Social Sciences & Humanities Open 11 (2025) 101307

Contents lists available at ScienceDirect

Social Sciences & Humanities Open

journal homepage: www.sciencedirect.com/journal/social-sciences-and-humanities-open

Regular Article

Exploring the impact of digital financial literacy to effective financial planning and control: Perspectives on competitiveness of Thai micropreneurs

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ARTICLE INFO

JEL classification:
D04
G53
M21
M41
O12

Keywords:
Financial literacy
Digital financial literacy
Effective financial planning and control
Perspectives on competitiveness
Micropreneurs

ABSTRACT

Micropreneurs, predominantly active in the informal sector, make significant contributions to both local and national economies. Despite their importance, there is a notable dearth of empirical research identifying the key factors that influence their business success. To address this gap, this study aimed to investigate the impact of financial literacy, digital financial literacy, and effective financial planning and control on the success of Thai micropreneurs. This quantitative research design involved collecting data from 145 small business owners across various regions of Thailand using a carefully designed questionnaire. The questionnaire, developed from previous research and a preliminary pilot study, assessed the financial literacy, digital financial literacy, and financial planning and control capabilities of the participants. Data analysis was performed using descriptive and inferential statistics, alongside Partial Least Squares Structural Equation Modeling (PLS-SEM) to evaluate the measurement and structural models. The findings revealed statistically significant influences among financial literacy, digital financial literacy, and effective financial planning and control. These results provide a deeper understanding of the interplay between these variables in the micro-entrepreneurial setting, offering valuable perspectives for academics, economists, policymakers, and financial institutions. The study underscores the critical need to enhance both traditional and digital financial literacy to support the sustainable management of microenterprises within the economic framework of Thailand.

1. Introduction

Micropreneurs in Thailand, typically solo entrepreneurs without immediate aspirations to expand rapidly, are integral to both local and national economies, especially within the informal sector (Nakase, 2023). Predominantly from Generation Y (ages 20–40), these individuals have developed alongside the rise of the internet and smartphones, fostering a strong inclination towards independent entrepreneurship (Bamboo, 2023). Supported by Thailand's robust digital infrastructure and policies that encourage digital innovation, the country provides an optimal environment for these young, tech-savvy entrepreneurs. The success of their ventures largely hinges on their financial literacy, digital acumen, and adeptness in financial management. These skills are essential not only for managing sales, costs, and earnings but also for leveraging digital tools across various business operations, including marketing, customer engagement, and financial stewardship. However, there is a notable gap in research into Thai micropreneurs' financial and digital literacy and their impact on financial planning. This paper seeks to address this gap by exploring these aspects within the context of Thailand's burgeoning digital economy. Specifically, the research aims to understand how effective financial planning and control can enhance the sustainability and

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https://doi.org/10.1016/j.ssaho.2025.101307
Received 28 April 2024; Received in revised form 22 December 2024; Accepted 19 January 2025
Available online 27 January 2025

growth of micro-enterprises.

In our rapidly digitalizing world, Thai micropreneurs strive to harness digital technology to boost their operational efficiency. Yet, adopting and effectively utilizing digital financial services poses significant challenges (Moenjak, Kongprajya, & Monchaitrakul, 2020). These entrepreneurs face a need for in-depth financial literacy and its digital counterpart to manage these services proficiently. A survey conducted in Bangkok highlighted a widespread deficiency in financial literacy, with many participants finding financial matters perplexing (Grohmann, 2018). Consequently, this phenomenon emphasizes the need in enhancing both financial and digital literacy to effectively exploit technology and digital financial services. Additionally, micropreneurs play a distinctive role in catalyzing innovation and economic growth (Kim, Kim, & Jeon, 2018). Launching a business also involves various challenges, necessitating skills beyond financial literacy, including strategic planning and resource management. Apart from that, success requires entrepreneurial competencies, effective marketing, technological innovation, managerial dexterity, and a competent team (Hani, 2021; Somwethee, Aujirapongpan, & Ru-Zhue, 2023). This study presents the results of surveys and observations conducted on financial literacy, digital financial literacy, and financial planning and control among Thai micropreneurs. This includes initial findings on the current state of these competencies and their impacts on business performance.

The economic growth in Thailand is driven by micropreneurs, but they face numerous challenges if their operations are not optimally managed. These challenges range from securing adequate business financing to gaining credibility for their brands. They may also face difficulties in procuring necessary equipment or navigating external issues such as location restrictions and high labor costs (Konsek-Ciechońska, 2019). With rapid changes in financial conditions, developing financial skills for executives and associated employees has become crucial (Karadag, 2015). Concurrently, the importance of digital proficiency in business settings is evident in the recruitment of individuals with digital skills and ongoing innovation in business-related digital knowledge (Reddy, Chaudhary, & Hussein, 2023). Micropreneurs not only create job opportunities and generate income but also enhance competitiveness at the grassroots level of the economy. Addressing persistent issues like business financial management and professional technology use in operations is crucial (Raghavan, Desai, & Rajkumar, 2017). Small or online businesses, often lacking robust protective and developmental systems, are particularly susceptible to high cyber risks and security issues, especially in finance-related matters. These vulnerabilities stem from a deficiency in financial and technological resources, which hampers the establishment of a solid security infrastructure. However, these businesses show a capacity for innovation, attributed to their inherent flexibility and responsiveness to rapidly changing environments (Jiraphanumes, Aujirapongpan, & Songkajorn, 2023). Moreover, small businesses tend to adopt a streamlined decision-making approach, encouraging experimentation and learning from missteps to fuel improvement and innovation (Marom, Lussier, & Sonfield, 2019). This study is important because it addresses a significant gap in the literature concerning the financial and digital literacy of Thai micropreneurs and their impact on effective financial planning and control. The novelty of this study lies in its focus on integrating these competencies to enhance business sustainability and growth. By contributing new insights into the development of related literature, this research offers practical paths for policy makers and micropreneurs to follow in enhancing these essential skills.

Furthermore, while the interplay between planning and operational activities within microenterprises has been examined, the specific focus on the control aspect of planning and its influence on operations remains underexplored (Wijewardena & De Zoysa, 2001). Existing research has delved into areas like digital competence and the adaptability of micropreneurs in times of crisis. Studies have shown that financial literacy significantly affects business decision-making and overall sustainability. Nonetheless, the research on financial planning and control abilities is surprisingly scant. This unaddressed gap in the literature becomes particularly relevant for micropreneurs in Thailand, a landscape frequently beset by challenges and uncertainties. This study aims to fill this void by investigating the crucial elements that contribute to a micropreneur's success, including financial literacy, digital proficiency, and efficient financial management. These components are not only pivotal to individual business success but also serve to bolster the overall competitiveness of Thailand's economy. The findings from this research endeavor are anticipated to inform policy and strategic decision-making, assisting micropreneurs not only in Thailand but also in other countries with analogous economic conditions. Moreover, this study is expected to outline practical paths for enhancing both financial and digital literacy, along with effective financial management within the realm of micropreneurs. Thus, it holds promise to extend both theoretical insights and pragmatic directions to a critical segment of the entrepreneurial landscape.

The structure of this paper is outlined as follows, section 2 provides a detailed review of relevant literature and establishes the hypotheses for this study. Section 3 describes the research methods used, including the approaches for data gathering, criteria for selecting samples, definitions of key variables, and the design of the regression models employed. Section 4 presents the main results of the study, along with thorough empirical analysis. The concluding Section 5 summarizes the insights derived from the research outcomes.

2. Literature review

A review of the literature on financial literacy, digital financial literacy, and effective financial planning and control offers valuable insights into the financial and digital competencies pertinent to small businesses. This examination not only enhances our understanding of business management in the digital age but also helps identify critical problem areas and support needs (Morgan, Huang, & Trinh, 2019). Furthermore, it illuminates ways in which small businesses can improve their financial planning and control processes, thereby enhancing their robustness and sustainability in a rapidly evolving economic landscape.

2.1. Financial literacy

Understanding financial literacy involves recognizing the capacity to apply financial knowledge and skills to make informed and high-quality financial decisions. Financial literacy encompasses competencies across various domains including money management, saving, investing, insurance, and long-term financial planning (Klapper, Lusardi, & Van Oudheusden, 2015). Recent research focusing on financial literacy within medium- and small-sized enterprises (SMEs) has increased significantly, yet its development has been both rapid and inconsistent (Molina-Garcia, Dieguez-Soto, Galache-Laza, & Campos-Valenzuela, 2023). It is surprising to find that many micropreneurs lack familiarity with even basic financial terminology, and their financial literacy often extends only to specific activities such as record-keeping and sourcing convenient funding, indicating a generally low level of financial literacy (Topimin & Hashim, 2020). Conversely, micropreneurs are often perceived as financially adept due to their frequent engagement in financial decision-making. Their level of financial literacy may even improve modestly as they secure higher incomes and utilize financial services more frequently (Finaldi Russo, Galotto, & Rampazzi, 2022). Understanding the multifaceted nature of financial literacy, the need for effective financial planning, and the employment of suitable financial structures is crucial. A lack of financial literacy among small business operators can create barriers to accessing external funding sources, further emphasizing the importance of this skillset (Topimin & Hashim, 2020). This complex landscape presents both challenges and opportunities for enhancing the financial capabilities and success of small business ventures.

