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The interplay of digital and management accounting competency to competitive performance in the open innovation era: A case of Thai micropreneurs

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ABSTRACT

Today's digital age requires entrepreneurs to effectively use technology and finance, especially micro-entrepreneurs, who are a cornerstone of many Asian economies, including Thailand. However, a conspicuous void exists in scholarly research pertaining to the dynamic interaction between digital proficiency and accounting expertise within this demographic. This study, hence, sought to bridge this gap by examining the relationships between digital competency (DC), management accounting competency (MAC), and competitive performance (CP) among Thai microentrepreneurs. Using a sample of 151 participants, our findings were both significant and revealing: Digital competency had a pronounced direct effect on management accounting competency, with a path coefficient of 0.798 ($p < 0.01$). Similarly, digital competency directly influenced competitive performance, evidenced by a path coefficient of 0.742 ($p < 0.01$). Management accounting competency also showed a direct relationship with competitive performance, registering a path coefficient of 0.462 ($p < 0.01$). Importantly, there was an indirect relationship where digital competency influenced competitive performance through the mediation of management accounting competency, indicated by a path coefficient of 0.368 ($p < 0.01$). These findings hold substantial implications for educational institutions and policymakers, emphasizing the imperative of integrating comprehensive digital and accounting training within curricular frameworks and entrepreneurial development programs.

Introduction

In the rapidly evolving digital landscape, adept utilization of technology and digital sciences has become indispensable for businesses, particularly for micropreneurs who frequently grapple with the necessity of embracing technological advancements (Kraus et al., 2022). Digital data and technology carry weight not only within the information technology sector but also bear notable significance for micropreneurs, particularly concerning the essential facet of organizational management: management accounting competency (Lutfi et al., 2022). However, the paradox lies in the essentiality of micropreneurs excelling as competitive players in the business arena. Therefore, nurturing digital proficiencies and enhancing management accounting skills stand as

pivotal prerequisites for attaining competitive efficacy in the field of micropreneurship.

Digital competency entails the mastery of using digital technologies and tools within business operations, with a pivotal facet being digital accounting management, a decisive factor in the success of small-scale enterprises (Falloon, 2020). Possessing digital accounting management skills and knowledge empowers micropreneurs to enhance their competitive prowess, a critical competence for achieving business success (Perifanis and Kitsios, 2023). The strategic development of digital competency and management accounting proficiency thus leads to tangible improvements in competitive performance outcomes. However, a research gap exists in this domain, especially within the Thai context, presenting an opportune moment to investigate the influence of digital

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competencies on management accounting capabilities and the competitive performance of micropreneurs in Thailand (Ditkaew, 2023).

Prior research has explored the correlation between digital capabilities and managerial accounting competencies (Huu, 2023), as well as the connection between digital capabilities and outcomes related to competitive performance (Garini and Muafi, 2023). Nonetheless, certain inquiries remain unanswered, particularly regarding the intricate interplay among digital capabilities, managerial accounting competencies, and competitive performance outcomes (Busulwa et al., 2022). Furthermore, the significance of managerial accounting competencies in enhancing business capabilities, particularly in fostering competitive performance outcomes, is evident (Wanasida et al., 2021). Accordingly, this study aims to bridge gaps in the existing literature by investigating the nexus of these three variables within the context of small enterprises in Thailand. The primary focus of this study lies in discerning the impact of digital capabilities on managerial accounting proficiencies and achievements in competitive performance (Gerasimenko and Razu-mova, 2020). The anticipated outcome is that the findings will empower Thai micropreneurs to leverage their digital strengths to enhance both managerial accounting competencies and competitive performance outcomes.

The central research query poses the question: How do digital capabilities, managerial accounting competencies, and competitive performance outcomes interrelate in the specific context of Thai micropreneurs? Drawing from the intricate connections among these factors, our hypotheses propose:

- (1) a positive impact of digital capabilities on managerial accounting competencies
- (2) a positive influence of digital capabilities on competitive performance outcomes
- (3) a positive effect of managerial accounting competencies on competitive performance outcomes.

Insights into these relationships hold the potential to equip small business owners with the means to elevate their competitive advantage and operational efficiency.

Literature review

The examination of how digital capabilities impact both managerial accounting skills and competitive performance reveals varying perspectives on the nexus of digital capabilities and accounting management, with numerous unexplored dimensions. Furthermore, there is limited research that specifically investigates the use of technology and accounting management to enhance competitive capabilities among micropreneurs (Erstad et al., 2021; Ylä-Kujala et al., 2023). This research gap contributes to an incomplete understanding of the intricate business landscape (Gisbert and Bullen, 2015). Acknowledging this research void, the present study undertakes a comprehensive literature review that encompasses the intricate interplay between digital capabilities and accounting management. It seeks to uncover the areas within this relationship that have not yet been thoroughly examined. Additionally, the study addresses the relatively uncharted territory of how technological innovation and accounting management can be harnessed to foster competitive capabilities among micropreneurs.

Digital competency

In today's academic and business landscape, digital competency has gained substantial prominence, making it essential to comprehensively grasp its implications for competition among micropreneurs (Koyuncuoglu, 2022). This competence entails the adept utilization, understanding, and creative generation of digital information, yet a coherent understanding of its essence remains a challenge. Within the business sphere, digital competency encompasses the skill set required to

effectively employ technology for improved operational outcomes (Perifanou and Economides, 2019). Amplifying digital competency within micropreneurs can usher in heightened business achievements, enabling seamless adaptation to technological shifts, the establishment of tech leadership, and the enhancement of operational efficiency (Saarikko et al., 2020). In open innovation, where collaboration and the unhindered exchange of ideas are paramount, digital competency assumes even greater importance. For service-oriented businesses, it translates into leveraging digital platforms to enhance customer engagement, obtain real-time feedback, and enable agile service delivery. For those engaged in product sales, it means efficient e-commerce operations, data-driven inventory management, and the application of predictive market analytics. Proficiency in navigating and effectively utilizing the digital domain can significantly influence a micropreneur's competitive edge within an open innovation ecosystem (Scuotto et al., 2021). Nonetheless, it is worth noting that relying solely on digital competency may not suffice for small businesses to thrive competitively. One plausible explanation lies in the complexities associated with managing digital resources, particularly in the domain of accounting (Blackburn et al., 2020). Consequently, an in-depth exploration of digital competency within the context of micropreneurs becomes imperative, necessitating extensive research efforts and dedicated inquiry (Scuotto et al., 2021).

