Optimizing MSME sustainability through digital marketing, innovation, and financial literacy with financial technology support

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Abstract
Purpose – This study aims to analyze the influence of digital marketing, business innovation, and financial literacy on the sustainability of MSMEs in Malang city, with financial technology (fintech) adoption as a mediating variable. **Method** – This study is a quantitative research with primary data in the form of a questionnaire. Using a purposive sampling technique, data were collected from 120 MSME actors in the culinary, fashion, crafts, and creative services sectors. Analysis was conducted using structural equation modeling–partial least squares (SEM-PLS) via SmartPLS 4.0. **Findings** – The results show that digital marketing, business innovation, and financial literacy positively and significantly affect MSME sustainability. Financial technology adoption also directly influences sustainability and significantly mediates the relationship between digital marketing and sustainability. However, it does not significantly mediate the relationship between business innovation or financial literacy and sustainability, indicating the need for better alignment between innovation and financial knowledge with financial technology usage. **Implications** – Theoretically, this study enriches the literature by integrating organizational innovation theory and the technology acceptance model (TAM), offering a comprehensive model of MSME sustainability. Practically, the findings guide MSME actors in strengthening digital marketing strategies and adopting financial technology-based financial management. Local governments are encouraged to implement integrated digital and financial literacy programs, while financial technology providers are advised to improve user education and experience for MSMEs, especially those less familiar with technology. These findings provide actionable insights for building inclusive, tech-savvy, and sustainable MSMEs in the digital economy.
Keywords: MSME sustainability, digital marketing, innovation, financial literacy, financial technology.

Introduction

The sustainability of MSMEs has become a strategic issue amid global economic uncertainty and the continuously changing dynamics of domestic markets. MSMEs are now required to be more adaptive to digital transformation, shifting consumer behavior, and the increasing complexity of business management. Digital marketing, business model innovation, and improved financial literacy, especially with the support of financial technology, are key approaches believed to strengthen competitiveness and ensure business continuity. Globally, MSMEs that integrate these three approaches, as seen with businesses in India leveraging e-wallets, digital financing systems, and data-driven marketing, show significant growth (Gupta, Agarwal, and Nautiyal 2022). Financial literacy is also crucial in managing risks and utilizing financing opportunities wisely.

In Indonesia, MSMEs contribute over 60% of the GDP and absorb about 97% of the workforce (Limanseto 2025). Malang's culinary, crafts, fashion, and creative service sectors have proliferated post-Covid-19. The acceleration of technology adoption due to the pandemic has encouraged MSMEs to integrate technology, although its implementation is still not optimal. Many MSMEs in Malang face challenges such as limited access to technology, lack of understanding about effective digital marketing strategies, and concerns over financial technology security, which hinder digital transformation (Ausat and Peirisal 2021).

The Malang city government has implemented programs like digital marketing training and technology-based financial literacy (Zuhroh et al. 2025). However, the impact has not been widespread due to barriers such as knowledge gaps, perceptions of financial technology risks, and low technology readiness (Purnamasari et al. 2024). The success of digital technologies is still limited to a few MSMEs, such as "Bakso President," which utilizes digital payments and social media promotions to expand its market (Siahaan and Moko 2024). Other culinary MSMEs have also implemented digital pre-order systems integrated with financial record-keeping, improving managerial efficiency (Yogatama, Sudarmiatin, and Wening Patmi Rahayu 2024). However, a significant gap in digital adoption remains among most MSMEs, requiring a more targeted, participatory, and evidence-based approach to accelerate inclusive and sustainable digital transformation.

Previous studies provide a substantial body of evidence supporting the positive influence of digital marketing on MSME performance, particularly in enhancing market reach, customer engagement, and sales. For instance, Pertiwi, Setiawan, and Rahayu (2022) demonstrated that social media use significantly boosted consumer loyalty and market expansion for culinary-sector MSMEs in Surabaya. Likewise, Muis, Adhi, and Kamalia (2024); Salsabila et al. (2024) revealed that digital platform adoption increased transaction volumes and strengthened brand loyalty. However, this optimistic view is not always consistent. Peláez et al. (2023) found that some MSMEs could not manage digital marketing tools effectively, leading to wasted resources and no measurable improvement in business performance. Even more striking, research by Fernandes and Oliveira (2024) showed that MSMEs overwhelmed with multi-platform management experienced marketing fatigue and diminishing returns, negatively affecting customer retention and brand image. This diversity in outcomes indicates a lack of consensus on the true extent of digital marketing's effectiveness.

A similar inconsistency emerges regarding business innovation. On the one hand, research by Saefudin, Dora, and Latifah (2023) emphasized that product and process innovation increased competitiveness and continuity among fashion-sector MSMEs in Bandung. Supporting this, Harnida et al. (2024) asserted that innovation in operational management led to improved efficiency and better sustainability outcomes. On the other hand, findings by Chatterjee et al. (2023) argued that innovation initiatives often failed to yield significant performance gains among micro-businesses due to limited capital, lack of technical skills, and resistance to change. In some cases, as Walker and Rowlinson (2007) reported, continuous product updates without market validation led to cost overruns and customer confusion, ultimately harming business continuity. These conflicting outcomes underscore that the role of innovation in MSME sustainability is not yet definitively established and may depend heavily on contextual and internal capability factors.

Financial literacy is another variable that has been examined with mixed conclusions. Studies such as Suidarma et al. (2024) concluded that MSME owners with strong financial literacy managed cash flow more effectively and avoided unproductive debt, leading to improved financial performance. Similarly, Badria and Hasanah (2024) linked financial knowledge with enhanced accountability and better long-term planning. Conversely, research by Tubastuvi and Purwidianti (2023) found no significant correlation between financial literacy and profitability among rural MSMEs, suggesting that literacy alone may not be sufficient without access to supporting financial infrastructure. Even more critically, Sesa, Wonar, and Allolayuk (2024) demonstrated that some financially literate MSME actors still made poor investment decisions due to behavioral biases and informal borrowing habits. These diverging results reflect a complex relationship between financial literacy and business outcomes, indicating that other mediating or moderating variables may be at play.

While many of these studies provide valuable insights into the individual roles of digital marketing, innovation, and financial literacy, they broadly examine these factors in isolation. There remains a significant gap in research that integrates these three variables into a unified framework to assess their combined influence on MSME sustainability. Few studies explore whether these elements yield more substantial effects when working synergistically compared to their individual impacts. This fragmented understanding limits the ability of policymakers and practitioners to develop holistic strategies for MSME development. Moreover, this disjointed approach fails to capture the dynamic interdependencies that likely exist between marketing strategies, innovation capability, and financial acumen in real-world business environments.

Compounding this issue is the limited attention given to the mediating role of financial technology in enhancing these relationships. Although Sari and Nugroho (2021) observed that financial technology improved MSME financial management, their study did not investigate whether financial technology could be a conduit between digital marketing and long-term business sustainability. Similarly, Saputro and Winarni (2023) focused on digital literacy and e-wallet usage but neglected financial technology's broader strategic implications. Wu, Pathan, and Zheng (2024) found that mobile banking boosted access to capital but did not tie this to business model innovation or digital strategy. Harsono and Suprapti (2024) emphasized real-time financial technology decision-making but did not evaluate its longitudinal impact on sustainability. These gaps suggest that the potential of financial technology to mediate the effects of digital marketing, innovation, and financial literacy on sustainability remains significantly underexplored.

Furthermore, while Rahayu et al. (2023); Badria and Hasanah (2024) recognized financial technology’s contribution to transparency and accountability, they stopped short of analyzing whether this integration serves as a strategic enabler connecting digital and financial strategies. This indicates a missed opportunity to examine how financial technology can function as a tool and a strategic mechanism that binds marketing efficiency, innovation agility, and financial literacy into a cohesive model of MSME growth and resilience. Without such an integrated perspective, the literature fails to provide a clear roadmap for leveraging technology holistically to foster sustainability among MSMEs. Therefore, the present study aims to address these inconsistencies by investigating the direct effects of digital marketing, business innovation, and financial literacy on MSME sustainability while examining financial technology's mediating role. This approach is expected to provide a comprehensive understanding of how these elements interact, clarify conflicting findings in prior studies, and contribute a more integrative model for enhancing the long-term viability of MSMEs in the digital era.