Financial literacy is central to both personal and business success, consolidating knowledge, understanding, and skills in financial management. This complex domain facilitates the efficient use of money and fosters financial stability. Within this study, three fundamental pillars of financial literacy are explored: financial confidence, financial decision-making, and financial management skills. Financial confidence refers to a thorough understanding of one's finances, coupled with the assurance to manage personal finances and debts effectively. It is worth noting that even high financial literacy, without confidence, can lead to financial troubles (Palameta et al., 2016). Financial decision-making includes the ability to comprehend the full spectrum of one's financial landscape, making informed decisions on money-related matters, and managing financial risks adeptly. The effectiveness of decision-making may be influenced by our psychological and emotional perspectives about money (Frydman & Camerer, 2016). Meanwhile, financial management skills involve the fundamental competencies necessary to manage personal finances at a basic level, such as handling bank accounts, paying bills, and engaging in budgeting and debt management (Engel, Bar, Beaton, Green, & Dawson, 2016). These skills extend beyond basic monetary utilization to include collecting and analyzing financial information and making informed decisions (Chase, 2010). Understanding these integral aspects of financial literacy can significantly enhance financial management capabilities, thereby laying a solid foundation for long-term financial stability.

2.2. Digital financial literacy

Digital literacy is an indispensable skill that enhances societal engagement in our technology-driven world, playing a crucial role in various educational realms such as open education, distance learning, and digital-related education (Marín & Castaneda, 2023). The rapid proliferation of Information and Communication Technology (ICT) has catalyzed advancements across numerous sectors, including banking, transportation, and economics. This rapid transformation necessitates a modern skill set, compelling individuals to acquire diverse abilities, competencies, and proficiencies to adapt to a landscape where technology permeates daily life (Reddy, Sharma, & Chaudhary, 2020). One of the significant challenges in fostering digital literacy lies in understanding the multifaceted and varying scenarios of digital literacy and the associated digital divide. Viewing digital literacy as a societal practice offers a more nuanced perspective (Marín & Castaneda, 2023). The assessment of digital literacy can be undertaken through several indicators, such as proficiency in utilizing digital technology, online communication, information search and analysis, access to online resources, and adherence to standards for digital safety. The aim of these measures is to cultivate and refine the vital skills required for active participation in today's digital society (Chetty et al., 2018). Additionally, the positive correlation between both financial literacy and digital literacy on asset returns is notable. Notably, digital literacy exerts a more pronounced positive impact on growth, particularly in the short term. While both financial education and digital literacy are essential for comprehension and implementation, digital literacy emerges as a crucial factor propelling business growth over the long term (Fauzi, Antoni, & Suwarni, 2020). By recognizing and embracing the importance of digital literacy, society can be better equipped to thrive in a world where technology continually evolves and shapes our lives.

The role of technology in the contemporary business landscape is both significant and transformative. With the rise of social technologies, such as social media platforms, businesses can forge relationships with customers and communicate through innovative channels (Akpan, Soopramanien, & Kwak, 2021). The application of virtual technology has further broadened the horizons of business operations, facilitating long-distance engagement and expansion into diverse markets, all while minimizing costs. Information and Communication Technology (ICT) emerges as a linchpin for small businesses, offering an array of tools that promote adaptability and growth in the digital era. From basic hardware like computers to specialized software for calculations and expansive internet usage, these technological tools enable small businesses to keep pace with evolving digital trends (Peltier, Zhao, & Schibrowsky, 2012). In terms of decision-making, big data and predictive data analysis tools are revolutionizing the process, allowing business operators to make precise and informed decisions. This capability is particularly beneficial in an environment marked by uncertainty and complex challenges, enabling companies to navigate tumultuous waters with enhanced confidence and acumen (Akpan et al., 2021). The convergence of these technological aspects illustrates a vibrant synergy that fosters efficiency, innovation, and sustainability within modern business practices.

Digital financial literacy refers to the ability to comprehend and utilize digital technology for financial management. In this study, several key indicators represent components of digital knowledge: knowledge of financial technology (fintech), familiarity with automated financial technology (machine learning in finance), and understanding of cyber risks. Fintech knowledge pertains to financial services that leverage technology applications, such as the Internet of Things (IoT). Given the rapid expansion and evolution of fintech trends, understanding these technologies is crucial. For instance, the emergence of mobile payment platforms like Apple Pay and Samsung Pay exemplifies a rapidly growing service for contemporary consumers (Lim, Kim, Hur, & Park, 2019). Moreover, Machine Learning (ML) has become increasingly significant in the financial sphere. It enables the forecasting and analysis of financial data, offering accurate predictions concerning profits, risks, and market volatility. ML also assists in detecting financial fraud and managing risk within financial businesses. Applications of ML in investment analysis, stock price calculations, and investment portfolio management can empower investors to make effective decisions and mitigate risk (Dixon, Halperin, & Bilokon, 2020). Lastly, in the financial industry, understanding cyber risks is imperative, given that cyberattacks can compromise financial stability and disrupt systems. Such risks can affect the operations of financial organizations, with potential repercussions for customers and service users (Kopp, Kaffenberger, & Wilson, 2017). Possessing a comprehensive understanding of these three digital knowledge aspects can facilitate effective management of technology across all facets of finance.

2.3. Effective financial planning and control

Effective financial planning and control are essential for the prosperity of businesses, particularly for small-scale entrepreneurs, often referred to as 'micropreneurs'. This broader perspective on financial planning transcends basic budgeting to include comprehensive risk management. The risk management process entails identifying, evaluating, and mitigating potential business risks, thereby building investor trust and confidence (Mengel & Wouters, 2015; Prohorovs, Bistrova, & Ten, 2019). Implementing structured financial controls, such as audits, accounting practices, and the monitoring of revenue and expenses, allows businesses to efficiently manage and regulate their financial activities. These measures are pivotal in allocating financial resources effectively and economically, ultimately boosting business performance (Wijewardena & De Zoysa, 2001). It is imperative for companies to gather sufficient financial resources, assess financial performance continuously, manage potential risks, and deter fraud. These actions enhance financial management and support sustainable business strategies (Mengel & Wouters, 2015). Additionally, fostering positive financial behaviors among employees plays a crucial role in supporting these financial management efforts in micropreneurial settings. Employees who are responsible and proactive significantly contribute to risk mitigation and improved financial efficiency (Ruscitasari, Nurcahyanti, & Wibisono, 2022). Moreover, embracing technological advancements can propel micropreneurs towards market expansion and sustainability by refining workflows, improving products or services, and developing effective marketing and communication strategies (Kim et al., 2018).

Mastering effective financial planning and control is critical for any business aiming to efficiently manage and oversee its financial resources, a key driver of competitive edge and goal achievement. This comprehensive approach integrates three principal activities: operating, investing, and financing. Operating activities, detailed in the cash flow statement, involve cash transactions from main business operations such as sales and routine expenses (Accounting Tools, 2022). On the other hand, investing activities focus on long-term profitability and growth, such as acquiring machinery for production enhancement or purchasing other businesses to improve operational efficiency (Nasrudin, 2020). Financing activities involve transactions related to long-term capital, sourced from investors and creditors who provide funds through mechanisms such as bonds (FreshBooks, 2023). Together, these activities forge a cohesive strategy that promotes financial stability and sustainable growth, highlighting the pivotal role of effective financial planning and control in realizing a business's long-term goals.

2.4. Financial literacy and digital financial literacy

The proliferation of digital financial services has significantly facilitated the accessibility and management of personal finances, enhancing overall efficiency (Lyons & Kass-Hanna, 2021). Central to this evolution is the advancement of digital literacy, which is indispensable for fully leveraging digital payment tools and platforms involved in handling sophisticated personal financial options (Prete, 2022). The interplay between financial literacy and digital literacy is complex; both positively impact the propensity to initiate online businesses, although the influence of digital literacy tends to be more indirect (Bayrakdaroğlu & Bayrakdaroğlu, 2017). Additionally, proficient financial management is linked to an increased likelihood of adopting digital financial services, which promotes financial integration, especially among micropreneurs (Hermawan, Gunardi, & Sari, 2022). On a broader scale, the utilization of information and communication technology (ICT) can catalyze growth in small businesses through various means such as improving operational efficiency, reducing costs, enhancing customer interaction, broadening marketing avenues, and improving the presentation of products and services. Nevertheless, small enterprises face several challenges in adopting ICT, including technical limitations, financial barriers, and obstacles related to change adaptation (Barba-Sánchez, Martínez-Ruiz, & Jiménez-Zarco, 2007). These considerations have prompted the proposal of the following hypothesis:

Hypothesis 1. Financial literacy directly influences digital financial literacy.