Digital competency extends beyond technical proficiency and encompasses diverse aspects of both daily life and work-related interactions in the digital realm (Ilomäki et al., 2011). Synthesizing insights from existing literature, this study distills the fundamental components of digital competency into the following categories:

- 1) *Digital Tools* encompass the skillful utilization of essential technologies and relevant applications in both professional and personal contexts (Hinds, 2019). Within small businesses, adept use of these tools can notably enhance productivity and operational efficiency (Bagale et al., 2021).
- 2) *Digital Creativity* involves leveraging technology to foster innovative thinking and creation (Selfa-Sastre et al., 2022), enabling businesses to remain adaptable and responsive in dynamic situations (Travkina and Sacco, 2020).
- 3) *Digital Communication* emerges as a cornerstone in the digital era (Nagl, 2023), and for businesses, effective digital communication can expedite responses and streamline interactions (Pascucci et al., 2023).
- 4) *Digital Collaboration* is an essential skill for contemporary enterprises, denoting collaborative endeavors within digital platforms (Kwiatkowska and Wiśniewska-Nogaj, 2022). The capability to collaborate seamlessly through digital channels holds the potential to enhance team efficiency and open innovation effectiveness (Antikainen et al., 2010; Tønnessen et al., 2021).
- 5) *Digital Life* signifies the integration of digital usage into everyday routines, substantially shaping overall digital competency (Hoehe and Thibaut, 2022). Acknowledging the functional and transformative aspects of technology within daily life contributes to the development of proficient tech-related skills and knowledge (Beer and Mulder, 2020).

Management accounting competency

The rapidly changing business world requires finance and accounting professionals to acquire new skills for successful performance. The ICMA (Institute of Certified Management Accountants) has identified and summarized essential competencies for management accountants, which encompass six domains:

- (1) Strategy, Planning, and Performance (competence in envisioning the future, strategizing, decision-making, risk management, and performance monitoring)

- (2) Reporting and Control (measuring and reporting work outcomes in compliance with relevant standards and regulations)
- (3) Technology and Analytics (managing technology and analyzing data to support organizational success)
- (4) Business Acumen and Operations (adapting and operating according to the circumstances and needs of the business)
- (5) Leadership (competence in collaborating with others, inspiring motivation, and developing teams to achieve organizational goals)
- (6) Ethics and Professional Values (the importance of professional ethics, adherence to the law, and promoting the values of the profession for sustainable business operations)

Each of these six domains signifies a fusion of indispensable knowledge, skills, and abilities imperative for contemporary digital-age finance and accounting professionals. These competencies hold paramount importance for present and future professional accomplishments. Moreover, they serve as a roadmap for skill evaluation, professional growth, and the adept management of capabilities within the realm of management accounting (Wasawanawat, 2022).

Micropreneurs, typically operating solo in small-scale entrepreneurial endeavors, assume multifaceted roles. Possessing adept management accounting competencies empowers them to utilize financial insights for bolstering decision-making, planning, and business control, while also enabling more effective monitoring and assessment of performance (Thitiyapramote, 2021). These competencies encompass pivotal abilities, such as comprehending financial reports. By exploring these reports, micropreneurs can evaluate their business's financial well-being, thus fostering refined financial planning (Loth, 2023). Proficiency in budget preparation and management enables micropreneurs to grasp their business's fiscal capacity, paving the way for enhanced future planning (Posner et al., 2009). Those who possess the skill to strategize and regulate their business activities are better positioned for success in the expansion and advancement of their ventures (Wennberg, 2013). The capability to dissect and make informed financial decisions empowers micropreneurs to define meticulous financial objectives, elevating their confidence in business operations (Tuovila, 2023). Additionally, the competence to monitor and gauge business performance equips micropreneurs to refine strategies and adeptly respond to evolving market dynamics (Jackson, 2023).

Competence in management accounting is considered a key factor influencing the success and sustainability of micropreneurs (Olarewaju and Msomi, 2021). Emphasizing the enhancement of these accounting competencies within an organization can aid in improving business operational efficiency (Ojra et al., 2021). Management accounting competencies are specific functional attributes encompassing accounting tasks, financial planning, financial control, and performance evaluation (Grozdanovska et al., 2017). Employing appropriate financial techniques and tools to manage these tasks can help micropreneurs make efficient decisions and adapt to changes in the business environment (Ma et al., 2022). The ability to swiftly execute financial functions, especially under conditions of limited financial resources, holds paramount importance for micropreneurs (Husin and Ibrahim, 2014). Conversely, an inability to effectively bolster these accounting competencies might lead to unsuitable financial decisions, unpredictability in financial decision outcomes, or inefficient financial resource planning (Frydman and Camerer, 2016). Thus, delving into a literature review concerning management accounting competencies furnishes insights into the factors influencing micropreneur efficiency and outlines pathways for honing skills to attain heightened business triumph. This study distills the essential elements of management accounting competencies as follows:

- (1) *Planning and Control Skills*: Proficiency in planning and control is integral to management accounting competencies, encompassing setting financial goals and resource allocation for clear business

direction (Huang and Huang, 2019). Effective financial control aids progress monitoring and issue identification (Hall, 2023).

- (2) *Communication Skills*: Clear and timely communication of financial information is vital to assure stakeholders of efficient operations, reducing conflicts and misunderstandings while fostering mutual understanding and business growth (Jeffery, 2009; Ariguzoh, 2022).
- (3) *Tools and Technology*: In an era of rapid technological advancement, utilizing appropriate tools and technology for accounting management, such as accounting software, financial planning systems, and data analysis tools, is increasingly crucial. Technology leverage enhances accounting process efficiency, reduces errors, and elevates financial decision accuracy (Quinto & Emmanuel, 2022).

Competitive performance

Attaining competitive excellence stands as a paramount objective for micropreneurs who aspire to establish a distinctive presence within the highly competitive market landscape (Nenzhelele, 2014). The assessment of competitive effectiveness encompasses a wide array of metrics, including market share, growth rate, and customer satisfaction levels (Mittal et al., 2023). A substantial market share serves as a positive indicator of competitive performance (March, 2023), signifying the market's endorsement of the business's offerings. Equally pivotal is the maintenance of a consistent growth trajectory; sustained expansion and increased sales underscore robust competitive capabilities (Pratono et al., 2019). Furthermore, rapid growth compared to competitors can enable smaller businesses to penetrate new markets and yield prompt financial returns. Customer satisfaction also holds paramount importance as a measure of competitive performance. Companies capable of satisfying and fostering customer loyalty tend to retain and foster this loyalty over the long term (Leninkumar, 2017).

When considering the competitive performance of micropreneurs equipped with digital capabilities and managerial accounting competencies, a range of factors come into play, prominently including amplified sales, heightened customer satisfaction, and bolstered business profitability (Hasbolah et al., 2021). Digital and accounting competencies serve as reliable catalysts for sustaining sales growth, where micropreneurs adept in managerial accounting exhibit an upward trajectory in sales compared to their counterparts lacking this skill (Drydakis, 2022). The strategic utilization of these competencies in perpetually enhancing products or services translates to augmented customer satisfaction, nurturing enduring transactions and deeper client commitment. Micropreneurs harnessing digital and accounting prowess for continuous enhancements are poised to enhance overall customer contentment (El Nashar, 2015). By astutely managing financial risks, identifying fresh opportunities through risk assessment, and venturing into new business avenues, micropreneurs can substantially amplify their business profits (Boukheroua et al., 2021). This study encapsulates the pivotal components that underpin competitive performance, as follows:

- (1) *Unique Innovations*: Introducing novel and unprecedented innovations can engender confusion, disrupt forecasting, and introduce an aura of uncertainty among competitors. This dynamic provides pioneering businesses with a sustained competitive advantage over the long term (Rakangthong et al., 2023). However, the essence of innovation extends beyond individual, organizational, or societal value creation (Adner and Kapoor, 2010). Its ultimate purpose should transcend, contributing to the creation of a brighter future where people can embrace the highest quality of life (Lee and Trimi, 2018).
- (2) *Technological Advancement*: The flux of technological changes emerges as another potent driver of competitive prowess for micropreneurs. Harnessing contemporary technology equips

businesses to manage operations with precision and reduce overhead costs (Radčić and Petković, 2023).