The novelty of this study lies in its empirical focus on financial technology adoption as a mediating variable that connects and amplifies the strategic influence of digital marketing, business innovation, and financial literacy on MSME sustainability. While numerous studies have examined the individual impact of these factors, few have integrated them within a unified model that incorporates financial technology adoption as a dynamic bridge linking these strategic capabilities. Previous research such as by Setiawan et al. (2021), who highlighted the significance of perceived ease of use and security in financial technology utilization; Wu, Pathan, and Zheng (2024), who demonstrated its role in enhancing financial access and transaction efficiency; and Rahayu et al. (2023), who noted its contribution to transparency and accountability suggests that financial technology adoption offers more than mere technological support; it enables operational acceleration, cost minimization, and data-informed decision-making. However, none of these studies explored financial technology adoption as a mediating mechanism that simultaneously strengthens marketing reach, innovation responsiveness, and financial decision-making. This integrated perspective is essential to capture the synergistic potential of these variables in enhancing long-term MSME resilience.

Although the relationship between digital marketing, innovation, and financial literacy has been previously explored, the uniqueness of this study lies in positioning financial technology adoption not only as a technological tool but as a strategic integrator within the MSME operational framework. This area remains underexplored mainly, particularly in regional economic contexts. Furthermore, most prior research has focused on MSMEs in Indonesia's large metropolitan centers Jakarta (Harsono and Suprapti 2024), Surabaya (Pertiwi, Setiawan, and Rahayu 2022), and Bandung (Saefudin, Dora, and Latifah 2023), where digital infrastructure and access to innovation ecosystems are more developed. In contrast, this study targets MSMEs in Malang, a mid-sized city with a distinct blend of growing digital literacy, shifting consumer dynamics, and expanding but uneven access to financial technology services. This locational specificity enhances the empirical value of the study by addressing the geographic disparity in current MSME research and testing the model in a less-studied yet economically vibrant urban context.

Based on these gaps, this study aims to examine the direct effects of digital marketing, business innovation, and financial literacy on MSME sustainability and investigate the mediating role of financial technology adoption in strengthening these relationships. This objective is grounded in the urgency to understand how integrated digital and financial strategies can be tailored to support MSMEs beyond major urban centers. The research holds significant practical value, particularly for MSME owners, digital service providers, and local policymakers. The study supports the formulation of evidence-based interventions by offering a clearer understanding of how financial technology adoption can amplify the impact of existing business capabilities, digital literacy programs, and financial technology policies to improve MSME sustainability in regional economies like Malang. The study addresses a theoretical void and provides actionable insights to enhance competitiveness and resilience among grassroots businesses in Indonesia's evolving digital economy.

Literature review

Technology acceptance model (TAM)

The technology acceptance model (TAM), developed by Davis (1989), serves as the primary theoretical foundation for explaining the technology adoption process by individuals or organizations. TAM aims to understand the factors that influence user acceptance of new technologies. The main components of TAM are perceived usefulness, the extent to which a person believes that using a particular technology will improve his or her performance. Perceived ease of use is the extent to which a person believes the technology is easy to use. In the context of MSMEs, technology adoption, particularly in financial technology and digital marketing, is significantly influenced by the extent to which MSME actors perceive the technology as beneficial and easy to use. For instance, financial technology services such as QRIS, digital wallets, and financial recording applications that offer efficient and affordable solutions are more likely to be accepted if they are perceived to simplify operations and enhance efficiency (Ramayanti, Azhar, and Azman 2025).

Organizational innovation theory

Organizational innovation theory, as introduced by Damanpour (1991), emphasizes that organizational performance and competitiveness can be enhanced by adopting technical and administrative innovations, such as developing new products, process improvements, and evolving business models that align with dynamic market demands. In the MSME context, innovation becomes an adaptive strategy that enables businesses to survive, grow, and remain competitive despite resource limitations, with continuous innovation enhancing bargaining power and operational sustainability (Callegari and Nybakk 2022). This theory aligns closely with the TAM, which provides a framework for understanding how MSMEs adopt new technologies as part of their innovation strategies. According to TAM, technology adoption is driven by perceived usefulness and ease of use, which directly affect the willingness of MSMEs to innovate. TAM supports the premise of organizational innovation theory by explaining how the perception of technological value facilitates innovation processes that ultimately drive business efficiency, competitiveness, and sustainability within MSMEs (Carvalho et al. 2021).

MSME sustainability

MSME sustainability is conceptually defined as the ability of micro, small, and medium enterprises to maintain their existence and growth over the long term while continuously responding to environmental dynamics and maintaining stable performance (Onyeje, Court, and Agbaeze 2022). Elkington (1998), through the triple bottom line concept, explained that business sustainability encompasses economic (profitability), social (impact on society), and environmental dimensions. However, in the MSME context, sustainability is often interpreted as the capacity to withstand market pressures, manage resources efficiently, maintain customer relationships, and consistently sustain income and productivity. Sustainability is not merely about business survival but the capacity to innovate, adapt, and continuously create value amidst technological and societal changes (George, Merrill, and Schillebeeckx 2021).

Digital marketing

Digital marketing is a marketing approach that utilizes digital media such as social media, email, websites, and search engines to reach consumers more broadly, quickly, and efficiently while fostering long-term, customer-centred relationships (Chaffey and Ellis-Chadwick 2016). In MSMEs, digital marketing is crucial in increasing brand visibility, expanding market reach, reducing promotional costs, and enhancing customer engagement through two-way communication, essential for business sustainability (Sharabati et al. 2024). Closely aligned with the TAM, perceived usefulness and ease of use significantly influence digital marketing adoption among MSMEs. When MSME actors find that digital platforms help them measure campaign effectiveness, adjust content in real-time, and streamline marketing activities, their intention to adopt such technology increases. Moreover, the easier these platforms are to use and integrate into existing business processes, the more likely they are to be accepted and utilized effectively. This interconnectedness creates a supportive ecosystem in which digital marketing technologies are adopted and leveraged as strategic tools to enhance business growth and long-term competitiveness (Vărzaru and Bocean 2024).

Financial literacy

Financial literacy is a person's ability to understand and manage personal finances effectively. It includes the knowledge, skills, and attitudes needed to make wise financial decisions in everyday life (Johan, Rowlingson, and Appleyard 2021). As popularized by Lusardi and Mitchelli (2007), financial literacy highlights the essential role of understanding, managing, and making sound financial decisions, particularly among MSME owners, who must navigate challenges such as cash flow management, budgeting, and access to financing. Financial literacy becomes a foundational skill that enhances businesses' strategic and operational resilience, enabling owners to distinguish between productive and consumptive capital, assess financial risks, and formulate sustainable financial strategies.

Business innovative

Business innovation refers to the deliberate and systematic renewal process within an organization, which may involve the creation of new products, production methods, distribution models, managerial approaches, and business strategies (Weiss and Kanbach 2023). This definition aligns with the view of Damanpour (1991), who stated that innovation is a novel combination of production factors to generate added economic value. In organizational literature, Chen, Yin, and Mei (2018) also support this understanding by emphasizing that innovation can be both technical (product and process) and administrative (structure and policy). In MSME practices, business innovation is an adaptive response to external environmental dynamics, allowing businesses to survive, grow, and remain competitive by applying new approaches that align with market needs (Quansah, Hartz, and Salipante 2022).

Financial technology adoption

Financial technology adoption is when individuals, businesses, or institutions begin to accept and use it in their financial activities (Jalal, Mubarak, and Durani 2023). The adoption of financial technology refers to entrepreneurs' acceptance and use of digital technology to conduct financial activities, including payment transactions, financial record-keeping, loans, and financial planning. Davis (1989), through the TAM, explained that adopting a technology is influenced by perceived usefulness and ease of use. Financial technology represents a disruptive innovation in traditional financial services, characterized by automation, accessibility, and efficiency. In MSMEs, financial technology adoption transforms how entrepreneurs manage cash flow, access financing, and conduct business transactions with customers and partners, accelerating operational digitalization and enabling data-driven decision-making (Tanchangya et al. 2025).