2.5. Financial literacy and effective financial planning and control

Financial literacy empowers individuals to effectively utilize contemporary financial tools, such as fintech, which supports sound financial planning and contributes to the economic stability of nations. Research indicates a significant link between financial literacy and the quality of financial planning; individuals with higher levels of financial literacy are more likely to develop comprehensive financial plans and exhibit a deeper understanding of financial operations and controls (Agarwal, Amromin, Ben-David, Chomsisengphet, & Evanoff, 2015). Such financially savvy individuals typically engage in long-term financial planning. Consequently, policies designed to enhance financial literacy can lead to more informed and proactive personal financial management (Arrondel, Debbich, & Savignac, 2014). Additionally, financial literacy, alongside family support and financial planning, plays a pivotal role in influencing an individual's financial well-being (Adam, Frimpong, & Boadu, 2017). The interaction of financial literacy and self-control also affects financial behavior, with individuals possessing both high financial literacy and strong self-control demonstrating better financial behavior than their peers who lack in either or both (Khoirunnisaa & Johan, 2020). Increased financial literacy is associated with higher financial efficiency and prudent behavior across genders in Generations X and Z (Mawad, Athari, Khalife, & Mawad, 2022). Furthermore, research suggests a connection between self-control, financial literacy, and saving behaviors, especially among small business owners. Those with lower self-control benefit significantly from financial literacy in enhancing their savings habits, as extensive saving behaviors are not typically observed following financial literacy training alone (Mpaata, Koske, & Saina, 2021). It is also noted that financial literacy, self-control, and socioeconomic status collectively impact consumption behaviors (Putri, Sutieman, Noy, & Pattiasina, 2022).

In the context of small and medium-sized enterprises (SMEs), financial literacy is crucial. Studies show that businesses with higher financial literacy are more likely to develop coherent business strategies and manage finances more efficiently than those with lower literacy levels (Utami, Aprilia, & Putra, 2021). This competency in financial literacy directly enhances the operational efficiency of small businesses (Engström & McKelvie, 2017). Moreover, the combination of financial literacy and positive financial attitudes significantly influences the financial management behaviors of micropreneurs, affecting their planning and control strategies (Ratnawati, Azzahra, & Dewanta, 2023). Based on these findings, the following hypothesis is proposed:

Hypothesis 2. Financial Literacy directly influences effective financial planning and control.

2.6. Digital financial literacy and effective financial planning and control

The digital transformation has significantly altered the operational dynamics of small and medium-sized enterprises (SMEs), necessitating a higher level of digital readiness among micropreneurs (Zahoor, Zopiatis, Adomako, & Lamprinakos, 2023). The integration of digital technologies has revolutionized the operational approaches of these businesses, facilitating opportunities for growth, enhanced efficiency, and innovation. The adoption of cutting-edge technologies not only equips businesses with competitive edges but also ensures their survival by enabling the flexible modification of existing business models (Akpan et al., 2021). Additionally, marketing capabilities and research and development efforts play a critical role in enhancing the marketing strategies of micropreneurs (Wirawan, Fadah, Suryaningsih, & Wulandari, 2021). Research investigating the impact of digital knowledge on the intention to utilize digital technologies among professionals in the creative industries reveals that digital knowledge profoundly influences such intentions (Cavalheiro, Nikou, & Widén, 2020). Furthermore, the digital literacy of senior managers plays a pivotal role in mediating the relationship between creative leadership and digital capabilities (Calli, Ozsahin, Coşkun, & Arik, 2022). Presently, technological tools including social networking for business development, customer relationship management systems, new communication mediums, virtual technology for remote operations, and the internet are essential in minimizing operational costs. Moreover, big data and predictive analytics have become invaluable for making intricate business decisions under challenging conditions (Akpan et al., 2021). The use of information and communication technology, such as computers, calculation software, and the internet, is critical in shaping the trajectory of small businesses today (Peltier et al., 2012). Based on the comprehensive review of the literature, the following hypothesis is proposed:

Hypothesis 3. Digital financial literacy directly influences effective financial planning and control.

The above systematic literature review examines the interrelationships between financial literacy, digital financial literacy, and effective financial planning control, resulting in a hypothesis that delineates the connections among these variables. These relationships are visually depicted within the conceptual framework of the research (Fig. 1). This framework outlines the anticipated interactions between the variables and provides the basis for an empirical investigation into their connections.

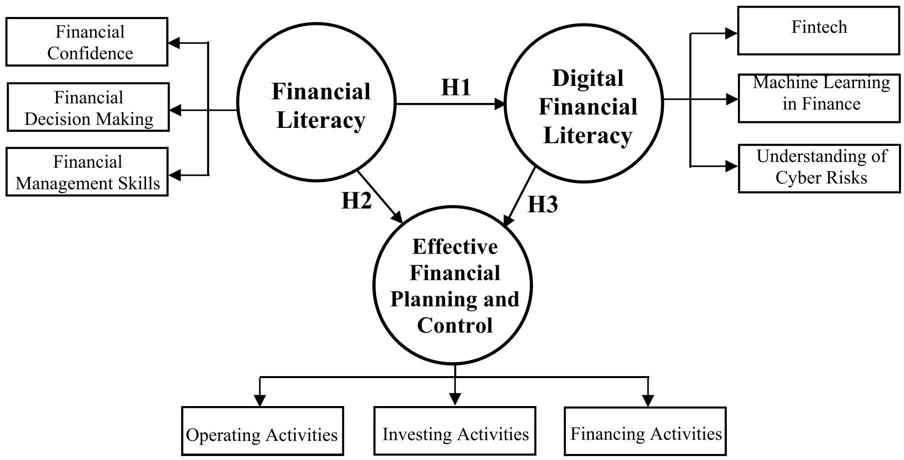

Fig. 1. Research conceptual framework.

More specifically, the proposed conceptual framework delineates the interrelationships between financial literacy, digital financial literacy, and effective financial planning and control within the context of micropreneurial activities. Central to the framework is effective financial planning and control, which is pivotal for the successful management of a business's financial resources. This central construct is influenced by two primary factors: financial literacy and digital financial literacy. Financial literacy encompasses traditional knowledge and skills related to financial decision-making, management skills, and a comprehensive understanding of financial principles. Conversely, digital financial literacy involves the proficiency in utilizing digital tools and platforms, including fintech and machine learning in finance, to manage financial activities effectively.

The framework emphasizes the direct impact of both traditional and digital financial literacy on effective financial planning and control, highlighting the necessity for a holistic financial education that incorporates both dimensions. Furthermore, it identifies three critical areas where effective financial planning and control are essential: operating activities, which encompass day-to-day business operations; investing activities, which involve the allocation of resources for future growth; and financing activities, which pertain to managing funding sources and the capital structure of the business. This conceptual framework emphasizes the interconnectedness of these elements, suggesting that enhancing both traditional and digital financial literacy is crucial for the sustainability and growth of microenterprises.

3. Materials and methods

3.1. Research design, context, and participant

This study adopted a quantitative research design to investigate the relationship between financial literacy, digital financial literacy, and effective financial planning and control among micropreneurs in Thailand, as previously illustrated in Fig. 1. For data collection, the research combined convenience and snowball sampling techniques. Initial respondents were accessed through online platforms and telephone communication, chosen for their availability and convenience in participating in the study. Subsequently, the researcher disseminated questionnaires among targeted micropreneur groups in Thailand. Participants were encouraged to share the survey within their professional circles. Employing snowball sampling, a recognized non-probability sampling technique, the study expanded its participant base through established networks, thus enhancing reach and engagement across the target demographic. Data collection was exclusively conducted online, and questionnaires were distributed to various micropreneur groups or to individuals introduced to the study via telephone between July 21, 2023 and September 7, 2023. The questionnaire was carefully designed to include clear definitions of each variable to ensure comprehension and accuracy.

The research was reviewed and approved by the Institutional Review Board of the Human Research Ethics Committee of Nakhon Ratchasima College (NMCEC-0009/2566), Thailand. Prior to participation, all respondents were provided with an informed consent form detailing the study's purpose, procedures, and confidentiality assurances. Respondents were required to electronically sign the consent form before completing the questionnaire, ensuring their voluntary participation and understanding of the study.

Moreover, the sample size determination was guided by two statistical methods: the inverse square root and the gamma-exponential methods, as cited by Kock and Hadaya (2018). The study aimed for a statistical power of 80% and a significance threshold of 0.05. According to the inverse square root method, a minimum of 110 samples was required. The eventual collection of 145 completed questionnaires deemed the sample size adequate for the study's goals. To assess potential data bias, a detailed comparative analysis of the first 30 and the last 30 datasets was performed, revealing no significant differences, thus confirming the unbiased nature of the data collected. Detailed characteristics of the sample are documented in Table 2.