- (3) *Customer Satisfaction*: A cornerstone in establishing and perpetuating competitive efficacy resides in customer satisfaction. Businesses that deliver exceptional customer service cultivate loyalty and foster robust customer commitment, facilitating the retention of existing customers while attracting new ones (Szyndlar, 2023).

Digital competency and management accounting competency

Digital proficiency and adept management accounting skills stand as imperatives for the competitive edge of micropreneurs. This capability is especially vital for those who can seamlessly integrate digital technology into their business operations in the open innovation era, empowering them to skilfully manage and analyse data, thereby facilitating swift and efficient decision-making (Bharadwaj et al., 2013; Lin, 2023). The astute utilization of digital competencies to manage and scrutinize data equips micropreneurs with the capability to deeply comprehend financial and market information, thereby tailoring products or services to align with customer and market requisites (Weill and Aral, 2005). Moreover, by anchoring decisions in data insights, the enhancement of digital prowess and management accounting knowledge equips micropreneurs to make well-informed choices, culminating in an amplified competitive prowess within the market landscape (Cokins, 2009). The avenue of digital competency not only enhances data management and analysis for micropreneurs but also underpins enhanced competitive efficiency.

In this digital era, possessing apt digital knowledge and skills stands as a pivotal imperative for micropreneurs, equipping them to effectively navigate shifts in business trends and customer demands (Nambisan, 2017). Proficiency in management accounting augments micropreneurs' ability to judiciously manage and analyse their business's financial data, thereby facilitating crucial decisions encompassing business expansion, risk mitigation, and profitability optimization (Ma et al., 2022). The fusion of digital capabilities and management accounting skills serves as a potent tool for micropreneurs to establish and sustain competitive prowess, aligning them adeptly with customer needs and adeptly managing business fluctuations (Kaplan et al., 2010). Derived from a comprehensive literature review, the researchers establish the following hypothesis:

Hypothesis 1: Digital competency positively influences management accounting competency.

Digital competency and competitive performance

Digital competency encompasses the capacity to harness digital technology for business operations, wielding profound influence on the competitive performance of micropreneurs. By enriching consumer-centric aspects, digitally adept micropreneurs utilize technology to amplify the appeal of their products or services, thereby augmenting customer demand and resonance (Porter and Heppelmann, 2014). This synchronization dovetails with the agility required to navigate evolving market dynamics through digital technology utilization, enabling swift adaptation and proficient competition (Nambisan, 2017). Those endowed with digital prowess leverage technology to curtail operational costs and heighten service velocity, culminating in fortified competitive prowess (Bharadwaj et al., 2013). Moreover, digital technology serves as the bedrock for crafting innovative products and services attuned to customer preferences, a catalyst for intensified market competitiveness (Rogers, 2016; Sungthong et al., 2023). Its utility extends to cultivating robust customer relationships, achieved through online communication channels and elevated service standards (Parida et al., 2015). This propels brand building, as digital technology fosters the establishment of a trustworthy and resilient brand, furnishing micropreneurs with potent tools for effective market competition (Kane et al., 2015). Such digital dexterity enables micropreneurs to adapt to technological shifts, cultivate expansive customer bases, and deliver excellent customer

experiences, ultimately positioning them as dominant leaders in competitive markets (Viardot, 2013). Drawing from the comprehensive literature review, the researchers assert the following hypothesis:

Hypothesis 2: Digital competency positively impacts competitive performance.

Management accounting competency and competitive performance

Management accounting competencies significantly enhance the competitive performance of micropreneurs, especially in controlling costs. Using management accounting can aid micro-entrepreneurs in more effective cost management, leading to increased profits and enhanced competitive performance (Drury, 2013). Knowledge and skills in management accounting can help micropreneurs analyze the economic environment and competition more proficiently, allowing for timely and appropriate decision-making in rapidly changing situations (Langfield-Smith, 2008). This leads to better business competition planning and forecasting. Management accounting competencies enable micropreneurs to better plan their business strategies and forecast financial benefits, resulting in more efficient management and the ability to handle uncertainties (Oley, 2016). Micropreneurs with strong management accounting skills can analyze costs, management control and determine the best-selling prices for their products or services, positioning them competitively in a high-competition market (Baltova, 2023) and open innovation era (Chenhall and Moers, 2015). Knowledge in management accounting allows micropreneurs to analyze the value of investments, whether they're in technology enhancement or the innovation of new products or services, fostering long-term profitability (Cadez and Guilding, 2008). Moreover, they can manage and control business risks effectively. Using management accounting skills helps micropreneurs understand and manage risks associated with their business operations better, which is crucial for competitive capability (Coad et al., 2016). In essence, possessing knowledge and competency in management accounting allows micropreneurs to plan, control, and forecast their business operations with greater precision, enabling them to maintain resilience in highly competitive markets. From the literature review, the researchers develop the following hypothesis:

Hypothesis 3: Management accounting competency has a positive impact on competitive performance.

Based on an extensive literature review that delves into the intricate relationships among digital capabilities, management accounting competency, and competitive performance, all within the context of the open innovation era and the competitive landscape of micropreneurs in Thailand, we present the research framework visually in Fig. 1.

Research methodology

Research design

This study employed a quantitative research design to examine the influence of digital capabilities on the managerial accounting proficiency and competitive efficiency of micro-entrepreneurs in Thailand. Thai micropreneurs play a significant role in the informal economy, making substantial contributions to both local and national economies. Given Thailand's growing digital economy and the increasing technological literacy of its population, the study aimed to comprehend the impact of digital capabilities on their accounting skills and business performance. Thailand's robust digital infrastructure, combined with improved internet accessibility and government initiatives promoting digital innovations, has created opportunities for young entrepreneurs to establish and expand their small-scale enterprises (Owoseni et al., 2022). While these entrepreneurs are progressively adopting digital tools for financial management, their success hinges on their digital skills, accounting competence, and competitive capabilities. Filling a critical research gap, this study delved into these issues within the context of ongoing digitization trends, providing valuable insights for

