enhance MSMEs' access to capital, fostering economic growth and resilience in the digital era.

CONCLUSION

From the results of the study, the existing conclusion is that partially the variables of financing digitalization affect the operational effectiveness of MSMEs, product innovation of payment digitalization, digital infrastructure and financial technology of MSMEs in Indonesia. Partially, the variables of payment digitalization product innovation, digital infrastructure and MSME financial technology affect the operational effectiveness of MSMEs. Simultaneously, the variables of financing digitalization have an effect on the operational effectiveness of MSMEs through variables mediated by the variables of payment digitalization product innovation, digital infrastructure and financial

technology. The study's implications underscore the need for MSMEs to adopt digital financing solutions to enhance operational efficiency and competitiveness. Policymakers should prioritize infrastructure development and digital literacy programs to support MSME adoption of fintech and innovative products. However, the study has limitations the cross-sectional design that limits insights into long-term effects. Future research should employ longitudinal approaches to examine the sustained impact of financing digitalization and explore additional mediators, such as government policies or consumer behavior, to provide a more comprehensive understanding of MSME growth in the digital era.

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