3.2. Research instrument

In this study, a questionnaire was employed as the primary research tool, developed through an extensive review of relevant literature and validated by a panel of three experts in innovation management. The questionnaire was divided into three sections: entrepreneurial and business attributes, financial literacy, digital financial literacy, and effective financial planning and control. The financial literacy section included items adapted from studies by Klapper et al. (2015) and Topimin and Hashim (2020), focusing on financial confidence, decision-making, and management skills, using a 5-point Likert scale. Digital financial literacy questions were based on work by Lim et al. (2019) and Dixon et al. (2020), covering fintech knowledge, machine learning in finance, and cyber risks. The effective financial planning and control section drew on Mengel and Wouters (2015) and Accounting Tools (2022), evaluating operating, investing, and financing activities. Each item was rated on a 5-point Likert scale, with higher scores indicating greater competency. The expert panel ensured content validity, leading to minor adjustments for clarity. A pilot study with 30 participants confirmed the questionnaire's reliability, with all items scoring above 0.8 on Cronbach's alpha. The complete questionnaire is included in Appendix A for detailed reference. This thorough approach ensures the accuracy and relevance of the questionnaire, providing robust data for analyzing the relationships between financial literacy, digital financial literacy, and effective financial planning and control among Thai micropreneurs.

In the research instrument section, it is essential to detail the indicators used to measure each variable. This includes specifying whether the indicators are formative or reflective, and clarifying whether the measurement instruments were developed by the author or adopted from previous research. Table 1 provides a comprehensive overview of these aspects:

In this study, the three main variables—Financial Literacy, Digital Financial Literacy, and Effective Financial Planning and Control—were operationalized with three observed variables per main variable. For the development of the survey questions, the observed variables under Financial Literacy and Digital Financial Literacy were each represented by two questions per observed variable. However, the observed variables under Effective Financial Planning and Control were represented by three questions per observed variable. This was due to the higher complexity of measuring this variable, as it encompasses multiple dimensions, including Operating Activities, Investing Activities, and Financing Activities, requiring additional questions to comprehensively capture these components.

To aggregate the responses for each observed variable, the average score of the respective survey items was calculated. This was performed using SPSS to compute the means for each observed variable. These mean values were subsequently used for Structural Equation Modeling (SEM) analysis via Partial Least Squares Structural Equation Modeling (PLS-SEM). The use of mean scores to represent the observed variables helps reduce data complexity while ensuring effective and precise statistical analysis in evaluating the relationships between the main variables and their corresponding observed variables within the research model.

3.3. Data analysis

The initial phase of data analysis commenced with the evaluation of indicator levels for each variable, followed by the presentation of descriptive statistics for the sampled population. The data scores were classified into five distinct levels based on their average values: lowest (0.00–1.00), low (1.01–2.00), medium (2.01–3.00), high (3.01–4.00), and highest (4.01–5.00). Analysis of the conceptual model was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM), which encompassed two distinct evaluative approaches:

1. Reflective Measurement Model Analysis: This approach involved assessing factors such as indicator loading, internal consistency reliability, convergent validity, and discriminant validity. Composite Reliability (CR) and Average Variance Extracted (AVE) were used to assess the confirmatory validity of the constructs. According to the guidelines by Hair, Risher, Sarstedt, and Ringle (2019), CR values above 0.70 and AVE values above 0.50 were considered acceptable. For discriminant validity, the Fornell-Larcker Criterion (Fornell & Larcker, 1981) and the Heterotrait-Monotrait Ratio (HTMT) were applied, with HTMT values below 0.85 indicating adequate discriminant validity as per Henseler, Ringle, and Sarstedt (2015).
2. Structural Model Analysis: This approach focused on examining aspects like collinearity, predictive relevance, and the PLSpredict method. Collinearity was assessed using Variance Inflation Factor (VIF) values, with values below 5 indicating acceptable levels of collinearity. Predictive relevance was evaluated using the Stone-Geisser Qˆ2 test, with values greater than zero indicating predictive relevance.

The research hypotheses were tested using path coefficients and t-values derived from the PLS-SEM analysis. The criteria for accepting or rejecting the hypotheses were based on the significance level of 0.05, where hypotheses were accepted if the p-value was less than 0.05. Path coefficients greater than 0.1 with corresponding t-values greater than 1.96 (for a 0.05 significance level) were considered statistically significant.

The final stage of the analysis included a thorough examination aimed at validating the research hypotheses, which entailed assessing the interactions among the three constructs (financial literacy, digital financial literacy, and effective financial planning and control) to gain a comprehensive understanding of their interrelationships. The use of PLS-SEM allowed for robust analysis despite the complexity of the model and the relatively small sample size, making it an ideal choice for this study.

4. Results

The current study included 145 participants, all of whom were small business owners from various regions of Thailand. Table 1 provides a detailed overview of the sample's characteristics. The results are sequentially presented, following the data analysis procedures previously outlined.

4.1. Descriptive statistics

The sample consisted primarily of sole proprietorships (65.5%), followed by limited companies (24.8%) and partnerships (9.7%). The majority were engaged in the retail trade sector (46.9%), while other sectors included services and transportation (16.6%), agriculture (14.5%), the manufacturing industry (9.7%), information technology (8.3%), and public health (4.1%). Regarding service mode, 47.6% of businesses offered both in-store and online services, 40% provided in-store sales only, and 12.4% conducted sales exclusively online. The majority of businesses operated domestically (72.4%), with 27.6% functioning both domestically and internationally. In terms of operational experience, the largest segment had been in business for more than ten years (44.1%), followed by those operating for 1–5 years (33.8%), 6–10 years (15.9%), and less than one year (6.2%). Investment levels varied, with the majority investing less than 500,000 baht (44.8%). Other investment brackets included more than 3,000,000 baht (22.1%), between 500,001 and 1,000,000 baht (22.1%), between 1,000,001 and 2,000,000 baht (6.9%), and between 2,000,001 and 3,000,000 baht (4.1%). Regarding annual revenue, the largest group reported earning less than 100,000 baht (41.4%), followed by those earning between 100,000 and 500,000 baht (34.5%), 500,001 to 1,000,000 baht (11.0%), 1,000,001 to 5,000,000 baht (8.3%), and more than 5,000,000 baht (4.8%).

The descriptive statistics provide an overview of the sample characteristics, primarily consisting of sole proprietorships in retail trade, reflecting Thailand's broader microenterprise landscape. The significant presence of businesses offering both in-store and online services underscores the growing importance of digital platforms in micropreneurship, aligning with prior research on digital financial literacy (Moenjak et al., 2020). Most businesses operate domestically, with a notable portion engaging in international trade, highlighting the role of financial and digital literacy in expanding market reach. The experience distribution, particularly the segment with over ten years in operation, indicates a mature sector that could benefit from advanced financial planning and control strategies (Agarwal et al., 2015). Investment and revenue data show that most micropreneurs operate with limited financial resources, emphasizing the need for effective financial management and planning to sustain operations and growth (Engström & McKelvie, 2017). The variation in investment and revenue levels suggests diverse financial capabilities and challenges, reinforcing the need for tailored financial literacy programs. These insights underscore the critical role of financial and digital literacy in the success of Thai micropreneurs, supporting the study's hypotheses. Future research should focus on developing targeted educational interventions to enhance financial management and leverage digital tools for business

Table 1
Indicators used to measure research variables.

Research Variable	Observed Variable	Description of Observed Variable	Indicators	Reference	Indicator Type	Instrument Source
Financial Literacy	Financial Confidence	Knowledge and confidence in managing business finances effectively	Ability and confidence to effectively manage the business's finances independently.	Palameta et al. (2016)	Reflective	Adopted
			Knowledge and confidence in learning and applying financial systems and processes accurately.			
	Financial Decision Making	Ability to make informed financial decisions and manage cash flow liquidity	Ability to resolve financial issues in the business promptly.	Frydman and Camerer (2016)	Reflective	Adopted
			Ability to make decisions and manage the business's cash flow effectively.			
	Financial Management Skills	Understanding financial planning and expense control for the business	Understanding and planning the financial future of the business.	Engel et al., 2016; Chase, 2010	Reflective	Adopted
			Ability to control and manage business expenses efficiently.			
Digital Financial Literacy	Knowledge of Fintech	Knowledge and effective use of financial technology (Fintech) in business	Knowledge and ability to utilize financial technology (e.g., banking, payment systems) effectively in the business.	Lim et al. (2019)	Reflective	Adopted
			Confidence in leveraging financial technology to enhance business management efficiency.			
	Knowledge of Machine Learning in Finance	Experience and confidence in using automated financial tools and programs (AI)	Experience in using automated financial tools (e.g., AI-based calculators) for business decision-making.	Dixon et al. (2020)	Reflective	Adopted
			Ability to use AI tools to improve business financial management efficiency.			
	Understanding of Cyber Risks	Ability to manage and plan for cyber risks in business operations	Knowledge and ability to address financial and operational risks arising from cybersecurity issues.	Kopp et al. (2017)	Reflective	Adopted
			Preparedness and planning to mitigate cybersecurity risks affecting the business.			
Effective Financial Planning and Control	Operating Activities	Business has efficient cash management, planning for income and expenses, and efficient inventory management	The business has an efficient system for managing cash flow and ensuring liquidity.	Accounting Tools, 2022	Formative	Developed
			Clear planning and control of income and expenses to achieve financial goals.			
			Efficient procurement and inventory management to minimize waste and reduce costs.			
	Investing Activities	Business plans and controls investments, assets, and responds to customer needs effectively	Effective management of debtors, minimizing bad debts.	Nasrudin (2020)	Formative	Developed
			Ability to achieve business profit targets consistently.			
			Planning for investments in infrastructure, equipment, or technology to meet customer needs effectively.			
	Financing Activities	Business plans and sources funding efficiently, and manages debt and dividends effectively	Efficient utilization of business assets and technologies to maximize value.	FreshBooks (2023)	Formative	Developed
			Planning and securing funding sources, including loans, efficiently and at low cost.			
			Effective planning and execution of debt payments and profit-sharing with stakeholders.			