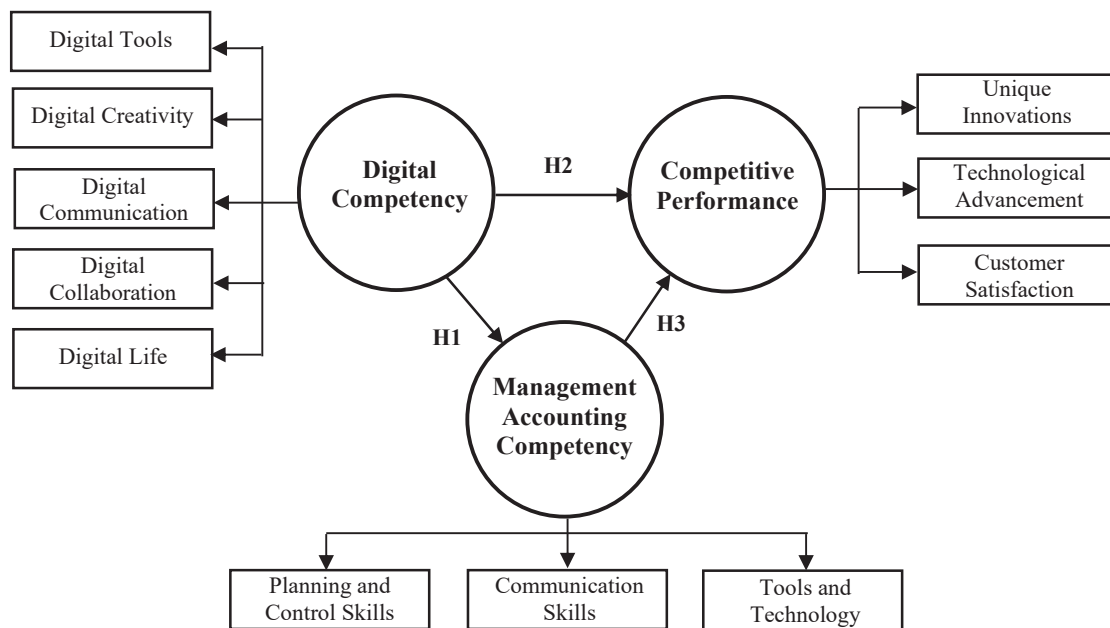


Figure 1. Research Conceptual Framework.

policymakers, scholars, and business development service providers seeking to enhance the financial and digital literacy of Thai micropreneurs.

Data for this study was gathered through a combination of online channels and telephone interviews. Utilizing online channels provides the advantage of reaching a broader and more convenient sample of participants. Nonetheless, it is important to acknowledge that this approach may introduce inherent biases, as individuals who choose online surveys might have different characteristics compared to those who opt for telephone interviews. The use of mixed data collection methods could also potentially impact the quality and reliability of the data collected. Therefore, it is crucial to consider these biases and implement strategies to ensure the robustness and reliability of the collected data. In this study, a total of 151 respondents participated in the survey. Although we encountered some limitations in terms of participants' cooperation in responding to the survey, it is essential to highlight that we ensured the adequacy of our sample size. The determination of this sample size was based on the availability and willingness of micro-entrepreneurs in Thailand to participate within the given timeframe. While the sample size was not pre-calculated using specific statistical methods, it is worth noting that a sample of 151 participants is considered substantial for various types of statistical analyses, particularly in exploratory research where the primary objective is to uncover patterns and relationships. Additionally, following the guidelines provided by Krejcie and Morgan (1970) for determining the required sample size, it's important to consider that a population of 1000 would necessitate a sample size of 278. As population size increases, the required sample size increases at a diminishing rate. Therefore, for our study, which focuses on a specific niche of micro-entrepreneurs in Thailand, a sample size of 151 can provide valuable insights. However, it is crucial to exercise caution when generalizing the findings, given the limited sample size, even though it enables the identification of trends and patterns.

Research instrument

The construction of the questionnaire was guided by a thorough examination of the existing literature and subjected to content validity analysis conducted by three highly experienced experts in the field of innovation management. These experts rigorously evaluated each

survey item to ensure alignment and consistency. The questionnaire was organized into two primary sections: the first section centered on entrepreneur and business characteristics, while the second section contained questions structured in a 5-point Likert scale format, with responses ranging from 1 (least) to 5 (most). This second section was specifically designed to assess the comprehensive model framework. At its inception, the questionnaire featured primary indicators encompassing digital capabilities (10 items), managerial accounting competencies (6 items), and competitive efficiency (6 items). The main operational variables are described in Table 1.

A pilot test involving a cohort of 30 participants was executed to validate the questionnaire's precision, with Cronbach's alpha coefficient employed to assess its reliability. The results substantiated the questionnaire's accuracy, as each individual item garnered a score exceeding 0.8. This validation underscored the questionnaire's trustworthiness for effective data collection purposes. To further evaluate potential bias, the initial 30 datasets were juxtaposed against the latter 30 datasets, revealing a lack of statistically significant disparities. This observation pointed towards the absence of any nonresponse bias. For seamless data collection and confidentiality assurance, the questionnaire was dispensed electronically.

In response to the feedback regarding the inclusion of Cronbach's Alpha values for each construct, we conducted a reliability test using a sample of 30 respondents. The results demonstrated satisfactory internal consistency for most of the observed variables. Specifically, the Cronbach's Alpha values for each construct were as follows: Digital Tools (0.848), Digital Creativity (0.660), Digital Communication (0.694), Digital Collaboration (0.773), Digital Life (0.810), Planning and Control Skills (0.568), Communication Skills (0.887), Tools and Technology (0.885), Unique Innovations (0.747), Technological Advancement (0.829), and Customer Satisfaction (0.719). These findings indicate that our questionnaire exhibits a commendable level of internal consistency across most constructs, while also highlighting areas, such as Planning and Control Skills and Digital Creativity, where further refinement may be beneficial.

In response to the feedback concerning the pilot testing, we conducted a comprehensive pilot test involving a sample of 30 participants carefully selected to represent a diverse range of demographics relevant to our study. Throughout the pilot testing phase, participants were actively encouraged to provide feedback regarding the clarity,

Table 1
Measurement items in the questionnaire.

Construct	Operationalization	Measurement	Reference
Digital Competency	Digital Tools	- Utilization of digital technology to support business operations. - Knowledge and ability to select appropriate digital technologies for business.	Hinds (2019)
	Digital Creativity	- Use of digital technology for product/service innovation. - Use of digital technology for marketing efforts.	Selfa-Sastre et al. (2022)
	Digital Communication	- Use of digital technology for business communication. - Utilizing digital technology to gather customer feedback.	Pascucci et al. (2023)
	Digital Collaboration	- Coordinating with partners or suppliers using digital technology. - Using digital technology for continuous learning and business development.	Kwiatkowska & Wiśniewska-Nogaj (2022)
	Digital Life	- Building business networks or online communities with digital technology. - Knowledge of online security and privacy in conducting business.	Hoehe & Thibaut (2022)
Management Accounting Competency	Planning and Control Skills	- Financial planning and performance evaluation. - Forecasting and managing financial risks.	Huang & Huang (2019) ; Hall (2023)
	Communication Skills	- Communicating financial information effectively. - Continuous self-development in financial aspects.	Jeffery (2009) ; Aririguzoh (2022)
	Tools and Technology	- Use of financial tools like Banking Technology. - Using digital technology to present financial data.	Quinto & Emmanuel (2022)
Competitive Performance	Unique Innovations	- Offering unique and innovative products/services. - Continuous improvement or innovation of products/services.	Rakangthong, et al. (2023) ; Adner & Kapoor (2010) ; Lee & Trimi (2018)
	Technological Advancement	- Competing effectively in the market. - Problem-solving within the business.	Radicic & Petković (2023)
	Customer Satisfaction	- Customer satisfaction levels. - Business acceptance and consistent customer support.	Szyndlar (2023)