Hypothesis development

Digital marketing significantly supports MSME sustainability by enabling wider market reach at lower costs, strengthening customer relationships, and building a consistent brand image. Chaffey and Ellis-Chadwick (2016) highlight its personalized, responsive, and measurable approach, which maintains customer loyalty and long-term promotional efficiency. Jung and Shegai (2023) found that digital marketing boosts product exposure and stabilizes sales, aiding business continuity. This aligns with TAM, where perceived usefulness and ease of use drive technology adoption (Davis 1989). MSMEs adopt and integrate easy and useful digital marketing tools into daily operations. Digital marketing theory emphasizes strategic digital tool use to enhance communication, engagement, and brand positioning, while organizational innovation theory views digital marketing adoption as an innovative shift enabling MSMEs to adapt to consumer and technological changes. Together, these theories show that MSMEs leveraging digital marketing are more adaptive, competitive, and resilient, directly supporting their sustainability and growth in dynamic markets. Research conducted by Deku, Wang, and Preko (2024) stated that digital marketing has a positive impact on the performance and sustainability of MSME businesses.

H1: digital marketing has a positive effect on MSME sustainability.

Business innovation enables MSMEs to remain relevant and competitive amid changing market conditions. Based on organizational innovation theory, innovation encompasses the creation of new products and improvements in processes, managerial strategies, and customer engagement approaches (Damanpour 1991). Innovation is a key to economic sustainability as it provides competitive advantages (Subagja, Ausat, and Suherlan 2022). In a study by Saefudin, Dora, and Latifah (2023), product innovation significantly increased customer retention and expanded the market reach of fashion MSMEs. Thus, continuous innovation helps MSMEs generate added value that reinforces their long-term position.

H2: business innovation has a positive effect on MSME sustainability.

Financial literacy is understanding and managing financial information to support sound business decisions. According to financial literacy theory, strong financial literacy helps business owners plan finances, avoid unproductive debt, and allocate resources efficiently (Lusardi and Mitchelli 2007). Hererra, Warokka, and Aqmar (2023) found that MSMEs with high financial literacy produce more accurate reports, manage cash better, and have greater financial resilience. Business sustainability must influence cost control, investment decisions, and survival during crises. The TAM by Davis (1989) is relevant as MSMEs increasingly adopt digital financial tools like bookkeeping apps and budgeting software; when these tools are seen as useful and easy to use, financially literate actors integrate them effectively, improving monitoring and planning. Organizational innovation theory supports this by viewing such adoption as process innovation that boosts agility and performance. Thus, financial literacy enhances decision-making and fosters innovative, technology-based financial practices essential for MSME sustainability.

H3: financial literacy has a positive effect on MSME sustainability.

Financial technology helps MSMEs improve operational efficiency, speed up transactions, and expand access to financing, making it essential for business sustainability. According to the TAM by Davis (1989), adoption depends on perceived usefulness and ease of use, which shape users' intentions to adopt tools like e-wallets, QRIS, digital bookkeeping, and online lending platforms. When MSMEs find these tools beneficial and easy to use, they integrate them into daily operations. This aligns with digital marketing theory, emphasizing digital integration for transaction efficiency and data-driven decisions, and organizational innovation theory, which views fintech adoption as process innovation that enhances efficiency, accountability, and responsiveness. Candraningrat, Dewi, and Dewi (2025) found that fintech use significantly boosts financial management and resilience in MSMEs. Thus, fintech adoption is a key driver of sustainability, as it reduces bottlenecks, improves cash flow, and mitigates risks in dynamic markets.

H4: financial technology adoption has a positive effect on MSME sustainability.

Integrating digital marketing and financial technology provides a significant strategic advantage for MSME sustainability in a digital economy. According to the TAM by Davis (1989), technology adoption increases when users perceive it as useful and easy to use. MSMEs combining digital marketing such as online ads, social media, and personalized emails with accessible fintech tools like QRIS and e-wallets enhance perceived value for entrepreneurs and customers. This supports digital marketing, which states that digital tools enable cost-effective targeting and precise impact measurement (Chaffey and Ellis-Chadwick 2016). The synergy improves transaction efficiency, customer experience, and trust, as e-payment options boost convenience, loyalty, and conversion (Syntiasari et al. 2023; Purnomo 2023). Here, fintech acts not just operationally but as a mediator, enhancing digital marketing's effectiveness in sustaining MSMEs by enabling smooth transactions and reinforcing digital brand credibility.

H5: finansial technology adoption can mediate the influence of digital marketing on MSME sustainability.

Organizational innovation, meanwhile, plays a vital role in increasing a firm's agility and long-term viability. According to organizational innovation theory, as conceptualized by Damanpour (1991), innovation in products, services, or processes is essential for an organization's adaptability and competitiveness. When innovative practices such as flexible pricing models, subscription-based services, or crowd-funded pre-orders are integrated with financial technology platforms, MSMEs achieve greater responsiveness and process efficiency. This fusion is also supported by the TAM framework, implying that if MSME actors perceive financial technology systems aligning well with their innovative business models and operational needs, their likelihood of adoption increases significantly. Kim et al. (2021) assert that when digital innovations are combined with seamless transaction systems, customer satisfaction and engagement also rise. Therefore, financial technology serves as a mediating bridge between organizational innovation and MSME sustainability enhancing the practical realization of innovative strategies through streamlined financial operations, broader access to funding, and greater scalability.

H6: financial technology adoption can mediate the influence of business innovation on MSME Sustainability.

In parallel, financial literacy theory posits that individuals with a higher financial understanding are better positioned to manage business resources effectively, assess risk, and make informed financial decisions (Lusardi and Mitchelli 2007). Financially literate MSME actors are thus more likely to grasp the strategic value of financial technology solutions. From a TAM perspective, their knowledge base improves the perceived ease of use and perceived usefulness of financial technology tools, increasing the probability of adoption. Entrepreneurs with strong financial literacy can select the most suitable financial technology products, such as digital bookkeeping systems or online credit platforms, and use them efficiently for long-term planning, budgeting, and risk control. As supported by findings from several research, MSMEs with financial literacy are significantly more engaged in the digital finance ecosystem (Damayanti et al. 2023; Sholihah, Nurhapsari, and Rohmania 2023). Therefore, financial technology adoption acts as a functional pathway that translates financial literacy into actionable business sustainability improvements through improved credit access, financial transparency, and proactive risk management.

H7: financial technology adoption can mediate the influence of financial literacy on MSME sustainability.

Figure 1 summarizes the research objectives through the formulated hypothesis. Each hypothesis highlights the positive and significant relationships between digital marketing, business innovation, and financial literacy on MSME sustainability directly and through financial technology adoption as a mediating variable.

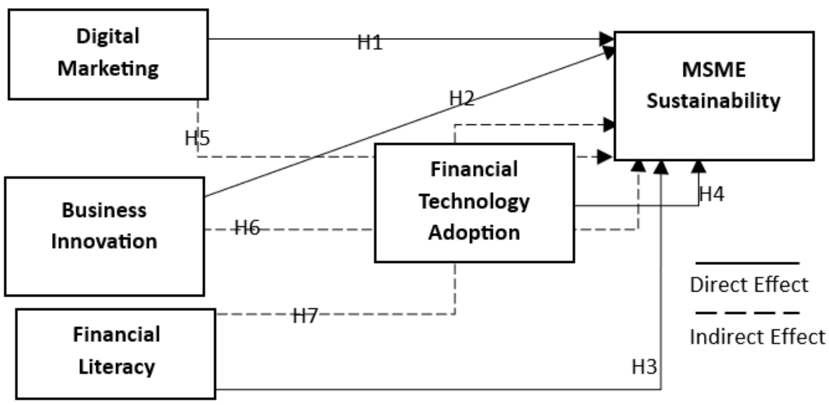

Figure 1 reserach framework

Method

This study employs a quantitative approach to objectively measure and analyze the relationships between digital marketing, business innovation, financial literacy, financial technology adoption, and the sustainability of MSMEs. The quantitative method was selected as it enables statistical hypothesis testing and the generation of generalizable findings. The research design is a survey allowing efficient data collection from MSME actors in Malang. Data were collected from January to March 2025 using an online questionnaire distributed via Google Forms, allowing a broad reach of respondents without geographic constraints. Respondents were asked to provide their perceptions on all research variables using a five-point Likert scale.