Table 2
The characteristic of sample.

Measure	Value	Frequency	Percentage
Business Form	Sole Proprietorship	95	65.5
	Partnership	14	9.7
	Limited Company	36	24.8
Type of Business	Retail Trade	68	46.9
	Services and Transportation	24	16.6
	Public Health	6	4.1
	Agriculture	21	14.5
	Manufacturing Industry	14	9.7
	Information Technology	12	8.3
Service Characteristics	In-store Sales	58	40.0
	Online Sales	18	12.4
	Both In-store and Online	69	47.6
Scope of Business	Domestic	105	72.4
	Both Domestic and International	40	27.6
Business Experience	Less than 1 year	9	6.2
	1–5 years	49	33.8
	6–10 years	23	15.9
	More than 10 years	64	44.1
Investment	Less than 500,000 baht	65	44.8
	500,001 to 1,000,000 baht	32	22.1
	1,000,001 to 2,000,000 baht	10	6.9
	2,000,001 to 3,000,000 baht	6	4.1
	More than 3,000,000 baht	32	22.1
Annual Revenue	Less than 100,000 baht	60	41.4
	100,001 to 500,000 baht	50	34.5
	500,001 to 1,000,000 baht	16	11.0
	1,000,001 to 5,000,000 baht	12	8.3
	More than 5,000,000 baht	7	4.8
Total		**145**	**100**

growth.

4.2. *Inferential statistics*

To analyze the impact of various general factors on Financial Literacy, Digital Financial Literacy, and Effective Financial Planning and Control, the study utilized t-tests and F-tests. These constructs were evaluated across multiple dimensions such as business form, type of business, service characteristics, scope of business, business experience, investment levels, and annual revenue. The analysis consistently indicated no statistically significant differences in the means of these three constructs across any of the categories examined, with all significance values exceeding 0.05.

The study found no significant differences in Financial Literacy, Digital Financial Literacy, and Effective Financial Planning and Control across various business forms, types, and characteristics. Specifically, comparisons among different business forms, such as sole proprietorships, partnerships, and limited companies, revealed no significant differences. Similarly, when evaluating different types of businesses, including retail trade, services and transportation, public health, agriculture, manufacturing industry, and information technology, no significant differences were found in the three constructs. Service characteristics, whether in-store sales, online sales, or a combination of both, also showed no significant differences in Financial Literacy, Digital Financial Literacy, and Effective Financial Planning and Control. Furthermore, there were no significant differences between businesses operating domestically and those operating both domestically and internationally.

The study also examined businesses with varying levels of operational experience, from less than 1 year to more than 10 years, and found no significant differences in the three constructs. Analysis of different investment levels, ranging from less than 500,000 baht to more than 3,000,000 baht, showed no significant differences. Similarly, different annual revenue levels, from less than 100,000 baht to more than 5,000,000 baht, did not result in significant differences in Financial Literacy, Digital Financial Literacy, and Effective Financial Planning and Control.

The inferential analysis demonstrates that the average scores for Financial Literacy, Digital Financial Literacy, and Effective Financial Planning and Control are consistent across various business contexts. This suggests that these competencies are uniformly maintained regardless of the business's form, scope, experience, investment, or revenue levels. Consequently, it can be inferred that educational programs and policy initiatives designed to enhance these competencies can be broadly applied without needing significant customization based on business characteristics (see Table 3).

4.3. *Measurement model analysis*

In the research, the constructs of Financial Literacy, Digital Financial Literacy, and Effective Financial Planning and Control were quantitatively measured and validated through the substantial factor loading of observable variables. The Financial Literacy construct comprised observable variables such as Financial Confidence, Financial Decision-making, and Financial Management Skills, with strong factor loadings of 0.924, 0.927, and 0.913, respectively. This construct exhibited high internal consistency with a Cronbach's alpha of 0.911 and impressive composite reliability, evidenced by rho_an at 0.913 and rho_c at 0.944. An Average Variance Extracted (AVE) of 0.849 further confirmed its validity. The Digital Financial Literacy construct included elements like Fintech, Machine Learning in Finance, and Understanding of Cyber Risks, showing robust factor loadings of 0.877, 0.884, and 0.880, a Cronbach's alpha of 0.856, and composite reliability (rho_an at 0.865 and rho_c at 0.912), with an AVE of 0.775. Effective Financial Planning and Control, evaluated through variables such as Operating Activities, Investing Activities, and Financing Activities, demonstrated factor loadings of 0.919, 0.943, and 0.894, a Cronbach's alpha of 0.908, composite reliabilities (rho_an at 0.918 and rho_c at 0.942), and an AVE of 0.845. Collectively, these constructs showed strong reliability and validity in assessing the specified financial dimensions, making them effective tools for this study, as detailed in Table 4.

This study utilized the Fornell-Larcker Criterion and the Heterotrait-Monotrait Ratio (HTMT) to evaluate the discriminant validity of the constructs for Digital Financial Literacy, Effective Financial Planning and Control, and Financial Literacy. According to the Fornell-Larcker Criterion, the square root of each construct's Average Variance Extracted (AVE) must exceed its highest correlation with any other construct. The findings confirmed this requirement, with the square root of the AVE for Digital Financial Literacy (0.880) exceeding its correlations with Effective Financial Planning and Control (0.677) and Financial Literacy (0.646). Additionally, the HTMT analysis further corroborated these results; values below 0.85 suggest adequate discriminant validity. The HTMT ratios for Digital Financial Literacy with Effective Financial Planning and Control (0.758), Digital Financial Literacy with Financial Literacy (0.720), and Effective Financial Planning and Control with Financial Literacy (0.854) all remained below this threshold, confirming the distinctiveness of each construct. Therefore, the measures in this study displayed strong discriminant validity for the evaluated constructs, as detailed in Table 5.

4.4. *Structural Model Analysis*

The research advanced with a detailed analysis using the Partial Least Squares Structural Equation Modeling (PLS-SEM) method to evaluate the proposed hypotheses. This in-depth examination explored the interrelationships and impacts among Financial Literacy, Digital Financial Literacy, and Effective Financial Planning and Control within the sample group. These interconnections and effects are visually depicted in Fig. 2.

Table 3
Comparative analysis of financial literacy, digital financial literacy and effective financial planning and control in different micropreneurs.

General Data	n	*t*-test – f-test for Equality of Means											
		Financial Literacy				Digital Financial Literacy				Effective Financial Planning and Control			
		x̄	σ	t/f	Sig	x̄	σ	t/f	Sig	x̄	σ	t/f	Sig
Business Form													
- Sole Proprietorship	95	3.93	0.77	0.255	0.775	3.44	0.89	0.816	0.444	3.70	0.75	0.577	0.563
- Partnership	14	3.78	0.75			3.34	0.89			3.93	0.60		
- Limited Company	36	3.88	0.72			3.21	0.95			3.73	0.79		
Type of Business													
- Retail Trade	68	3.96	0.79	0.652	0.661	3.37	0.98	0.369	0.869	3.72	0.72	0.411	0.840
- Services and Trans.	24	3.92	0.79			3.46	0.86			3.80	0.79		
- Public Health	6	3.61	1.21			3.17	1.11			3.44	1.15		
- Agriculture	21	3.69	0.68			3.22	0.79			3.63	0.85		
- Manufacturing Ind.	14	3.95	0.41			3.36	0.64			3.86	0.55		
- Information Tech.	12	3.99	0.57			3.60	0.92			3.82	0.68		
Ser. Characteristic													
- In-store	58	3.88	0.68	0.043	0.958	3.24	0.93	1.115	0.331	3.74	0.63	0.596	0.553
- Online	18	3.91	0.88			3.55	0.88			3.55	0.75		
- Both	69	3.92	0.77			3.43	0.88			3.77	0.83		
Scope of Business													
- Domestic	105	3.90	0.07	0.004	0.997	3.36	0.95	−0.319	0.750	3.69	0.73	−1.213	0.227
- Both Domes. & Inter.	40	3.90	0.11			3.41	0.78			3.85	0.78		
Business Experience													
- Less than 1 year	9	4.16	0.73	0.469	0.704	3.77	0.83	1.384	0.250	3.96	0.58	0.339	0.797
– 1–5 years	49	3.85	0.71			3.42	0.95			3.72	0.75		
– 6–10 years	23	3.94	0.69			3.51	0.71			3.76	0.57		
- More than 10 years	64	3.89	0.80			3.22	0.92			3.69	0.82		
Investment (baht)													
- Less than 500,000	65	3.85	0.82	0.206	0.935	3.33	0.94	0.607	0.658	3.56	0.79	1.522	0.199
– 500,001 to 1,000,000	32	3.92	0.66			3.56	0.69			3.85	0.66		
– 1,000,001 to 2,000,000	10	4.06	0.64			3.45	0.96			4.00	0.64		
– 2,000,001 to 3,000,000	6	3.94	0.68			3.36	0.73			3.85	0.56		
- More than 3,000,000	32	3.93	0.73			3.22	1.02			3.84	0.75		
Annual Rev. (baht)													
- Less than 100,000	60	3.88	0.74	0.629	0.643	3.32	0.96	0.258	0.904	3.58	0.74	1.302	0.272
– 100,001 to 500,000	50	3.98	0.62			3.44	0.74			3.85	0.64		
– 500,001 to 1,000,000	16	3.66	1.18			3.46	1.15			3.65	1.13		
– 1,000,001 to 5,000,000	12	3.93	0.71			3.31	1.01			3.92	0.68		
- More than 5,000,000	7	4.07	0.28			3.16	0.79			3.96	0.34		

**Statistically significant at the 0.05 level.

Table 4
Construct reliability and Convergent validity.