relevance, and comprehensibility of each questionnaire item. Drawing from their valuable input, we made several refinements to enhance the wording of specific questions and to ensure that all inquiries were devoid of ambiguity and easily understandable. Furthermore, any questions that were found to be redundant or not directly aligned with our research objectives were removed from the questionnaire. We believe that by sharing these details, we can convey the rigorous and meticulous nature of our pilot testing process, thereby reaffirming the reliability and validity of our final questionnaire.

To evaluate the potential for nonresponse bias, we conducted a comparison between early respondents and late respondents, operating under the assumption that late respondents may exhibit similarities to non-respondents. Our analysis did not reveal any significant differences in their characteristics, thus indicating that nonresponse bias is not a significant concern in our study. To bolster the robustness of our findings, we performed additional robustness checks using alternative model specifications, which consistently yielded consistent results. Despite the valuable insights our study offers, it is important to acknowledge certain limitations. The cross-sectional nature of our data constrains our ability to establish causality. Furthermore, although we took measures to mitigate biases, the use of self-reported data may introduce some degree of response bias.

Data analysis

The initial phase of our data analysis involved evaluating the indicator levels for each variable, followed by the presentation of descriptive statistics derived from the sample group. These levels were categorized into five tiers: the lowest level spanning from 0.00 to 1.00, a low level from 1.01 to 2.00, a moderate level from 2.01 to 3.00, a high level from 3.01 to 4.00, and the highest level from 4.01 to 5.00.

For the main analysis, the PLS-SEM methodology was employed. The ability of PLS-SEM to handle complex models and its suitability for exploratory research, particularly when theory development is the main objective, were the driving factors in the decision to use it over other statistical methods. PLS-SEM is particularly adept at analyzing models with multiple latent variables and indicators, making it an ideal choice for this study. A thorough test using PLS-SEM was done on the reflective measurement model, looking at things like indicator loading, internal consistency reliability, convergent validity, and discriminant validity. As suggested by Hair et al. (2019), the structural model was also carefully checked for things like collinearity, R^2 , predictive relevance (Q^2), and PLSpredict. Additionally, goodness-of-fit measures were considered to ensure the model's appropriateness and to provide a comprehensive understanding of how well the model fits the observed data. Ultimately, the study incorporated an analysis of the collective impact of all three structures to validate the established research hypotheses.

Results

The demographic data provided in this study hold significant relevance to the research questions and hypotheses. The patterns discerned within various demographic groups have the potential to exert an influence on the study's outcomes. Recognizing and delving into these relationships is crucial for achieving a comprehensive interpretation of the results. By considering how demographic factors may interact with the research variables, we can gain a deeper understanding of the nuanced dynamics at play within our study context. This, in turn, enhances the robustness and applicability of the findings to real-world scenarios.

The demographic profile of the study's participants offers a rich tapestry of insights that can be pivotal in understanding the nuances of the research findings. Firstly, the gender distribution, with females constituting 52.3 % and males at 45.7 %, suggests a relatively balanced representation. The slight dominance of female entrepreneurs might indicate a shift in traditional business roles, especially in the Thai

context. This could have implications for how different genders perceive and adapt to technological advancements and management accounting practices. The age distribution reveals a mature participant pool, with over half (53.0 %) being above 40 years old. This demographic might be more rooted in traditional business practices, but their willingness to participate in such a study indicates an openness to modern methods and technologies. It would be interesting to explore how their responses might differ from the younger age groups, especially those between 26 and 35, which together constitute 31.1 % of the sample. Education-wise, the fact that a significant 47.0 % of participants hold advanced degrees (master's or PhD) suggests a well-educated sample. This could influence their receptiveness to new business strategies and technologies. On the other hand, those with qualifications below a bachelor's degree, representing 11.3 %, might have unique insights based on practical experience rather than formal education. The majority of the businesses are sole proprietorships (61.6 %), which might indicate a more hands-on approach to business management. This could influence how they perceive and implement digital and accounting competencies in their operations. The dominant focus on domestic markets (67.5 %) also provides a context for understanding their business strategies and challenges, especially when juxtaposed with those catering to both domestic and international markets (32.5 %). The type of business, with services leading at 47.0 %, followed by retail at 19.2 %, and manufacturing at 15.9 %, offers insights into the sectors that are keen on integrating digital and accounting competencies. The distribution channels, primarily in-store sales (49.0 %), suggest a potential area of growth in the online sector, especially given the current global trend towards digitalization. In conclusion, this demographic breakdown serves as a foundational pillar for the study, offering contextual insights that can help in interpreting the research outcomes more holistically, as detailed in Table 2.

The appropriateness of the model, also known as the "Goodness of Model Fit," was evaluated using various metrics. The SRMR (Standardized Root Mean Square Residual), represents the average discrepancy between the observed correlations and the correlations predicted by the model. Values close to 0 indicate a good fit, with values less than 0.08 often considered acceptable. In our study, an SRMR value of 0.055 suggests that the model's predicted correlations align well with the observed data, indicating a good fit. The Unweighted Least Squares Discrepancy (dULS) for both models was 0.199, and the Geodesic Discrepancy (dG) was 0.227 for both models. The Chi-Square test assesses whether there is a significant difference between the estimated model and the observed (independent) model. The Chi-Square value for both models stood at 192.225. Another metric used to determine the model's fit is the NFI (Normed Fit Index), which compares the fit of our chosen model to a null model, where no relationships are assumed among the variables. Values range between 0 and 1, with values closer to 1 indicating a better fit. Generally, values above 0.90 are deemed to represent a good fit, though values above 0.80 can be considered acceptable in many contexts. Our NFI value of 0.875 suggests that our model provides a reasonably good fit to the data, especially when compared to a model with no assumed relationships, as illustrated in Table 3.

Factor analysis serves as a statistical tool aimed at uncovering underlying factors or variables that exert influence on our observations. The analysis involves a set of indicators encompassing diverse measures like Digital Tools and Digital Creativity. Loadings indicate the extent to which each indicator is linked to a factor; higher loadings point to a significant association between the indicator and the specific factor. Another facet is Indicator Reliability, which gauges the consistency of an indicator in producing similar results across multiple measurements. Weights denote the relative importance of each indicator in the analysis. Additionally, Variance Inflation Factor (VIF) quantifies the variability in independent variables. Elevated VIF values may suggest potential issues of multicollinearity, reflecting correlations between variables. In this study, the prominence of "Technological Advancement" as the most

Table 2
The characteristic of sample.