The population of this study comprises all MSMEs operating in Malang city that are actively engaged in the culinary, fashion, crafts, and creative services sectors. Based on 2023 data from the Central Bureau of Statistics of Malang city, there are 39,268 MSMEs distributed across five districts: Klojen (6,254 units), Blimbing (8,647 units), Lowokwaru (10,473 units), Sukun (8,203 units), and Kedungkandang (5,691 units). Given the large population and the study's focus on MSMEs with digital and financial technology adoption, a purposive sampling method was applied with strict inclusion criteria: (1) MSMEs that have been operating for at least two years, (2) those actively using digital platforms for marketing or financial transactions, and (3) those with experience utilizing financial technology tools such as e-wallets, QRIS, or digital bookkeeping systems. Based on these criteria, 120 MSMEs were obtained that were focused and analytically relevant.

Each variable in this study is measured based on theoretical constructs and developed in an operational variable table. Perceptions were measured using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The independent variables are digital marketing, business innovation, and financial literacy. The mediating variable is financial technology adoption, while the dependent variable is MSME sustainability (see Table 1). Data analysis was conducted using the structural equation modeling–partial least squares (SEM-PLS) method via SmartPLS 4.0 software. This method was chosen for its ability to analyze complex relationships among latent variables and its suitability for small to medium sample sizes. The analysis began with assessing the measurement model (outer model) to test convergent validity and construct reliability. Convergent validity was evaluated through factor loadings (>0.7) and average variance extracted (AVE > 0.5). Construct reliability was tested using Cronbach's alpha and composite reliability (CR), which must exceed 0.7. Subsequently, the structural model (inner model) was evaluated using R-square, Q-square, and path coefficient values to determine the strength and significance of the relationships among variables. Hypothesis testing used t-statistics > 1.96 for a 5% significance level.

Table 1 operational research variables

Variables	Indicators	Statements	Scale
Digital marketing (DM) (Chaffey and Ellis-Chadwick 2016)	DM1: Use of social media DM2: Digital platform marketing DM3: Customer interaction DM4: Digital promotional content	DM1: We actively use social media to promote our business DM2: We use digital platforms to reach customers DM3: We respond to customers online DM4: We create digital promotional content such as videos or photos.	Likert 1–5
Business innovation (BI) (Damanpour 1991)	BI1: Product development BI2: Business model transformation	BI1: We develop products based on customer needs. BI2: We change our service methods for better performance.	Likert 1–5

Variables	Indicators	Statements	Scale
	BI3: New business strategies BI4: Market responsiveness	BI3: We implement new strategies to stay competitive. BI4: We quickly adapt to market trend changes.	
Financial literacy (FL) (Lusardi and Mitchelli 2007)	FL1: Financial planning FL2: Cash flow management FL3: Understanding financing FL4: Financial recordkeeping	FL1: I regularly make financial plans for my business. FL2: I manage business income and expenses effectively. FL3: I understand different types of business financing. FL4: I record financial transactions regularly.	Likert 1–5
Financial technology adoption (FA) (Davis 1989)	FA1: Use of e-wallets/QRIS FA2: Bookkeeping applications FA3: Ease of use FA4: Perceived benefits	FA1: My business accepts payments via financial technology (e-wallets/QRIS). FA2: I use digital bookkeeping applications. FA3: Financial technology is easy to use in daily operations. FA4: Financial technology is very helpful in managing business finances.	Likert 1–5
MSME sustainability (MS) (Elkington 1998)	MS1: Income stability MS2: Business resilience MS3: Long-term growth MS4: Customer satisfaction and loyalty	MS1: My business income tends to be stable. MS2: My business is able to survive during difficult times. MS3: I am confident my business will grow. MS4: My customers are satisfied and loyal.	Likert 1–5

Results and discussion

Demographic of respondents

Based on the demographic data of 120 respondents in this study, most were female (56.7%), and most were within the productive age group of 25–34 years (39.2%). Regarding educational background, the most significant proportion held a bachelor's degree (35.0%), indicating a relatively high formal education level among Malang MSME owners. Most businesses had been operating for 4–5 years (40.0%), suggesting that most respondents had moderate entrepreneurial experience. The culinary sector dominated the type of business engaged in by respondents (35.0%), reflecting its popularity and market demand. Regarding digital marketing, the most widely used tools were social media (90.0%) and WhatsApp Business (80.0%), highlighting their effectiveness and accessibility for promoting products and interacting with customers. In terms of financial technology adoption, all respondents reported using digital payments such as QRIS or e-wallets (100.0%), followed by high usage of mobile banking (80.0%) and bookkeeping apps like BukuWarung (72.5%), indicating a substantial digital shift in both marketing and financial management practices among MSMEs in Malang.

Table 2 demographic of respondents

Characteristics	Category	Amount	Percentage
Gender	Male	52	43.3
	Female	68	56.7

Characteristics	Category	Amount	Percentage
Age	< 25 years	18	15.0
	25–34 years	47	39.2
	35–44 years	36	30.0
	> 44 years	19	15.8
Education level	Junior high school	9	7.5
	Senior high school	38	31.7
	Diploma	24	20.0
	Bachelor's degree	42	35.0
	Postgraduate degree	7	5.8
Business duration	2–3 years	33	27.5
	4–5 years	48	40.0
	More than 5 years	39	32.5
Business sector	Culinary	42	35.0
	Fashion	28	23.3
	Handicrafts	25	20.8
	Creative services	25	20.8
Types of digital marketing used	Social media	108	90.0
	Marketplace	92	76.7
	Business website	24	20.0
	WhatsApp business	96	80.0
	Email marketing	11	9.2
	Paid ads	45	37.5
Types of financial technology used	Digital payments (QRIS, e-wallet)	120	100.0
	Bookkeeping apps (bukuwarung, etc.)	87	72.5
	Mobile banking	96	80.0
	Online loans	39	32.5
	Invoicing/automated accounting apps	24	20.0

The categories under "types of digital marketing used" and "types of financial technology used" represent multiple response items, meaning each respondent was allowed to select more than one type of tool or platform they actively use in their business operations. As a result, the total frequencies in these sections exceed the total number of respondents (n = 120) since many MSME actors utilize a combination of digital marketing channels and financial technology applications to enhance their visibility, operational efficiency, and customer engagement. For instance, a single business may simultaneously use social media, marketplace platforms, and WhatsApp business for marketing while leveraging digital payments, mobile banking, and bookkeeping apps to manage their finances. This multiplicity reflects the growing trend of digital integration among MSMEs in Malang, especially those operating in competitive sectors like culinary, fashion, handicrafts, and creative services.

Outer model evaluation

The initial stage in the structural equation modelling analysis–partial least squares (SEM-PLS) is evaluating the outer model, also known as the measurement model. This stage aims to assess the extent to which the indicators used are empirically able to represent the latent constructs accurately, consistently, and reliably. The outer model examines the relationship between latent variables and their manifest indicators, thereby allowing the validity and reliability of each construct to be established before proceeding to the structural model (inner model) analysis. This evaluation is essential, as the quality of the measurement data determines the validity of the structural model's outcomes. In this study, the outer model assessment was conducted in three primary steps: convergent validity test, construct reliability test, and average variance extracted (AVE) test. The analysis was performed using SmartPLS version 4.0, a software tool specifically designed for analyzing structural models with high complexity and small to medium sample sizes. Consistent with the characteristics of MSMEs studied in this research.

Convergent validity

Convergent validity refers to the degree to which indicators that form a particular construct exhibit high internal correlation, as reflected in their loading factor values. In PLS modeling, convergent validity is considered satisfactory when each indicator has a loading factor greater than 0.70. This value implies that over 50% of the variance in the indicator is explained by the latent construct being measured. Based on the data analysis presented in Table 3, all indicators from the five primary constructs, digital marketing, business innovation, financial literacy, financial technology adoption, and MSME sustainability, have loading factors ranging from 0.799 to 0.852. These values exceed the minimum threshold, indicating that each indicator significantly and consistently represents its respective construct. Therefore, the results confirm that convergent validity has been achieved, and the data are appropriate for further structural model evaluation.