Constructs	Observable variables	Factor loading	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Financial Literacy	Financial Confidence Financial Decision Making Financial Management Skills	0.924 0.927 0.913	0.911	0.913	0.944	0.849
Digital Financial Literacy	Fintech Machine Learning in Finance Understanding of Cyber Risks	0.877 0.884 0.880	0.856	0.865	0.912	0.775
Effective Financial Planning and Control	Operating Activities Investing Activities Financing Activities	0.919 0.943 0.894	0.908	0.918	0.942	0.845

The PLS-Bootstrapping analysis was conducted to evaluate the significance and strength of the relationships between the constructs in the conceptual model. The analysis revealed that Financial Literacy significantly influences Digital Financial Literacy, with a path coefficient of 10.682, and Effective Financial Planning and Control, with a path coefficient of 8.806, indicating robust relationships. Additionally, Digital Financial Literacy positively impacts Effective Financial Planning and Control, with a path coefficient of 4.171. These path coefficients reflect the unstandardized estimates of the relationships, indicating their magnitude and statistical significance within the model.

In the context of Fig. 3, the values adjacent to the observed variables represent the contribution of each indicator to its respective latent construct, often referred to as their relative weights or contributions in the PLS-SEM framework. For Financial Literacy, Financial Confidence

Table 5
Discriminant validity.

Constructs	Fornell-Larcker Criterion			Heterotrait-Monotrait Ratio (HTMT)		
	Digital Financial Literacy	Effective Financial Planning and Control	Financial Literacy	Digital Financial Literacy	Effective Financial Planning and Control	Financial Literacy
Digital Financial Literacy	0.880					
Effective Financial Planning and Control	0.677	0.919		0.758		
Financial Literacy	0.646	0.785	0.921	0.720	0.854	

Note: Diagonal values in the Fornell-Larcker Criterion columns represent the square root of AVE for each construct, while off-diagonal values represent the correlations between constructs. HTMT values assess discriminant validity by evaluating the relationship between constructs to ensure they are conceptually distinct.

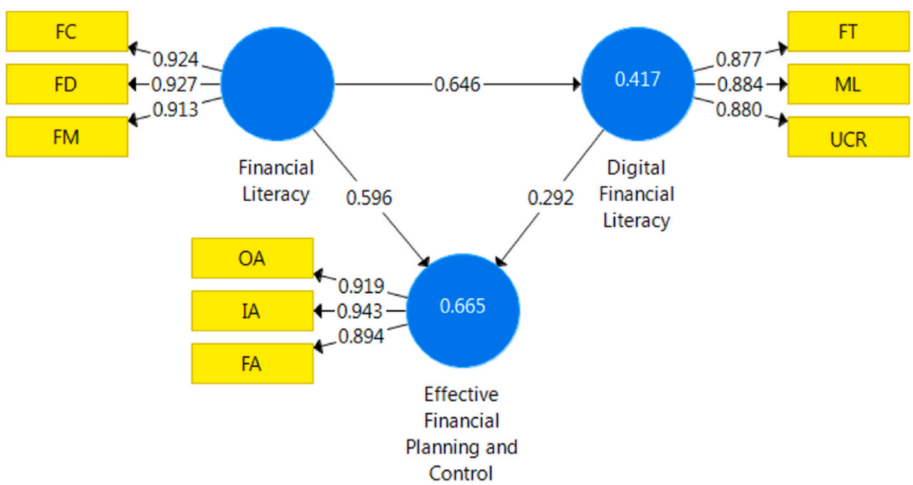

Fig. 2. The structural model.
Note: The acronyms in the figure represent the following: FC (Financial Confidence), FD (Financial Decision Making), FM (Financial Management Skills), FT (Fintech), ML (Machine Learning in Finance), UCR (Understanding of Cyber Risks), OA (Operating Activities), IA (Investing Activities), and FA (Financing Activities).

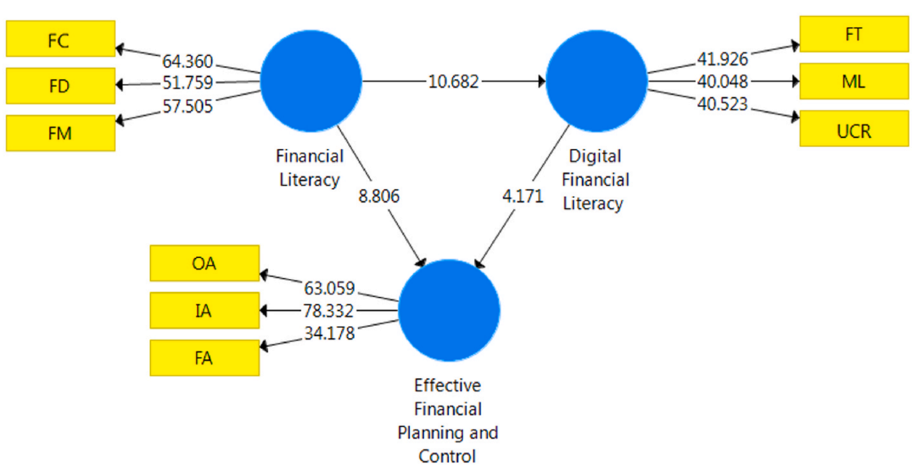

Fig. 3. PLS-bootstrapping.
Note: The acronyms in the figure represent the following: FC (Financial Confidence), FD (Financial Decision Making), FM (Financial Management Skills), FT (Fintech), ML (Machine Learning in Finance), UCR (Understanding of Cyber Risks), OA (Operating Activities), IA (Investing Activities), and FA (Financing Activities).

(64.360), Financial Decision Making (51.759), and Financial Management Skills (57.505) exhibited high contributions, highlighting their importance within the construct. Similarly, Digital Financial Literacy was characterized by contributions from Knowledge of Fintech (41.926), Knowledge of Machine Learning in Finance (40.048), and Understanding of Cyber Risks (40.523). For Effective Financial Planning and Control, Operating Activities (63.059), Investing Activities (78.332), and Financing Activities (34.178) emerged as key contributors.

It is important to note that these values do not represent standardized factor loadings, as factor loadings typically range between 0 and 1. Instead, they indicate the scale and influence of each indicator within the specific PLS-SEM model used in the study. The observed high values stem from the unstandardized nature of the model and reflect the relative importance of each indicator in shaping the latent constructs. The findings support the hypothesized relationships between the constructs. Financial Literacy significantly influences both Digital Financial Literacy and Effective Financial Planning and Control, underscoring the pivotal role of financial education in enhancing digital competencies and financial management capabilities. Digital Financial Literacy also significantly impacts Effective Financial Planning and Control, highlighting the importance of technological knowledge in managing financial operations effectively.

The PLS-Bootstrapping analysis and the visual representation in Fig. 3 confirm the robustness of the theoretical framework and hypotheses of the study. These findings emphasize the need for targeted interventions to enhance both financial and digital literacy among micropreneurs in Thailand to improve their financial planning and control practices, thereby fostering sustainable business success.

The analysis yielded significant insights into the relationships explored through hypothesis testing. Firstly, Hypothesis 1 (H1) verified a positive correlation between 'Digital Financial Literacy' and 'Effective Financial Planning and Control,' as demonstrated by a path coefficient of 0.292 (t-Statistic $= 4.151$, $p < 0.000$). This finding underscores the importance of digital financial literacy in enhancing effective financial planning and control. As digital tools become increasingly integral to financial management, micropreneurs who possess strong digital financial skills can better manage their business operations, leading to improved financial planning and control. This aligns with previous studies that emphasize the role of digital literacy in business efficiency and sustainability (Moenjak et al., 2020).

Hypothesis 2 (H2) identified a strong positive relationship between 'Financial Literacy' and 'Digital Financial Literacy,' supported by a path coefficient of 0.646 (t-Statistic $= 10.618$, $p < 0.000$). This significant relationship suggests that a solid foundation in financial literacy directly enhances an individual's digital financial literacy. Micropreneurs with higher financial literacy levels are more likely to effectively utilize digital financial tools and platforms, which can lead to better financial outcomes. This finding highlights the need for comprehensive financial education programs that integrate digital financial literacy components, ensuring that micropreneurs are well-equipped to navigate the digital financial landscape.