Measure	Frequency	Percentage	Measure	Frequency	Percentage
Gender			Distribution Channels		
Male	69	45.7	In-store Sales	74	49.0
Female	79	52.3	Online Sales	16	10.6
Non-binary	3	2.0	Both	61	40.4
Age			Market Sector		
20 – 25 years old	5	3.3	Domestic	102	67.5
26 – 30 years old	19	12.6	Both Domestic and International	49	32.5
31 – 35 years old	28	18.5	Business Experience		
36 – 40 years old	19	12.6	Less than 1 year	8	5.3
above 40 years old	80	53.0	1–5 years	50	33.1
Education			6–10 years	38	25.2
Below Bachelor's Degree	17	11.3	More than 10 years	55	36.4
Bachelor's Degree	63	41.7	Investment		
Master and PhD	71	47.0	Less than 500,000 baht	61	39.1
Business Form			500,001 to 1000,000 baht	25	37.1
Sole Proprietorship	93	61.6	1000,001 to 2000,000 baht	19	8.6
Partnership	14	9.3	2000,001 to 3000,000 baht	4	11.3
Limited Company	44	29.1	More than 3000,000 baht	42	4.0
Type of Business			Annual Revenue		
Manufacturing Business	24	15.9	Less than 100,000 baht	59	39.1
Services Business	71	47.0	100,001 to 500,000 baht	56	37.1
Wholesale Trade	11	7.3	500,001 to 1000,000 baht	13	8.6
Retail Trade	29	19.2	1000,001 to 5000,000 baht	17	11.3
Agriculture	16	10.6	More than 5000,000 baht	6	4.0
	151	100		151	100

Table 3
Goodness of model fit.

	Saturate Model	Estimate Model
SRMR	0.055	0.055
d _{ULS}	0.199	0.199
d _G	0.227	0.227
Chi-Square	192.225	192.225
NFI	0.875	0.875

influential indicator, with the highest factor loading of 0.9336, underscores its pivotal role in the context of our study. This high loading suggests that "Technological Advancement" is strongly associated with the underlying factor being measured, more so than other indicators. In practical terms, this might indicate that advancements in technology play a central role in shaping the behaviors, perceptions, or outcomes relevant to our research. For businesses or policymakers, this could mean that investments or interventions aimed at promoting technological advancements could have a more pronounced impact on the desired outcomes. On the other hand, the high Variance Inflation Factor (VIF) of 4.7252 for "Digital Creativity" raises some concerns about multicollinearity. This suggests that "Digital Creativity" might be correlated with one or more of the other indicators in the model. While multicollinearity doesn't undermine the reliability of the model as a whole, it can make it challenging to determine the individual impact of "Digital Creativity" separate from the other correlated indicators. In practical scenarios, this could mean that interventions aimed at promoting digital creativity might also inadvertently affect other related factors, making it challenging to isolate the effects of any single intervention. Relating these findings to our research questions or hypotheses, it is evident that understanding the role and influence of technological advancements is crucial. If our hypothesis was centered around the impact of technology on a particular outcome, this finding provides robust evidence to support it. Meanwhile, the high VIF for "Digital Creativity" suggests that while it's an essential factor, its intertwined relationships with other indicators necessitate a more nuanced approach when interpreting its effects or designing interventions. The details are presented in Table 4.

Table 4
Factor Analysis Results for Digital Excellence Indicators.

Indicator	Loadings	Indicator Reliability	Weights	VIF
Digital Tools	0.865	0.7482	0.223	3.1388
Digital Creativity	0.9131	0.8338	0.2187	4.7252
Digital Communication	0.9086	0.8255	0.2246	4.2129
Digital Collaboration	0.8373	0.701	0.2174	2.5116
Digital Life	0.8719	0.7603	0.2538	2.6567
Planning and Control Skills	0.8919	0.7954	0.3533	2.4757
Communication Skills	0.922	0.850	0.3701	3.0324
Tools and Technology	0.9014	0.8125	0.3813	2.4913
Unique Innovations	0.9171	0.8412	0.3676	2.9749
Technological Advancement	0.9336	0.8716	0.3794	3.4048
Customer Satisfaction	0.898	0.8063	0.3437	2.6102

Factor loadings serve as indicators of the relationship between the observed variables and their respective latent constructs. Typically, a factor loading above 0.7 is considered strong, suggesting that the observed variable is a good indicator of the latent construct. In the context of our study:

Digital Competency (DC): The factor loadings for the observable variables related to digital capabilities ranged from 0.837 to 0.913. These values are well above the 0.7 threshold, indicating a strong relationship between these variables and the DC construct.

Management Accounting Competency (MAC): The factor loadings for the observable variables associated with accounting capabilities ranged from 0.892 to 0.922. Again, these values signify a robust alignment with the MAC construct, reinforcing the strength and relevance of these variables in representing management accounting competency.

Competitive Performance (CP): The factor loadings for the observable variables tied to competitive efficiency spanned from 0.898 to 0.934. These values not only surpass the 0.7 benchmark but are also nearing the upper limit, highlighting an exceptionally strong correlation with the CP construct.

While the factor loadings in our study are strong, providing

confidence intervals or standard errors would offer a more comprehensive understanding of their precision. This additional information would allow readers to gauge the stability and reliability of these loadings across different samples or scenarios. From a practical standpoint, the strong factor loadings observed in our study underscore the reliability of our constructs. They suggest that the observable variables chosen for each construct aptly represent the underlying latent factors. This reliability is crucial, as it bolsters confidence in the subsequent analyses and interpretations drawn from the data. In essence, the robust factor loadings affirm that our constructs—Digital Competency, Management Accounting Competency, and Competitive Performance—are well-defined and accurately measured, providing a solid foundation for the broader implications and conclusions of our research. The details are presented in Table 5.

Discriminant validity was evaluated using the Fornell-Larcker criterion and the Heterotrait-Monotrait Ratio (HTMT) to establish the uniqueness of each measured factor. The details from Table 5 indicated that for Digital Competency (DC), the Fornell-Larcker value was 0.773. The HTMT value between DC and MAC was 0.874, while the HTMT value between DC and CP was 0.808. For Management Accounting Competency (MAC), the Fornell-Larcker value for MAC itself was 0.819. The Fornell-Larcker value between DC and MAC stood at 0.637, and the HTMT value between MAC and CP was 0.846. The Competitive Performance (CP) factor had a Fornell-Larcker value of 0.840. The Fornell-Larcker values between DC and CP, and between MAC and CP were 0.552 and 0.578, respectively. High values in the Fornell-Larcker Criterion indicated clear distinctions between the investigated factors. An HTMT value lower than 1 point showed a clear differentiation between factors. In summary, each factor in this table was distinctly different from one another, and each factor displayed both reliability and measurement accuracy, as presented in Table 6.