Table 3 measurement model results

Variables	Items	Factor loading	Cronbach's alpha	Composite reliability	AVE
Digital marketing (DM)	DM1	0.821	0.841	0.891	0.672
	DM2	0.808			
	DM3	0.842			
	DM4	0.826			
Business innovation (BI)	BI1	0.799	0.836	0.885	0.659
	BI2	0.820			
	BI3	0.817			
	BI4	0.813			
Financial literacy (FL)	FL1	0.834	0.857	0.899	0.690
	FL2	0.805			
	FL3	0.837			
	FL4	0.838			
Financial technology adoption (FA)	FA1	0.816			
	FA2	0.822	0.850	0.893	0.675
	FA3	0.842			
	FA4	0.801			
MSME sustainability (MS)	MS1	0.827	0.862	0.904	0.703
	MS2	0.840			
	MS3	0.846			
	MS4	0.852			

Source: primary data (processed, 2025)

Construct reliability test

After convergent validity is confirmed, the next step is to evaluate construct reliability to ensure that all indicators within a construct demonstrate sufficient internal consistency. Construct reliability is assessed using two statistical measures: Cronbach's alpha and composite reliability (CR). A Cronbach's alpha value of at least 0.70 is generally considered acceptable, although values above 0.60 may still be tolerated for exploratory research. Meanwhile, a CR value exceeding 0.70 is deemed adequate. Table 3 shows the results: Cronbach's alpha values for all constructs range from 0.836 to 0.862, while CR values range from 0.885 to 0.904. These figures indicate that each construct possesses strong internal consistency. Consequently, the measurement instruments used in the questionnaire are proven to be stable and reliable in capturing MSME actors' perceptions of digital marketing, business innovation, financial literacy, and the adoption and impact of financial technology on business sustainability.

Inner model evaluation

Once the measurement model (outer model) is confirmed valid and reliable, the next step in the SEM-PLS approach is to evaluate the inner or structural model. This evaluation aims to assess the causal relationships among latent variables in the model and to determine the model's overall predictive power. In this study, the inner model represents the relationships among digital marketing, business innovation, financial literacy, and MSME sustainability, with financial technology adoption acting as a mediating variable. The evaluation includes analysis of the R-square (coefficient of determination), Q-square (predictive relevance), and the significance of path coefficients through hypothesis testing. The analysis was carried out using the bootstrapping method with 5,000 sub-sample replications in SmartPLS version 4.0 to ensure the accuracy of the estimations.

R-square

The R-square value indicates the proportion of variance in the dependent (endogenous) variables that the independent (exogenous) variables can explain. This metric reflects the explanatory power of the structural model. This study analyses two endogenous variables: financial technology adoption and MSME sustainability. Table 4 shows that the R-square value for financial technology adoption is 0.625, meaning that digital marketing, business innovation, and financial literacy explain 62.5% of the variance in financial technology adoption. Meanwhile, the R-square for MSME sustainability is 0.684, indicating that combining digital marketing, business innovation, financial literacy, and financial technology adoption explains 68.4% of the variance in sustainability. Hair et al. (2011) state that R-square values of 0.25, 0.50, and 0.75 represent weak, moderate, and substantial explanatory power, respectively. Thus, the values obtained in this study fall into the moderate-to-strong range, demonstrating that the model has adequate explanatory capability and is suitable for predictive analysis in the context of MSME sustainability.

Table 4 R-square results

Variables	R-Square
Financial technology adoption (FA)	0.625
MSME sustainability (MS)	0.684

Source: primary data (processed, 2025)

Q-square predictive relevance

In addition to R-square, the model's predictive relevance is assessed using the Q-square value, also known as Stone-Geisser's Q^2. This measure evaluates how well the model and its parameter estimates reconstruct the observed values. Q-square is calculated using the blindfolding procedure, and a Q^2 value greater than 0 indicates that the model has predictive relevance. In this study, the Q-square is computed using the formula:

$Q^2 = 1 – (1 – R1^2) \times (1 – R2^2)$

Where $R1^2$ = 0.625 (for financial technology adoption) and $R2^2$ = 0.684 (for MSME sustainability):

$Q^2 = 1 – (0.375 \times 0.316) = 1 – 0.1185 = 0.8815$

Thus, the Q-square value of 0.882 confirms that the model has very strong predictive relevance for the variables under investigation. This implies that the model developed in this study statistically explains the relationships between variables and can predict consistent outcomes across different samples. These findings reinforce the structural validity of the proposed model in capturing the dynamics of MSME sustainability in the digital era.

Hypothesis testing

Using bootstrapping, hypothesis testing assessed the significance of relationships among latent variables using path coefficients, t-statistics, and p-values. A hypothesis is significant if $t > 1.96$ and $p < 0.05$, indicating meaningful variable links, especially regarding financial technology's mediation on MSME sustainability. Table 5 shows five of seven hypotheses accepted: H1 (digital marketing) with a path coefficient of 0.312, t=3.745, p=0.000; H2 (business innovation) at 0.291, t=3.210, p=0.001; H3 (financial literacy) at 0.278, t=3.005, p=0.003; H4 (financial technology adoption) with the largest effect at 0.354, t=4.020, p=0.000; and H5 (digital marketing via financial technology) at 0.205, t=2.965, p=0.004. Hypotheses H6 and H7 were rejected due to nonsignificant negative coefficients (-0.052 and -0.039) and low t-values (1.121 and 1.004). Overall, digital marketing, business innovation, financial literacy, and adoption of financial technology significantly affect MSME sustainability, while financial technology does not mediate business innovation or financial literacy effects.

Table 5 hypothesis test results

Hypothesis	Path coefficient	T-statistic	P-values
H1: digital marketing → MSME sustainability	0.312	3.745	0.000
H2: business innovation → MSME Sustainability	0.291	3.210	0.001
H3: financial literacy → MSME sustainability	0.278	3.005	0.003
H4: fintech adoption → MSME sustainability	0.354	4.020	0.000
H5: DM → fintech adoption → MSME sustainability	0.205	2.965	0.004
H6: BI → fintech adoption → MSME sustainability	-0.052	1.121	0.263
H7: FL → fintech adoption → MSME sustainability	-0.039	1.004	0.316

Source: primary data (processed, 2025)

Digital marketing and MSME sustainability

The results show that digital marketing positively affects the sustainability of MSMEs in Malang city. This finding demonstrates that strategic and consistent use of digital platforms can enhance MSMEs' resilience by promoting income stability, long-term growth, and stronger customer loyalty. From the perspective of the TAM, this result can be interpreted through the lens of two key constructs: perceived usefulness and perceived ease of use. MSME actors are more likely to adopt digital marketing tools such as social media, marketplaces, WhatsApp businesses, and paid digital advertisements when they believe these tools effectively achieve their business goals (usefulness) and are not difficult to operate (ease of use). This is supported by empirical evidence from recent studies, including Atika (2023), which found that MSMEs that adopt digital marketing strategies tend to perform better in market reach, customer engagement, and revenue consistency. Moreover, research by Soomro et al. (2024) confirms that adopting digital platforms among small businesses correlates with increased agility and consumer retention. Theoretically, this aligns with digital marketing theory by Chaffey and Ellis-Chadwick (2016), which underscores that digital environments enable value creation through real-time interactions, personalized communication, and analytics-driven decision-making.

Demographic data from Table 2 further reinforces this discussion. 90.0% of respondents use social media, 76.7% utilize marketplaces, and 80.0% use WhatsApp Business as a direct promotional channel. This pattern indicates a strong digital orientation among MSME actors in Malang city, particularly in the culinary (35.0%) and fashion (23.3%) sectors, which heavily rely on visual appeal and customer intimacy. Engaging visual content on platforms like Instagram or TikTok, commonly used by the 25–34 age group, the largest demographic (39.2%), further strengthens their ability to maintain customer loyalty and encourage repeat purchases. Furthermore, the TAM by Davis (1989) supports the observation that perceptions of ease of use and usefulness of digital marketing are key to the continued adoption of technology by MSME actors. In this study, most respondents have at least a high school or undergraduate level of education (66.7%), which likely contributes to higher digital literacy and confidence in utilizing marketing technologies. The connection between digital marketing and business resilience becomes even more evident during periods of uncertainty, such as the post-pandemic recovery phase, where online presence acts as both a complement and an essential component for business continuity.