Moreover, Hypothesis 3 (H3) confirmed a robust positive association between 'Financial Literacy' and 'Effective Financial Planning and Control,' with a path coefficient of 0.785 (t-Statistic $= 20.581$, $p < 0.000$). This robust relationship indicates that financial literacy is a critical factor in achieving effective financial planning and control. Micropreneurs with a strong understanding of financial concepts and principles are better positioned to manage their financial resources efficiently, leading to improved business performance. This finding is consistent with previous research that emphasizes the importance of financial literacy in business success (Agarwal et al., 2015).

Collectively, these results provide robust evidence supporting the critical role of financial and digital financial literacy in enhancing effective financial planning and control among Thai micropreneurs. The significant relationships identified in this study suggest that enhancing financial literacy can lead to improvements in digital financial literacy, which in turn contributes to more effective financial planning and control. In conclusion, the findings from this study underscore the importance of financial and digital financial literacy in achieving effective financial planning and control. By enhancing these competencies, micropreneurs can improve their financial management practices, leading to better business outcomes and contributing to the overall economic growth of Thailand.

4.5. Mediation analysis

The analysis also revealed crucial insights into the indirect influence of financial literacy on effective financial planning and control, mediated by digital financial literacy. The path coefficient for this indirect effect was recorded at 0.194 ($p < 0.001$), signifying a substantial positive relationship. These findings imply that enhancing financial literacy could indirectly bolster effective financial planning and control through improvements in digital financial literacy. The statistical significance of this indirect effect was corroborated by a t-statistic of 3.626. This mediation effect is categorized as partial mediation, indicating that while digital financial literacy significantly mediates the relationship between financial literacy and effective financial planning and control, financial literacy also has a direct impact on effective financial planning and control.

The identification of partial mediation in this study is particularly noteworthy. It suggests that digital financial literacy enhances the capacity for effective financial planning and control but does not fully account for the influence of financial literacy on these outcomes. This highlights that while digital tools and knowledge are essential, foundational financial literacy remains crucial. Micropreneurs benefit not only from understanding digital financial systems but also from having a strong base in traditional financial literacy, which directly impacts their ability to manage financial planning and control effectively, as shown in Table 6.

These results robustly support the critical role of digital financial literacy as a mediating factor in the relationship between financial literacy and effective financial planning and control (see Table 7). The dual impact of financial literacy—both direct and mediated through digital literacy—underlines the importance of comprehensive educational programs that address both aspects. By focusing on improving financial literacy, micropreneurs can gain the foundational knowledge necessary to navigate financial challenges, while digital financial literacy equips them with modern tools and techniques to enhance their financial management practices. In conclusion, the findings from this mediation analysis reinforce the significant role that both financial literacy and digital financial literacy play in effective financial planning and control. By enhancing both areas, micropreneurs can improve their financial management capabilities, ultimately leading to better business outcomes and contributing to the economic development of Thailand.

5. Discussion

The central aim of this study was to investigate the influence of financial literacy, digital financial literacy, and efficacious financial planning and control on the ability of Thai microentrepreneurs to thrive in their respective businesses. More specifically, the study endeavored to establish a foundation for educational programs and policy support, targeting the utilization of digital finance. This foundation is intended to furnish microentrepreneurs, academics, and policy advocates with pertinent discussions and findings that could contribute to the evolution of digital finance in Thailand. Within the literature, financial literacy is often perceived as being insufficient, primarily due to its inherent complexity and the challenges associated with comprehending it (Grohmann, 2018). Concurrently, there is a noticeable shift toward

Table 6
Direct effect.

Hypotheses	Effect	Path coefficients	t-Statistic	p-Value	Results
H1	Digital Financial Literacy - > Effective Financial Planning and Control	0.292**	4.151	0.000	Supported
H2	Financial Literacy - > Digital Financial Literacy	0.646**	10.618	0.000	Supported
H3	Financial Literacy - > Effective Financial Planning and Control	0.785**	20.581	0.000	Supported

Note: **Significant at 0.01.

Table 7
Indirect effect.

Effect	Path coefficients	t-Statistic	p-Value
Financial Literacy - > Digital Financial Literacy - > Effective Financial Planning and Control	0.194**	3.626	0.000

Note: **Significant at 0.01.

online platforms for financial communication and transactions, a trend that has been documented by Moenjak et al. (2020). In the context of Thailand, this trend is manifesting in the form of substantial advancements and unprecedented growth within the realm of digital financial services. The study's results necessitate an examination of three distinct, yet interconnected, concepts that have emerged from the findings.

5.1. financial literacy and digital financial literacy

Hypothesis One (H1) examined the relationship between 'financial literacy' and 'digital financial literacy.' Analyzing the data from the study, a path coefficient of 0.646 was disclosed, manifesting a strong positive correlation between these two variables. The statistical robustness of this relationship was further corroborated by a t-statistic of 10.618 and a p-value of less than 0.000, thereby reinforcing the statistical significance of this conclusion. Consequently, Hypothesis H1 was accepted. In this study, 'financial literacy' refers to the ability to understand and implement multifaceted financial concepts such as personal finance management, budgeting, and investing. 'Digital financial literacy,' on the other hand, is associated with the comprehension and application of these financial principles in digital contexts and encompasses the ability to deploy such literacy and acumen to execute high-quality financial decisions, including managing finances, saving, investing, insuring, and planning for future finances (Klapper et al., 2015). It also involves proficiency in using and comprehending digital financial tools and services. The study unveiled a distinct positive correlation between financial literacy and digital financial literacy, substantiating that an elevated level of financial literacy can foster digital financial literacy. This finding is congruent with previous research illustrating that financial literacy and digital knowledge positively impact the intention to initiate an online business, while digital knowledge also exerts a peripheral influence on this intention (Bayrakdaroğlu & Bayrakdaroğlu, 2017).

These first results hold substantial implications for micropreneurs who are heavily reliant on digital financial services and tools for managing their ventures. Consequently, the enhancement of financial literacy contributes to a more profound understanding and adept utilization of digital financial services and tools, thereby aiding in informed decision-making and efficient fiscal management (Hermawan et al., 2022). This emphasizes the indispensable role of financial education in fostering digital financial literacy. Policymakers and financial educators should underscore the cultivation and evolution of financial literacy as an integral stride towards understanding the requisite digital financial systems for micropreneurial activities. Endeavors should concentrate on elucidating the procedures for procuring financial literacy sources, orchestrating seminars, or training programs, or incorporating digital financial education content into extant learning platforms. For Thai micropreneurs, who grapple with rudimentary financial terminology and possess limited financial literacy confined to specific financial activities (Topimin & Hashim, 2020), this study solidifies the understanding that financial literacy and digital financial literacy maintain a direct and persistent correlation. This reiterates the necessity for a comprehensive development of both financial and digital financial literacy to stimulate efficacious financial management at the micropreneurial level.

5.2. Financial literacy and effective financial planning and control

The second hypothesis (H2) explored the interconnection between financial literacy and the practice of effective financial planning and control. The study obtained a path coefficient of 0.732, signifying a substantial positive correlation between these two variables. The corresponding t-statistic for this relationship was 12.214, with a p-value less than 0.000, conferring the conclusion with robust statistical authenticity. As a result, Hypothesis H2 was endorsed. Within the study's framework, effective financial planning and control pertain to the proficient employment of relevant financial literacy and tools for efficiently managing and controlling a business. Micropreneurs with advanced financial literacy often manifest superior financial strategies and exhibit more comprehensive financial operations and control (Agarwal et al., 2015). This study unraveled an unequivocal positive correlation between financial literacy and effective financial planning and control. That is, an enhanced level of financial literacy can foster more efficient financial planning and control. By deciphering the intricacies of complex financial literacy, opportunities for devising future financial strategies increase. Therefore, policies aimed at boosting financial comprehension may prove efficacious in inspiring individuals to ponder and plan for their financial future more judiciously (Arrondel et al., 2014).

These results bear profound significance for micropreneurs as the development of financial literacy may culminate in more adept financial planning and control, thus positively influencing business performance. Businesses that exhibit a high level of financial literacy often have well-articulated business plans and demonstrate superior financial management compared to businesses with lower levels of financial literacy (Utami et al., 2021). This outcome underscores the critical role of learning and enhancing financial literacy in the domain of micropreneurship. Micropreneurs should comprehend the importance of accruing financial literacy and concentrate on cultivating this knowledge to build sustainable and competitive ventures. Analyzing the context of Thai micropreneurs, this research corroborates that financial literacy maintains a direct relationship with effective financial planning and control. Sound financial literacy empowers micropreneurs to devise financial plans and execute financial control effectively, thereby enhancing the quality of micropreneurs' professional practices (Engström & McKelvie, 2017), leading to improved business performance.