The Partial Least Squares Structural Equation Modeling (PLS-SEM) method was employed to assess the hypotheses we set forth. This evaluated the relationships and impacts among Digital Competency, Management Accounting Competency, and Competitive Performance within the sample group, as illustrated in Fig. 2.

The results showcasing the direct relationships between various factors were presented through an analysis using path coefficients, t-statistics, and p-values to evaluate the research’s hypotheses (as shown in Table 7).

Hypothesis 1 (DC -> MAC): The path coefficient of 0.798 for the relationship between DC and MAC is notably high, suggesting a strong positive association. This means that as digital capabilities in an organization increase, there’s a corresponding enhancement in management accounting skills. For businesses, this implies that investments in digital training and tools could lead to substantial improvements in their accounting practices. The t-statistic of 19.103 further emphasizes the robustness of this relationship.

Hypothesis 2 (DC -> CP): A path coefficient of 0.742 indicates a

Table 5
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)
Digital Competency (DC)	Digital Tools	0.865	0.927	0.929	0.945	0.774
	Digital Creativity	0.913				
	Digital Communication	0.909				
	Digital Collaboration	0.837				
	Digital Life	0.872				
Management Accounting Competency (MAC)	Planning and Control Skills	0.892	0.890	0.891	0.932	0.819
	Communication Skills	0.922				
	Tools and Technology	0.901				
Competitive Performance (CP)	Unique Innovations	0.917	0.905	0.907	0.940	0.840
	Technological Advancement	0.934				
	Customer Satisfaction	0.898				

Table 6
Discriminant validity.

Constructs	Fornell-Larcker Criterion			Heterotrait-Monotrait Ratio (HTMT)		
	DC	MAC	CP	DC	MAC	CP
DC	0.773					
MAC	0.637	0.819		0.874		
CP	0.552	0.578	0.840	0.808	0.846	

strong positive relationship between DC and CP. This underscores the importance of digital proficiency in driving competitive outcomes. In practical terms, businesses that prioritize and bolster their digital skills are likely to experience better market performance and competitive advantage. The t-statistic of 16.744 reinforces the significance of this relationship.

Hypothesis 3 (MAC -> CP): The relationship between MAC and CP, with a path coefficient of 0.462, suggests a moderately positive association. This highlights that effective accounting practices can influence competitive success, though perhaps not as strongly as digital competency. Nevertheless, businesses focusing on refining their accounting practices can expect to see improvements in their market performance. The t-statistic of 2.388, while lower than the other relationships, still indicates a significant association.

These findings offer profound insights into the interplay of digital competency, management accounting skills, and competitive performance. The strong path coefficients, especially for relationships involving digital competency, emphasize the pivotal role of digital skills in today’s business landscape. By understanding these relationships, businesses can make informed decisions about where to invest resources for maximum impact. Moreover, the practical significance of these findings is evident in their potential to guide strategic decisions and policy formulations.

In the context of our study, the mediation analysis reveals a nuanced understanding of the relationship between Digital Competency (DC) and Competitive Performance (CP). While it might be intuitive to think that DC directly impacts CP, our findings suggest that this relationship is more intricate. Specifically, the influence of DC on CP is mediated by Management Accounting Competency (MAC). This means that as organizations enhance their digital capabilities, it not only directly improves their competitive performance but also indirectly does so by bolstering their management accounting skills, as shown in Table 8.

The practical implications stemming from this indirect relationship are multifaceted:

Holistic Development: Organizations aiming to enhance their competitive performance should not only focus on improving digital skills but also consider the intertwined role of management accounting. Investing in one area (like digital training) can have cascading benefits in other areas (like accounting practices).

Resource Allocation: Understanding this mediation effect can guide

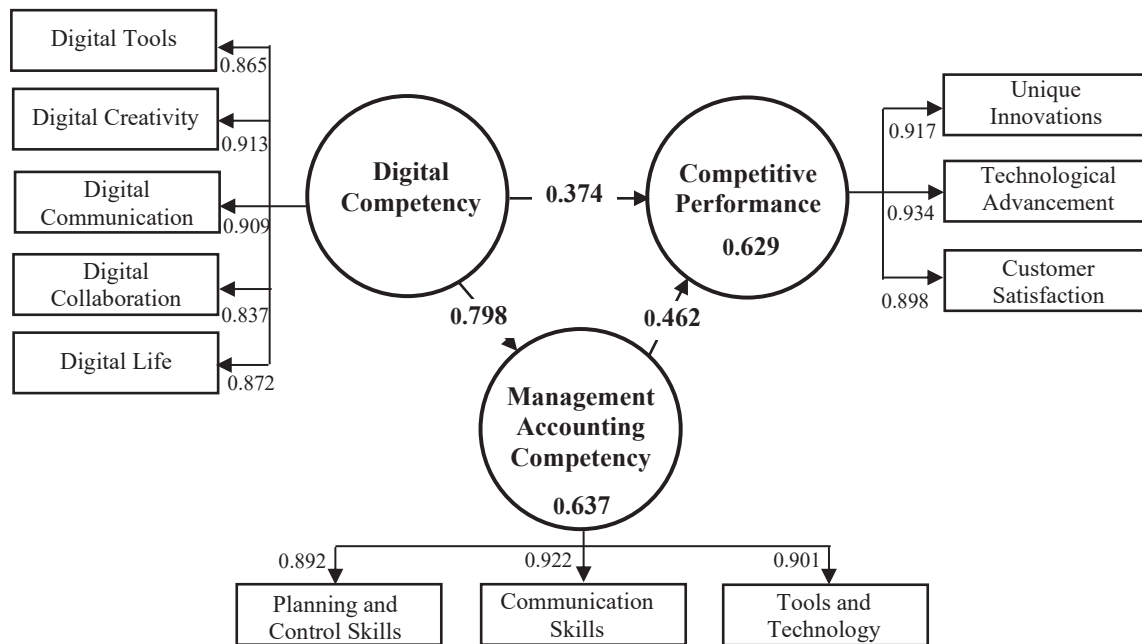


Figure 2. The structural model.

Table 7
Direct relationship.

Hypotheses	Effect	Path coefficients	t-Statistic	p-Value	Results
H1	DC -> MAC	0.798**	19.103	0.000	Supported
H2	DC -> CP	0.742**	16.744	0.000	Supported
H3	MAC -> CP	0.462**	2.388	0.017	Supported

Note: **Significant at 0.01.

Table 8
Indirect relationship.

Effect	Path coefficients	t-Statistic	p-Value
DC -> MAC -> CP	0.368**	2.219	0.027

Note: **Significant at 0.01.

businesses in resource allocation. For instance, if an organization’s MAC is already strong, they might get more significant returns by investing further in DC, knowing that it will indirectly boost CP.

Strategic Interventions: Policymakers and business leaders can design interventions that leverage this mediation effect. For example, training programs can be developed that integrate both digital and accounting skills, ensuring a more comprehensive impact on competitive performance.