Regarding long-term growth, digital marketing facilitates continuous innovation in customer engagement, product placement, and data-driven decision-making. These capabilities are highly correlated with sustainable business performance. The concept of organizational agility also supports this finding within the organizational innovation theory, which highlights marketing adaptation as a crucial element of business innovation that drives competitive sustainability (Damanpour 1991). Integrating digital marketing strategies, especially through social media and interactive communication with customers, significantly contributes to the sustainability of MSMEs in Malang city. Supported by digitally literate business demographics and strong usage patterns, MSMEs that adopt digital marketing cannot only survive but also grow and thrive in an increasingly digitalized economic landscape.

The findings have several important practical and policy implications. For MSME players, the results confirm the need for digital capacity building, particularly in utilising technology-based marketing strategies that are proven to strengthen business sustainability. As highlighted in the TAM framework, local governments and MSME support institutions need to design training programmes that focus on technology access, perceived usefulness and ease of use. In addition, digital industry players and developers of e-commerce and financial technology platforms can utilise this data to develop more intuitive features relevant to the small business segment that requires integrated digital marketing and transaction solutions. From an academic perspective, these findings open up opportunities for developing more contextualised technology adoption models in the MSME sector, particularly in urban areas such as Malang city. Thus, the success of digital marketing as a driver of business sustainability becomes a technological phenomenon, a reflection of the readiness of the ecosystem that supports the digital transformation of MSMEs more broadly and sustainably.

Business innovation and MSME sustainability

The results show that business innovation positively affects MSME sustainability in Malang city. MSMEs' ability to create new products, transform business models, devise novel strategies, and respond to market changes strengthens income stability, resilience, growth, and customer loyalty. This supports Dahlan, Priyana, and Syam (2023), who found that innovation enhances sustainability and market relevance, especially product diversification and customer-focused service. Febriani, Sopha, and Wibisono (2025) also noted that incremental and radical innovation boosts productivity, technological adaptability, and customer retention. Similarly, Sharabati et al. (2024) showed that marketing and digital innovation help creative industry MSMEs sustain operations during disruptions. These findings align with organizational innovation theory by Damanpour (1991), which posits that innovation across process, administrative, and strategic areas improves adaptability, competitiveness, and long-term viability. For MSMEs, continuous workflow innovation, digital customer outreach, and supply chain optimization ensure relevance and value creation amid economic uncertainty. Thus, innovation is a novel, systematic, and adaptive effort to align internal capabilities with evolving market demands.

Demographic data from Table 2 further supports this discussion. Around 40.0% of respondents have operated their businesses for 4–5 years, while 32.5% have been running businesses for over five years, indicating that most MSME owners possess a mature understanding of business dynamics. This suggests that innovation is a strategy for newly established enterprises and a vital approach for sustaining longer-running businesses. The culinary (35.0%) and fashion (23.3%) sectors dominant among respondents are particularly reliant on the speed of innovation, whether in the form of new product development, service variation, or alignment with lifestyle trends. Moreover, most respondents are aged 25–34 (39.2%), a dynamic age group typically open to change and new technologies. This productive age group is generally more proactive in exploring new business strategies and updating their marketing and operational approaches. This is further reinforced by respondents' educational backgrounds, with 35.0% holding undergraduate degrees and 20.0% possessing diplomas, providing a solid intellectual foundation to recognize innovation as a key sustainability strategy. Support for innovation is also indirectly explained through the TAM by Davis (1989), which posits that adopting new technologies and strategies is primarily influenced by business actors' perceptions of the ease of use and the benefits of such innovations.

Business innovation among MSMEs encompasses product enhancements and reflects resilience in redesigning marketing strategies, expanding distribution channels, and improving customer experiences. These efforts directly impact income stability by creating added value that differentiates their products or services from competitors. Additionally, innovation boosts business resilience, as MSMEs accustomed to innovating tend to possess greater flexibility in facing external changes such as market fluctuations or economic disruptions (Angeles 2024). The innovative capacity of MSMEs in Malang city is vital in ensuring and maintaining business sustainability. Supported by a business demographic composed of individuals in their productive years with high educational backgrounds and substantial business experience, innovation becomes a core catalyst for long-term growth and enhanced customer loyalty in an increasingly complex and digital business landscape. Therefore, fostering an innovation-driven culture among MSMEs should be a strategic priority continuously reinforced by the government, academia, and other supporting ecosystems.

These findings suggest that MSME sustainability in Malang city relies heavily on operational stability driven by a systematic, innovation-oriented mindset across business areas. Since innovation is key to long-term survival and competitiveness, stakeholders, especially policymakers, local governments, and business development agencies, should foster environments that encourage continuous innovation through programs like innovation boot camps, sector-specific mentoring, R&D tax incentives, and improved access to digital tools for product development and market agility. Academic institutions must also collaborate with MSMEs to develop adaptive business models and share practical knowledge on design thinking, digital transformation, and agile entrepreneurship. Innovation policies should be inclusive and tailored to MSMEs' demographic strengths, particularly younger, educated entrepreneurs who are more open to change and technology adoption. MSMEs in Malang and similar urban areas can better face uncertainties by strengthening this innovation ecosystem, sustaining customer satisfaction, and contributing to sustainable local and national economic growth.

Financial literacy and MSME sustainability

The results show that financial literacy positively affects MSME sustainability in Malang city by enabling business actors to plan finances, manage cash flow, understand financing, and record transactions systematically, supporting income stability, resilience, growth, and customer loyalty. This aligns with Cahyawati, Nantungga, and Tumewang (2023), who found that financially literate MSMEs implement structured strategies and avoid liquidity crises. Yakob et al. (2021) further emphasized that financial literacy aids rational investment and debt decisions, especially in economic turmoil. According to the TAM by Davis (1989), perceived usefulness and ease of use influence the adoption of financial management tools. MSMEs that find financial apps useful and easy are more likely to adopt them, as supported by Kallmuenzer et al. (2024), who noted higher adoption when tools improve performance without requiring advanced skills. Thus, financial literacy today involves not only understanding finance but also effectively using digital tools perceived as beneficial and manageable, indicating that improving financial literacy must be paired with boosting digital confidence and reducing complexity in technology adoption.

Support for this finding is also reflected in the demographic data in Table 2. Most respondents are business owners who have been operating for 4–5 years (40.0%) or more than 5 years (32.5%), indicating they have gained experience managing medium- to long-term financial cycles. Furthermore, education level is also an important factor supporting financial literacy capabilities. Approximately 35.0% of respondents hold a bachelor's degree and 20.0% a diploma, which theoretically provides them with stronger cognitive skills to understand financial concepts such as cash flow, capital financing, and business bookkeeping. This relatively high level of education supports more mature and financially responsible business planning. Additionally, the largest age group in this study falls within the 25–34 age range (39.2%), a productive age group generally more open to digital financial management. This correlates with the finding that most respondents have adopted bookkeeping applications (72.5%) and e-banking services (80.0%) in their financial operations. The integration of financial literacy and financial technology adoption reflects the importance of digital literacy in supporting more effective and efficient financial management practices in day-to-day business operations.

High financial literacy helps MSME actors enhance business resilience, as they are better equipped to forecast cash needs, manage liquidity, and prepare emergency funds during periods of instability (Harahap et al. 2022; Satpathy et al. 2025). In the long run, business owners who understand how to manage finances tend to make better decisions regarding investment, expansion, and product diversification. This capability ultimately affects customer satisfaction, as financially sound businesses can maintain consistent product and service quality. Although digital marketing and organizational innovation theories are not the primary focus in discussing financial literacy, the successful implementation of digital marketing strategies and business innovations is still heavily influenced by the entrepreneurs' competence in managing their financial resources. Therefore, financial literacy is a critical foundation supporting other strategies and is a key determinant in business sustainability amid digital competition. Thus, financial literacy significantly contributes to the sustainability of MSMEs in Malang city. With strong financial understanding supported by business experience, relatively high education levels, and digital readiness, MSME actors can build stable, shock-resistant businesses ready to grow sustainably in an ever-evolving economic landscape.