5.3. digital financial literacy and effective financial planning and control

The third hypothesis (H3) delved into the association between digital financial literacy and the execution of proficient financial planning and control. The empirical evidence substantiated a statistically salient positive correlation between these variables, evinced by a path coefficient of 0.602 and a t-statistic of 9.119 for this interrelation, along with a p-value less than 0.000, which imparts undeniable statistical authenticity to the conclusion. Consequently, Hypothesis H3 was upheld. Proficient financial planning and control denote the deployment of suitable digital financial literacy and digital financial instruments for effectively steering and controlling a business. This competency emerges as a vital determinant of business success, particularly for smaller-scale enterprises, or so-called Micropreneurs (Mengel & Wouters, 2015). The study's results illuminate a robust positive correlation between digital financial literacy and proficient financial planning and control, implying that an elevated level of digital financial literacy can stimulate proficient financial planning and control. The incorporation of cutting-edge technology into business practices not only confers a competitive edge but also ensures longevity by enabling a flexible adaptation of existing business models (Akpan et al., 2021).

These results are essential for micropreneurial entrepreneurs by bolstering digital financial literacy, fostering a broader understanding of multifaceted scenarios, and stimulating fresh perspectives and directions for profound comprehension among these entrepreneurs (Marín & Castaneda, 2023). This can culminate in more efficient financial planning and control, thereby exerting a positive influence on business performance. Moreover, the outcome emphasizes the importance of learning and augmenting digital financial literacy to construct sustainable and competitive businesses.

5.4. Practical recommendations

To support the development of micropreneurs, it is essential to implement comprehensive educational programs that integrate both traditional financial literacy and digital financial literacy training. These programs should be designed to equip micropreneurs with the necessary skills to manage their finances effectively using modern digital tools. By focusing on these dual aspects of financial education, micropreneurs can become more adept at navigating the complexities of financial management in today's digital age.

In addition to educational programs, policymakers should consider implementing initiatives that promote financial and digital literacy among micropreneurs. Such initiatives could include providing subsidies for financial education programs, offering incentives for the adoption of digital tools, and supporting continuous learning and development. These measures would help ensure that micropreneurs have access to the resources and knowledge they need to succeed in a competitive business environment.

5.5. Theoretical contributions

This study makes a significant contribution to the existing literature by developing a conceptual framework that links financial literacy, digital financial literacy, and effective financial planning and control. This framework provides a structured understanding of how these elements interact to influence the financial management practices of micropreneurs. Future researchers are encouraged to build on this framework, exploring similar relationships in different contexts or regions to validate and expand its applicability.

Moreover, the study's mediation analysis reveals that digital financial literacy partially mediates the relationship between financial literacy and effective financial planning and control. This finding offers a nuanced understanding of how these competencies interact and influence one another. It suggests that while digital financial literacy plays a crucial role, foundational financial literacy remains essential. Researchers are encouraged to further investigate the mediating roles of other factors in financial management, which could provide deeper insights into the complex dynamics at play.

5.5.1. Limitations and future research directions

This study provides valuable insights into the interplay between financial literacy, digital financial literacy, and effective financial planning and control among Thai micropreneurs. However, there are several limitations that should be acknowledged to enhance the transparency and academic rigor of the research.

5.5.1.1. Limitations. First, the study employed a cross-sectional research design, which limits the ability to establish causal relationships between variables. While the findings demonstrate significant associations, longitudinal research is needed to observe how these relationships develop over time. Second, the study relied on self-reported questionnaires for data collection. This approach may introduce potential biases such as social desirability bias or recall bias, which could affect the accuracy of the responses. Incorporating alternative data collection methods, such as interviews or behavioral observation, could provide a more robust validation of the findings. Third, the research was conducted with a sample of 145 micropreneurs in Thailand, focusing on specific geographic and economic contexts. The limited sample size may constrain the generalizability of the results to other regions or business scales. Future studies could include larger and more diverse samples to enhance the external validity of the findings. Finally, the study utilized Partial Least Squares Structural Equation Modeling (PLS-SEM) for data analysis, which is appropriate for exploratory research but may not capture the nuances of more complex or higher-order constructs. Future studies could employ alternative statistical techniques, such as covariance-based SEM, to validate the proposed relationships.

5.5.1.2. Future research directions. Future research should consider conducting longitudinal studies to examine how financial and digital financial literacy evolve over time and their long-term impact on business success. Expanding the research scope to include diverse geographic, cultural, and economic contexts would offer a more comprehensive understanding of the relationships explored in this study. Additionally, investigating the role of emerging technologies, such as artificial intelligence, blockchain, and digital currencies, in shaping financial literacy and planning practices is recommended. These advancements may introduce new dimensions to financial management and decision-making. Moreover, future studies could explore the integration of financial literacy programs tailored to the needs of micropreneurs, assessing their effectiveness in improving both financial competencies and business outcomes. By addressing these gaps, future research can provide actionable insights that enhance the financial resilience and sustainability of microenterprises. By acknowledging these limitations and exploring future directions, this study highlights the critical importance of financial and digital literacy for effective financial management. These competencies are not only essential for improving business performance but also contribute to the broader economic development of Thailand.

6. Conclusion

This study explored the relationships between financial literacy, digital financial literacy, and effective financial planning and control among Thai micropreneurs, highlighting the critical role these factors play in enhancing financial management practices. The analysis confirmed a strong positive influence between financial literacy and digital financial literacy, suggesting that micropreneurs with higher levels of financial literacy are better equipped to utilize digital financial tools and platforms effectively. This ability to leverage digital resources is crucial in the modern business environment, where digital proficiency can significantly impact business success.

Additionally, the study found a robust positive influence between financial literacy and effective financial planning and control. Micropreneurs who have a solid understanding of financial concepts are able to develop superior financial strategies and manage their business operations more effectively. This underscores the importance of foundational financial knowledge in maintaining and growing a business. Moreover, a significant positive influence was identified between digital financial literacy and effective financial planning and control. This finding highlights the importance of digital skills in contemporary financial management, enabling micropreneurs to enhance their business efficiency through better financial planning and control. The mediation analysis further revealed that digital financial literacy partially mediates the relationship between financial literacy and effective financial planning and control. This indicates that while digital financial literacy is essential, a strong foundation in financial literacy remains crucial for effective financial management. Therefore, both traditional and digital financial literacy are vital for the success of micropreneurs in Thailand.

CRediT authorship contribution statement

Narinthon Imjai: Writing – original draft, Visualization, Software, Methodology, Formal analysis, Conceptualization. **Kanokwan Meesook:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Phiphop Somwethee:** Writing – review & editing, Visualization, Resources, Investigation. **Berto Usman:** Writing – review & editing, Visualization, Investigation, Formal analysis. **Somnuk Aujirapongpan:** Writing – review & editing, Writing – original draft, Validation, Resources, Methodology, Investigation, Formal analysis, Conceptualization.

Data availability

Data generated or analyzed during this study are available from the authors on request.

Funding

The authors received no financial support for the research and/or authorship of this article.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

Kanokwan Meesook is a co-first author of this article.

Appendix A

Questionnaire items

These questions are about yourself and how you see yourself in relation to your feelings at this moment: (1 = Strongly disagree/2 = Somewhat disagree/3 = Neither agree nor disagree/4 = Somewhat agree/5 = Strongly agree)

Financial Literacy

Financial Confidence

1. You possess the knowledge and confidence to effectively manage the financial operations of your business independently.
2. You are knowledgeable and confident in learning and applying financial tasks within your business, such as performing tasks independently, understanding financial systems, and ensuring accuracy.

Financial Decision Making

1 You are capable of identifying and resolving financial issues in your business promptly.
2. You can make informed decisions and manage your business's cash flow to maintain liquidity effectively.

Financial Management Skills

1. You understand and can plan the financial future of your business.
2. You possess the knowledge and ability to control your business expenses efficiently.

Digital Financial Literacy

Fintech

1. You are knowledgeable and capable of integrating financial technologies (Fintech) into your business operations effectively, such as banking technology or payment systems.
2. You are confident in your ability to leverage financial technologies (Fintech) to enhance the efficiency of your business management.

Machine Learning in Finance

1 You have experience and confidence in using automated financial tools or programs, such as AI-powered calculators, for making financial decisions in your business.
2 You can use automated financial tools or AI-powered programs to improve the efficiency of your business's financial management.

Understanding of Cyber Risks

1 You have the knowledge and capability to address financial disruptions or cyber risks that may arise in your business operations.
2. You have developed plans to mitigate and address financial disruptions or cyber risks effectively in your business.

Effective Financial Planning and Control

Operating Activities

1. Your business has an efficient system for managing cash flow, ensuring liquidity, and supporting operations effectively.
2. Your business has clear plans for managing and controlling income and expenses to achieve targeted profitability.
3 Your business implements effective procurement and inventory management systems, minimizing waste and reducing costs.

Investing Activities

1 Your business has strategies to manage receivables effectively, ensuring minimal bad debts.
2 Your business consistently achieves the profitability targets it sets.
3 Your business plans investments in infrastructure, equipment, or technology that align with customer demands and needs effectively.

Financing Activities

1 Your business utilizes assets or technologies that have been invested in, ensuring maximum value and efficiency.
2 Your business plans and secures funding sources, including loans, quickly and cost-effectively.
3 Your business has plans and strategies in place to pay interest to creditors or distribute dividends efficiently to stakeholders or partners.

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