In essence, the mediation analysis not only enhances our comprehension of the intricate relationships at play but also furnishes actionable insights for businesses and policymakers alike. Recognizing the mediating role of management accounting competency in the relationship between digital competency and competitive performance offers a more holistic perspective on organizational dynamics, emphasizing the interconnectedness of skills and competencies in shaping competitive outcomes.

Discussion

This research delved into the examination of Digital Competency’s

influence on both Management Accounting Competency and Competitive Performance, with a specific emphasis on the viewpoints of micropreneurs in Thailand. The study’s outcomes uncovered substantial and noteworthy associations between Digital Competency and both Management Accounting Competency and Competitive Performance. Additionally, it was established that Management Accounting Competency significantly impacts Competitive Performance. The results of the hypotheses can be summarized as follows:

Digital competency and management accounting competency

There is a significant relationship between Digital Competency and Management Accounting Competency among micropreneurs. Proficiency and knowledge in the digital domain are indispensable for enhancing processes within Management Accounting. Such expertise can lead to more efficient management control system and better business growth. This observation aligns with the research of [Bharadwaj et al. \(2013\)](#). Micropreneurs who can adeptly apply digital technological innovation in their business operations can manage and analyze data proficiently, facilitating rapid and effective decision-making ([Shim et al., 2002](#); [Looy, 2021](#)). Moreover, managerial accounting skills empower these entrepreneurs to handle and analyze their business’s financial data, supporting crucial decisions related to management control, business expansion, risk management, and sustainability. This assertion is consistent with the findings of [Ma et al. \(2022\)](#).

Digital competency and competitive performance

There is a discernible impact of Digital Competency on Competitive Performance, suggesting that businesses equipped with advanced digital capabilities are poised to achieve superior competitive standings in the market. With the accelerated pace of technological innovation and digital advancements, the utilization of such advancements is essential for businesses to thrive ([Rycroft, 2007](#)). Micropreneurs who excel in their digital proficiencies can harness technology to streamline operational costs and enhance customer service efficiency, thereby fortifying their competitive prowess, as corroborated by [Bharadwaj et al. \(2013\)](#). This emphasis on digital competency underscores the imperative of adaptability in a digitally driven market landscape, enabling

micropreneurs to promptly respond to market fluctuations and maintain a competitive edge over their contemporaries, consistent with the insights provided by Nambisan (2017).

Management accounting competency and competitive performance

The influence of Management Accounting Competency on Competitive Performance underscores that enterprises fortified with robust accounting and managerial systems are strategically positioned to carve a significant competitive niche in the market. Such enterprises, leveraging their superior Management Accounting Competency, often exhibit swifter and more judicious decision-making, thereby navigating market intricacies more adeptly than their competitors. Micropreneurs endowed with meticulous managerial accounting proficiencies are equipped to pinpoint the optimal costs and selling prices for their offerings, an edge that becomes invaluable in fiercely competitive terrains, as validated by Baltova (2023). This acumen not only propels micropreneurs towards judicious fiscal management but also amplifies profitability, resulting in enhanced competitive operational efficacy, a viewpoint echoed by Drury (2013).

Considering the results from the three hypotheses, businesses aiming to remain resilient and robust in the market should reinforce and develop both Digital Competency and Management Accounting Competency. This adaptation and responsiveness are crucial to navigate the evolving shifts in the digital age market.

Theoretical contributions

The findings of this study have several theoretical contributions. Firstly, it reaffirms the pivotal role of Digital Competency not only in shaping Management Accounting Competency but also in influencing the Competitive Performance of micropreneurs in Thailand. Secondly, this research extends the scope of literature review, effectively bridging a scholarly gap by delving into the interplay between digital components and Management Accounting Competency, particularly within the context of developing nations. Furthermore, the study validates the Competitive Theory of micropreneurs by highlighting that possessing Digital Competency can serve as a strategic edge for micropreneurs navigating dynamic economies. Importantly, this research establishes a coherent link between various theoretical dimensions, intricately weaving digital elements, managerial accounting proficiency, and competitiveness from the unique perspective of micropreneurs. Lastly, by inspiring avenues for future research, this study encourages the exploration of similar relationships in different contexts or business landscapes beyond the present study. Altogether, this research significantly enriches our comprehension of the correlation between Digital Competency and other capabilities within the realm of micropreneurs in Thailand.

Practical implications

The findings of this study have significant implications. Firstly, micro-entrepreneurs can enhance their Management Accounting Competency and Competitive Performance by prioritizing the development of their digital knowledge. Secondly, to bolster Management Accounting Competency, government agencies and organizations should arrange specialized training and education program in the digital and accounting domain. Thirdly, integrating digital technology into business management can notably amplify Competitive Performance. Moreover, Digital Competency plays a pivotal role in efficient decision-making by enabling the prediction of trends and informed choices. In the current digital era, entrepreneurs who adeptly leverage data for swift decision-making gain a distinct competitive edge. Additionally, possessing knowledge and Digital Competency aids in analyzing and managing potential risks more effectively, contributing to improved risk management. Lastly, for the preparation of future entrepreneurs, educational

curricula addressing Management Accounting knowledge must underscore the cultivation of Digital Competency. This approach ensures the viability of their business operations in the evolving landscape. In essence, this research establishes actionable guidelines that empower micro-entrepreneurs to adeptly apply knowledge and Digital Competency, thereby enabling them to achieve competitive success within their market.

Conclusion

Through a comprehensive examination of the interplay between digital capabilities, management accounting competency, and competitive performance, this study elucidates a compelling cause-and-effect relationship: Digital Competency significantly and directly impacts the Management Accounting Competency and Competitive Performance of micropreneurs in Thailand. In the contemporary digital landscape, the adept utilization of technology and digital tools emerges as an imperative, exerting profound influence across diverse facets of business management, including the realm of management accounting. This proficiency not only facilitates agile responses to market dynamics and demands but also serves as a conduit for heightened operational efficiency and the attainment of competitive outcomes. Moreover, the significance of Management Accounting Competency as a linchpin for bolstering business competitiveness, facilitating astute decision-making, and fortifying competitive resilience remains unequivocal. This investigation underscores the pivotal role played by acquiring and honing both Digital Competency and management accounting skills, underscoring their indispensability for Thai micropreneurs in augmenting their competitive prowess and operational efficacy.

Ethics declaration

Authors declared that the participants were assured that their participation is voluntary and that they can withdraw from the study at any time. The data collected from the participants was kept confidential and anonymous, and the data was only be used for research purposes. Authors further declared that the study complied with ethical guidelines set forth by the Institutional Review Board of the human research ethics committee of Nakhon Ratchasima College (NMCEC-0010/2566), Thailand.

CRedit authorship contribution statement

Conceptualization, methodology, software, validation, formal analysis, N.I. and S.A.; investigation, S.A. and N.M.; writing – original draft preparation, N.I. and S.A.; writing – review and editing, N.I., S.A. and N.M.; visualization, N.I. and N.M.; supervision, S.A.; project management, S.A.; All authors have read and agreed to the published version of the manuscript.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Somnuk Aujiरणongpan reports financial support was provided by Walailak University Institute of Research and Innovation.

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