These findings highlight the urgent need to promote financial literacy and enhance the perceived ease of use and usefulness of financial technologies to support MSME sustainability. Government, financial institutions, and educators should collaborate to create inclusive training programs that teach financial concepts and demonstrate how digital tools such as e-banking, budgeting apps, cloud accounting, and financing simulators can be integrated into MSME operations. From the TAM perspective, adoption depends on making these tools intuitive, accessible, and beneficial. When MSMEs see financial technologies as helpful and easy to use without requiring advanced skills, their intention to adopt strengthens, maximizing financial literacy's impact. Policies should reduce perceived complexity and showcase relatable success stories from peers who have improved stability and growth through digital financial management. These efforts are vital to building sustainable, financially resilient MSMEs capable of adapting to economic shifts and technological change.

Financial technology adoption and MSME sustainability

The results show that adopting financial technology positively affects MSME sustainability in Malang city by supporting income stability, business resilience, growth, and customer loyalty. Using e-wallets, QRIS, and digital bookkeeping, perceived as easy and useful, enhances transaction speed, financial transparency, and operational efficiency, as shown by Shobandiyah, Kurniati, and Astohar (2023). Tay, Tai, and Tan (2022) also found that fintech reduces administrative burdens and improves informal MSMEs' access to digital financial services. Urefe et al. (2024) linked fintech adoption with higher financial literacy, enabling better budgeting and cash flow management. These findings support TAM by Davis (1989), emphasizing perceived ease of use and usefulness as key to adoption. For MSMEs, fintech enables digitized transactions, automated reporting, payment tracking, and microloan access, helping reduce cash dependency, increase financial visibility, expand markets, and build credibility. Thus, fintech adoption is a critical strategic factor driving MSME sustainability and competitiveness in evolving economies.

Data from Table 2 supports the validity of this finding. All respondents (100%) use digital payment services such as QRIS and e-wallets, 80.0% use e-banking, and 72.5% have integrated digital bookkeeping applications such as BukuWarung or similar into their operations. This indicates that most MSMEs in Malang are already at a relatively advanced stage of adopting financial technology. Most of these business actors operate in the culinary sector (35.0%) and fashion sector (23.3%), which heavily depend on transaction speed and payment efficiency to maintain smooth operations and customer satisfaction. Financial technology usage is also strongly supported by the demographic profile of the respondents, which shows a relatively high level of education: senior high school graduates (31.7%), diploma holders (20.0%), and university graduates (35.0%). This enables business actors to more easily understand and effectively adopt financial technology. Moreover, the largest age group is between 25 and 34 (39.2%), typically more tech-savvy and accustomed to using digital financial applications. This capability supports business resilience, as MSMEs can quickly adapt to consumer behaviour shifts, which increasingly favors contactless payments and digital transactions.

Beyond supporting financial management, financial technology adoption also accelerates long-term business growth through access to automated financial reports, sales performance monitoring, and the potential use of digital microloan features that facilitate business expansion. From the perspective of financial literacy theory by Lusardi and Mitchelli (2007), financial technology enhances financial literacy practices among MSME actors by simplifying bookkeeping processes and enabling data-driven decision-making, thereby improving financial management quality and operational efficiency. Furthermore, financial technology adoption is a supporting element in the organizational innovation theory framework by Damanpour (1991), as it transforms how business actors manage financial resources and build better relationships with customers through fast, secure, and practical digital payment systems. This directly impacts customer satisfaction and loyalty, which are increasingly influenced by the convenience and efficiency of digital transactions. Financial technology adoption is vital in supporting the financial transactions of MSMEs and plays a strategic role in strengthening business competitiveness and sustainability. In the context of MSMEs in Malang city, which have demonstrated a high level of financial technology adoption, continued support for expanding financial technology usage is essential. This can be achieved through education, training, and cross-sector collaboration to create an inclusive and sustainable digital ecosystem.

The findings imply that expanding financial technology use among MSMEs should be a strategic priority for governments, fintech providers, educators, and business groups to promote inclusive growth and long-term sustainability. Beyond infrastructure, efforts must boost digital literacy, offer tailored training, and ensure access to user-friendly fintech suited to MSME needs. Policymakers should embed fintech in financial inclusion strategies by providing incentives like subsidized digital tools and simplified microloan processes to lower adoption barriers, especially for remote or less-educated MSMEs. Broad fintech adoption also benefits the economy by improving tax transparency, formalizing informal businesses, and strengthening the digital economy. Therefore, integrating fintech into MSME operations is essential for operational improvement, innovation, equity, and sustainability in Indonesia's entrepreneurial ecosystem.

The role of financial technology adoption in mediating the influence of digital marketing on MSME sustainability

The results show that adopting financial technology can mediate the influence of digital marketing on MSME sustainability in Malang. This confirms digital marketing's crucial role in MSME growth, especially when combined with fintech, which enables smooth transactions and customer engagement. Supporting this, Rane, Achari, and Choudhary (2023) found that MSMEs using social media with digital payments saw higher customer engagement and repeat sales, boosting business continuity. Atika (2023) similarly showed that combining online promotions with digital financial services improved cash flow and operational efficiency, key to MSME resilience. These findings align with TAM, which states that perceived ease of use and usefulness drive technology adoption and outcomes (Davis 1989). For MSMEs, fintech's convenience enhances digital marketing effectiveness by enabling fast, secure, and user-friendly transactions that build trust and loyalty. Thus, digital marketing's effect on MSME sustainability is strengthened through fintech adoption, creating an integrated digital ecosystem that expands market access, financial transparency, and operational agility.

From a demographic perspective, data from Table 2 shows that 90.0% of MSMEs use social media as a promotional tool, and 80.0% also utilize WhatsApp Business, indicating that entrepreneurs actively use digital channels to build customer relationships. On the other hand, 100% of respondents have adopted digital payment services, and over 72% use bookkeeping applications, suggesting that integrating digital marketing strategies and financial technology is already widespread among MSMEs in Malang. Financial technology adoption strengthens the impact of digital marketing on income stability by facilitating fast, secure, and flexible transactions. In addition, the ability of business owners to provide modern payment systems enhances customer satisfaction and loyalty, as consumers feel more comfortable and valued. In the long run, the combination of effective digital marketing and technology-based financial systems creates a business model that is adaptive and growth-oriented.

In other words, the success of digital marketing in improving business sustainability is highly influenced by how well MSME actors adopt and integrate financial technology into their daily operations. Financial technology serves not only as a transaction tool but also as a critical element in reinforcing the impact of digital marketing on the resilience and competitiveness of MSMEs as a whole (Kilay, Simamora, and Putra 2022; Antoni, Judijanto, and Supriadi 2024). Therefore, financial technology adoption plays a mediating role that amplifies the positive impact of digital marketing on the sustainability of MSMEs. The combination of both creates a strategic synergy that enhances operational efficiency and customer experience while laying the foundation for a more stable, sustainable, and responsive business ecosystem in the face of the digital economy's dynamics in Malang city.

The implications of these findings are significant for policymakers, business support organizations, and MSME actors. Encouraging the combined adoption of digital marketing and financial technology tools should become a priority in programs aimed at MSME development, as this integrated approach drives business growth and long-term resilience against economic uncertainties. Capacity-building initiatives, such as digital literacy training and financial technology workshops, will be essential to maximize the benefits and ensure equitable access to these technologies across various MSME sectors. Furthermore, collaboration between financial technology providers, digital marketing platforms, and local government agencies can foster an enabling environment where MSMEs receive tailored support that addresses promotional and financial management needs. Ultimately, embracing this synergy can help MSMEs in Malang city to innovate continuously, expand their market reach, and strengthen customer relationships, thereby contributing to broader regional economic stability and inclusive growth.

The role of financial technology adoption in mediating the influence of business innovation on MSME sustainability

The results show that adopting financial technology cannot mediate the influence of business innovation on MSME sustainability in Malang. This indicates that fintech adoption does not effectively mediate the link between innovation and sustainability, contradicting the organizational innovation theory, Damanpour (1991), which argues that innovation should boost performance and adaptability. Similar studies, like Nugraha et al. (2022), found that innovations without alignment to digital infrastructure or fintech yield limited operational and financial benefits. Hendrawan et al. (2024) also noted that innovation alone is insufficient for sustainability without digital transformation, including fintech adoption for efficient financial management. These findings suggest that MSME innovations in Malang remain mostly traditional or isolated, lacking integration with fintech tools such as digital payments or automated bookkeeping, which limits innovation's full impact on business continuity and growth.

Demographic data from Table 2 show that most MSMEs have adopted financial technology, 100% use digital payment systems, and 72.5% use bookkeeping applications, yet this adoption does not necessarily correlate directly with innovation in business strategy or business model transformation. For example, MSME players in sectors such as handicrafts (20.8%) and creative services (20.8%) may face challenges in integrating financial technology features into the service innovations they are developing. Meanwhile, the dominant age group (25–34 years old at 39.2%) is generally tech-savvy but may still lack the capacity to connect innovative ideas with digital financial management effectively. Within the framework of the TAM, the failure of financial technology to mediate this relationship may also be explained through perceived usefulness. If business actors do not perceive a direct benefit of financial technology in supporting their innovation strategies, the integration between innovation and financial technology is unlikely to occur optimally. This suggests that the level of understanding or digital literacy related to how financial technology can support business innovation is still uneven among MSMEs in Malang.

This finding provides an important insight: adopting technology does not automatically enhance the effect of business innovation, particularly when not accompanied by adequate systems, digital capabilities, and strategic knowledge on the part of the business owners. Weak integration between innovative strategies and technology-based financial management may lead to ineffectiveness in achieving outcomes such as income stability, business resilience, or customer satisfaction (Adetumi et al. 2024; Homayoun, Pazhohi, and Tamam 2024). Thus, financial technology adoption is not an effective mediator in the relationship between business innovation and MSME sustainability in Malang city. Therefore, a more integrated approach is needed to encourage MSME actors to innovate and understand how such innovations must be supported by adaptive digital financial systems that align with long-term sustainability goals.

These findings imply that MSME policies in Malang city must adopt a holistic approach promoting independent innovation alongside strengthening digital capacity, especially in strategic fintech use. Collaboration among local governments, training centers, and fintech providers is essential to enhance digital literacy and practical fintech integration into innovation processes, adding value to financial management, efficiency, and customer experience. Focused mentoring and technical and digital business skills education are crucial to ensure robust digital financial systems support innovations. This enables MSMEs to innovate within an integrated digital ecosystem, boosting resilience and sustainability amid fierce digital economy competition while fostering adaptive business models and minimizing innovation failure risks due to weak digital infrastructure.

The role of financial technology adoption in mediating the influence of financial literacy on MSME sustainability

The result shows that financial technology adoption cannot mediate the influence of financial literacy on MSME sustainability in Malang city. This indicates that fintech is ineffective as a mediator. This reveals a gap between MSMEs' financial knowledge and its application within digital fintech systems. According to TAM by Davis (1989), perceived usefulness and ease of use drive technology adoption; despite financial literacy, low perceptions of fintech's usefulness and ease limit adoption. Majid, Chaudhary, and Ali (2022) found that without sufficient fintech understanding and experience, financial literacy alone cannot promote effective fintech use. Therefore, enhanced education and training focusing on fintech's ease and tangible benefits are crucial to integrate financial literacy with technology adoption better, supporting MSME sustainability in the digital era.

A review of the demographic data in Table 2 shows that although 87 respondents (72.5%) use digital bookkeeping applications, this does not necessarily reflect strategic or optimal usage. Some MSME actors may only use basic features without truly understanding or utilizing functions that support business sustainability, such as cash flow analysis or automated profit and loss reporting. Moreover, respondents with mid-level education, such as senior high school graduates (31.7%), may still face challenges in linking financial literacy with digital technology in an integrated manner. In the context of the TAM, perceived ease of use and perceived usefulness of financial technology can also act as barriers (Davis 1989). Suppose MSME owners perceive digital financial applications as challenging or believe they do not provide direct operational benefits. In that case, adoption is unlikely significant and may even be counterproductive. This highlights the challenge of educating MSME actors that financial literacy involves understanding concepts and how to practically implement them through technologies that enhance efficiency and enable better decision-making.

Furthermore, business sustainability, which encompasses income stability, business resilience, long-term growth, and customer satisfaction, will be challenging if business owners cannot combine financial understanding with appropriate digital systems. This lack of integration can lead to inaccurate recordkeeping, delays in financial performance evaluations, and poor data-based decision-making. Therefore, in the context of this study, financial literacy has not been able to affect MSME sustainability when mediated by financial technology adoption positively. This low significance suggests that strengthening financial literacy must be accompanied by mentoring in financial digitalization so that MSME actors cannot only understand financial concepts but also operate and optimize financial technology functionally. Such efforts are crucial for building financially savvy and digitally adaptive MSMEs in the era of a technology-driven economy.

These findings highlight key implications for MSME development in Malang's digital era. First, improving financial literacy alone is insufficient without enhancing MSMEs' ability to use financial technology effectively, so education and training must focus on both knowledge and practical fintech skills, emphasizing ease of use and clear benefits. Second, ongoing mentoring is essential to help MSMEs integrate financial literacy with digital tools, reducing errors and improving data-driven decisions. Third, government and stakeholders should promote cross-sector collaboration to ensure affordable, user-friendly technology access and foster fintech innovations tailored to local MSMEs. These efforts will help MSMEs become more adaptive, resilient, and sustainable amid the evolving digital economy.

Conclusions

The results from the SEM-PLS analysis, which involved 120 MSME actors from the culinary, fashion, crafts, and creative services sectors, led to several key conclusions. First, digital marketing, business innovation, and financial literacy were found to have a direct, positive, and significant effect on the sustainability of MSMEs. Second, financial technology adoption also positively and significantly impacted business sustainability. Third, financial technology adoption significantly mediated the relationship between digital marketing and MSME sustainability, suggesting that integrating digital marketing strategies with technology-based financial systems fosters sustainable competitiveness. However, financial technology mediation did not show significant or negative effects on the relationship between business innovation and financial literacy with MSME sustainability. These factors have not yet been effectively integrated with financial technology.

The findings of this study contribute to the literature on MSME sustainability by applying an integrated approach combining the TAM. This comprehensive framework helps explain how digital and financial capabilities influence MSMEs' resilience and long-term growth. The results are important for MSME owners, local governments, and financial technology service providers. For business owners, it is crucial to focus on enhancing digital marketing strategies while integrating them with technology-based transaction and financial management systems. Local governments and related agencies should prioritize developing integrated programs to improve digital and financial literacy, demonstrating how technology adoption can support business sustainability. Financial technology providers must also improve user experiences and education, particularly for MSMEs that are less adaptable to technological advancements.

This study has several limitations. First, its geographic scope is limited to Malang city, so the findings may not apply to other regions with different MSME characteristics. Second, the study's reliance on self-administered questionnaires for data collection may have introduced subjective bias. Third, the quantitative approach did not comprehensively explore contextual factors such as organizational culture, local policies, or market dynamics. Therefore, future qualitative or mixed methods research is recommended to understand better the complex causal relationships that influence MSME sustainability. The study provides several recommendations for stakeholders. MSME owners should focus on building internal capacities in innovation and tech-based financial management through integrated training programs, which include business strategy, financial management, and digitalization, to enhance competitiveness and sustainability. Local governments and support institutions need more intensive efforts to create an inclusive digital ecosystem, particularly to address the gap between business innovation and financial literacy in conjunction with optimal financial technology utilization. In future research, academics are encouraged to explore moderation variables, such as digital literacy levels, trust in technology, and local ecosystem support, to gain deeper insights into the dynamics influencing MSME sustainability.

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